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PAPR Reduction in OFDM Systems Using PTS: With New Phase Sequences

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Abstract: - Along with the advantages of OFDM signals like high spectral efficiency and robustness against ISI, main drawback of OFDM signals is high PAPR. Many techniques are proposed to reduce PAPR including amplitude clipping, clipping and filtering, coding, tone reservation (TR), tone injection (TI), active constellation extension (ACE), partial transmit sequence (PTS), selected mapping (SLM) and interleaving. One of the effective methods, Partial Transmit Sequence is described in this article. In the conventional PTS (C-PTS) several inverse fast Fourier transform (IFFT) operations and complicated calculations to obtain optimum phase sequence, increase computational complexity of C-PTS. But in new proposed phase sequence the number of IFFT operations is reduced to half at the expense of a slight PAPR degradation. In this paper, a technique is proposed to reduce the number of IFFT operations to half at the expense of a slight PAPR degradation. Simulations are performed in Matlab with QPSK modulation with OFDM signal.

Keywords: - *Bit error rate, computational complexity, Multi-carrier signal, PAPR Reduction, PTS*

I. INTRODUCTION

Multicarrier transmission, also known as orthogonal frequency-division multiplexing (OFDM) or discrete multi tone (DMT), is a technique with a long history that has recently seen rising popularity in wireless and wireline applications. The recent interest in this technique is mainly due to the recent advances in digital signal processing technology. International standards making use of OFDM for high-speed wireless communications are already established or being established by IEEE 802.11, IEEE 802.16, IEEE 802.20, and European Telecommunications Standards Institute (ETSI) Broadcast Radio Access Network (BRAN) committees.

For wireless applications, an OFDM-based system can be of interest because it provides greater immunity to multipath fading and impulse noise, and eliminates the need for equalizers, while efficient hardware implementation can be realized using fast Fourier transform (FFT) techniques. One of the major drawbacks of multicarrier transmission is the peak-to-average power ratio (PAPR) of transmit signal. If the peak transmit power is limited by either regulatory or application constraints, the effect is to reduce average power allowed under multicarrier transmission relative to that under constant power modulation techniques. This in turn reduces range of multicarrier transmission. Moreover, to prevent spectral growth of the multicarrier signal in the form of intermodulation among subcarriers and out-of-band radiation, the transmit power amplifier must be operated in its linear region (i.e. with a large input backoff), where the power conversion is inefficient. This may have deleterious effect on battery lifetime in mobile applications. In many low-cost applications, drawback of high PAPR may outweigh all potential benefits of multicarrier transmission systems. A number of approaches have been proposed to deal with PAPR problem. These techniques include amplitude clipping [1], clipping and filtering [2, 3], coding [4], tone reservation (TR) [5], tone injection (TI) [5], active constellation extension (ACE) [6], and multiple signal representation techniques such as partial transmit sequence (PTS) [8-11], selected mapping (SLM) [12-13] and interleaving [15]. These techniques achieve PAPR reduction at the expense of transmit signal power increase, bit error rate (BER) increase, data rate loss, computational complexity increase, and so on. In this article some important PAPR reduction techniques for multicarrier transmission are described.

II. PAPR OF A MULTICARRIER SIGNAL

A multicarrier signal is the sum of many independent signals modulated onto subchannels of equal bandwidth. Let us denote collection of all data symbols X_n, $n = 0, 1, \ldots, N-1$, as a vector $X = [X_o, X_1, \ldots, X_{N-1}]^T$ that will be termed a data block. The complex baseband representation of a multicarrier signal consisting of N subcarriers is given by:

$$x(t) = \frac{1}{\sqrt{N}} \sum_{n=0}^{N-1} X_n e^{j2\pi n \Delta f t}, \; 0 \le t \le T \tag{1}$$

where $j = \sqrt{-1}$, Δf is subcarrier spacing and NT denotes useful data block period. In OFDM subcarriers are chosen to be orthogonal (i.e., $\Delta f = 1/NT$). PAPR of transmit signal is:

$$PAPR = \frac{\max\limits_{0 \le t < NT} |x(t)|^2}{\frac{1}{NT} \int_0^{NT} |x(t)|^2 dt} \tag{2}$$

In remaining part of this article, approximation will be made in that only NL equidistant samples of $x(t)$ will be considered where L is an integer that is larger than or equal to 1. These "L-times oversampled" time-domain signal samples are represented as vector $x = [x_0, x_1, \ldots, x_{NL-1}]^T$ and obtained as:

$$x_k = x(k.T/L) = \frac{1}{\sqrt{N}} \sum_{n=0}^{N-1} X_n . e^{j2\pi k n \Delta f T/L}, \; k = o, 1, \ldots NL-1. \tag{3}$$

It can be seen that the sequence $\{x_k\}$ can be interpreted as the inverse discrete Fourier transform (IDFT) of data block X with $(L-1)N$ zero padding. It is well known that the PAPR of the continuous-time signal cannot be obtained precisely by the use of Nyquist rate sampling, which corresponds to the case of $L = 1$. It is shown in [15] that $L = 4$ can provide sufficiently accurate PAPR results. The PAPR computed from the L times oversampled time domain signal samples is given by:

$$PAPR = \frac{\max\limits_{0 \le k < NL-1} |x_k|^2}{E\left[|x_k|^2\right]} \tag{4}$$

where $E[.]$ denotes expectation.

III. PAPR REDUCTION METHODOLOGIES

As discussed in introduction there are a number of techniques developed for PAPR reduction. The conventional PTS (C-PTS) is a promising technique that can reduce the PAPR, while its complexity increases rapidly as the number of subblocks increases.

3.1 Partial Transmit Sequence (PTS)

3.1.1 Conventional PTS (C-PTS)

Let X denote random input signal in frequency domain with length N. X is partitioned into V disjoint sub blocks $X_v = [X_{v,0}, X_{v,1}, \ldots, X_{v,N-1}]^T$, $v = 1,2,\ldots,V$ such that $\sum_{v=1}^{V} X_v = X$ and then these sub blocks are combined to minimize the PAPR in time domain [8]. The sub block partition is based on interleaving in which the computational complexity is less compared to adjacent and Pseudo-random, however it has the worst PAPR performance among them.

By applying the phase rotation factor $b_v = e^{j\phi v}$, $v = 1, 2, \ldots, V$ to the IFFT of the vth subblock X_v, the time domain signal after combining is given by:

$$x'(b) = \sum_{v=1}^{V} b_v x_v \tag{7}$$

Where $x'(b) = [x'_0(b), x'_1(b), \ldots, x'_{NL-1}(b)]^T$ and L is the oversampling factor. The objective is to find the optimum signal $x'(b)$ with lowest PAPR.

Both b and x can be shown in matrix form as follows:

$$b = \begin{bmatrix} b_1, & b_1, \cdots & b_1 \\ \vdots & \vdots & \vdots \\ b_v, & b_v, \cdots & b_v \end{bmatrix}_{V \times N} \tag{8}$$

$$x = \begin{bmatrix} x_{1,0}, & x_{1,1}, \cdots & x_{1,NL-1} \\ \vdots & \vdots & \vdots \\ x_{v,0}, & x_{v,1}, \cdots & x_{v,NL-1} \end{bmatrix}_{V \times NL} \quad (9)$$

It should be noted that all elements of each row of matrix b are of same values and this is in accordance with C-PTS method. It should be noted that in order to have exact PAPR calculation, at least 4 times oversampling is necessary. As oversampling of x, add zeros to vector, hence number of phase sequence to multiply to matrix x will remain same. Now, the process is performed by choosing optimization parameter $\tilde{b}$ with following condition:

$$\tilde{b} = \arg\min\left(\max_{0 \le k \le NL-1} \left| \sum_{v=1}^{V} b_v x_v \right|\right) \quad (10)$$

After finding the optimum $\tilde{b}$ then the optimum signal is transmitted to the next block.
For finding optimum $\tilde{b}$, we should perform exhaustive search for *(V-1)* phase factors since one phase factor can remain fixed, b_1=1. Hence to find optimum phase factor, W^{V-1} iteration should be performed, where W is the number of allowed phase factors.

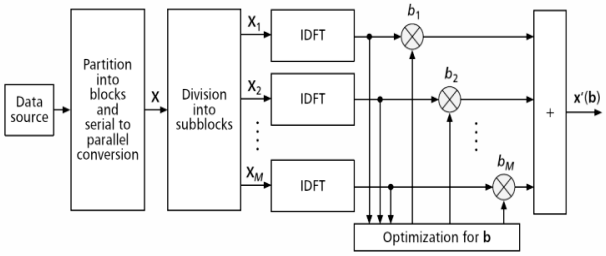

Fig. 1: Block diagram of PTS technique

3.1.2 Proposed Phase Sequence

A new phase sequence is proposed in [9], in order to decrease computational complexity of the C-PTS technique. As mentioned in [12], total complexity of C-PTS is more than SLM because of high number of iterations for finding optimum phase sequence. With this new phase sequence, we can have less complexity compared to C-PTS while PAPR reduction is almost the same. The new phase sequence is based on the generation of N random values from the possible phase factors *{1 -1}*, if we consider the number of allowed phase factor *W=2*. Therefore the new phase sequence can be constructed as follows:

$$\hat{b} = \begin{bmatrix} b_{1,1}, & b_{1,2}, \cdots & b_{1,N} \\ \vdots & \vdots & \vdots \\ b_{v,1}, & b_{v.2}, \cdots & b_{v,N} \end{bmatrix}_{V \times N} \quad (11)$$

Where N is number of subcarriers and V is number of sub blocks partitioning.
As mentioned in (9), matrix x has *VxNL* elements and each row consists of *NL* elements, after oversampling by *L*. As oversampling will add zeros to the vector, then after multiplying phase sequence b with x, the only section that counts in the multiplying will be N elements, hence the new phase sequence matrix in (11) still has N rows and the oversampling factor does not have any effect on that.

In (11), N random phase sequence is generated periodically V times. As compared with (8), new phase sequence matrix has N different random values while each row of phase sequence in (9) is with same value. These values are randomly selected from the allowed phase factors. E.g. in case of number of allowed phase factors *W=2*, then phase sequence can be chosen from {1,-1} and when *W=4* then {1,j,-1,-j}. The time domain signal from the new phase sequence that is based on (7) can be obtained from phase sequence matrix in (11) multiplies point-wise with matrix in (9). In C-PTS, it was mentioned that for searching the optimum phase factor, W^{V-1} iteration is required. It means that, if for example *W=2* and *V=4*, then we need 8 iterations to find the optimum phase sequence. For the new phase sequence format, the way to find the optimum phase factor will be different. In this case, first N different random phase sequence is generated and this is continued V times according to (11), hence the optimum phase factor is each row of this matrix. But for finding the optimum phase factor, matrix in (11) should be randomly generated several times. We constrain the number of times that the matrix would be generated to be the same as in C-PTS for fair comparison. Hence for the case of *W=2* and *V=4*, C-PTS has 8 iterations and therefore (11) should be generated 8 times. In this case we have 8 possibilities, because the first bit is fixed, {1,1,1}, {1,1,-1}, {1,-1,1}, {1,-1,-1},{-1,1,1},{-1,-1,1},{-1,1,-1},{-1,-1,-1}. Optimum phase factor will be chosen from these 8 phase sequences. In our proposed method, because there are

N different random phase factors, to search for the optimum phase sequence it requires N8 iterations which is not practical. But here, we only apply the same iteration as was applied in C-PTS and later it will be shown through simulations, that good PAPR performance is achieved, and it is also possible to have less iteration while keeping the PAPR performance same as C-PTS but with reduced complexity.
Hence the matrix in (11) can be extended as follows:

$$\hat{b} = \begin{bmatrix} b_{1,1} & \cdots & b_{1,N} \\ \vdots & \vdots & \vdots \\ b_{v,1} & \cdots & b_{v,N} \\ b_{v+1,1} & \cdots & b_{v+1,N} \\ \vdots & \vdots & \vdots \\ b_{p,1} & \cdots & b_{p,N} \end{bmatrix}_{[P\times N]} \quad (12)$$

where P is the number of iterations that should be set in accordance with the number of iterations of the C-PTS. The value of P can be calculated as follows:

$$P = DW^{V-1},\ D = 1, 2, \ldots, D_N \quad (13)$$

where D is coefficient that can be specified based on the PAPR reduction and complexity and D_N is amount that is specified by user. Value of P explicitly depends on the number of subblocks V if assuming the number of allowed phase factor is constant.

There is a tradeoff for choosing the value of D, the higher D leads to higher PAPR reduction but at the expense of higher complexity; while lower D gives smaller PAPR reduction but with less complexity. If $W=2$ and $V=4$, then in C-PTS there are 8 iterations and hence $P=8D$. If $D=2$ then $P=16$ and both methods have the same number of iterations. But when $D=1$ then number of iterations to find the optimum phase factor will be reduced to 4 and this will result in complexity reduction. The main advantage of this method over C-PTS is the reduction of complexity while at the same time maintaining the same PAPR performance.
With the proposed method, this scenario is possible and reason is use of NxP random phase sequence which has more capability to reduce PAPR further, whereas in C-PTS this value is only W^{V-1}.

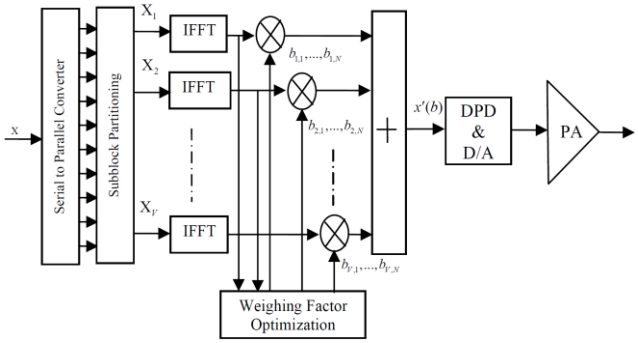

Fig. 2 Block diagram of the proposed PTS technique

The other formats that matrix in (12) can be expressed are the interleaved and adjacent phase sequences matrix respectively. The optimum phase sequence of (12) can be derived by successive search of phase sequence based on the value derived from (13) and then multiplied with input signal according to (9).
In this paper random phase sequence matrix as (12) is used because it has the highest PAPR performance among them by considering $W=2$.

3.1.3 Computational Complexity

The total complexity of the C-PTS when oversampling factor L=1, is given by [14]:

$$T_{C\text{-}PTS} = 3VN/2logN + 2VW^{V-1}N \quad (14)$$

Whereas for the proposed method this value is as follows:

$$T_{Proposed\ PTS} = 3/4VNlogN + PVN \quad (15)$$

where P is the number of iterations and V is the number of subblocks. It can be observed that (14) and (15) consist of two parts; the first part is actually the complexity of the IFFT itself and the second part is the complexity of the searching algorithm. Most of the papers did not consider the second part which causes miscalculation of the complexity. It should be noted that the number of IFFT in (15) is halved which basically is concluded from the simulation results. From the simulation results in the following section the PAPR performance of the proposed method when number of IFFT is half of the C-PTS, is almost same. This is shown for different number of subblocks which proved that in the proposed method the number of IFFT is halved compared to the C-PTS because it leads to the same PAPR performance.
The computational complexity reduction ratio (CCRR) of the proposed technique over the C-PTS is defined as [5]:

$$CCRR = (1 - \frac{Complexity \quad of \quad the \quad \Pr oposed \quad PTS}{Complexity \quad of \quad the \quad C-PTS}) \times 100\,\% \tag{16}$$

Table 1 below presents the computational complexity of C-PTS and proposed method, for N=512 and W=2.

Table 1 Computational Complexity of DSI-PTS Technique and Conventional PTS When N=512 And W=2

	No. of sub blocks	C-PTS	Proposed PTS		CCRR	
			D=1	D=2	D=1	D=2
Total complexity	V=4	60416	30208	46592	50%	23%
	V=8	1103872	551936	1076224	50%	3%

It is clear that the CCRR is improved for both V=4 and V=8. It should be noted that when D increases, the complexity reduction becomes less while PAPR performance improves, as shown in the simulations.

3.1.4 Side Information

The other important factor in studying the PAPR method is the side information which has to be transmitted to the receiver to extract the original signal. One method is the side information can be transmitted with a separate channel at the expense of spectrum efficiency. The number of required side information bits in C-PTS is $[log2W^{V-1}]$ where W is the number of allowed phase factors and the sign $[y]$ denotes the smallest integer less than y. In the proposed method the required side information will not change, however, the only drawback of this method is that, because of the increase in the phase sequence matrix, higher memory space is required.

IV. RESULTS AND DISCUSSION

In order to evaluate and compare the performance of the proposed method with C-PTS, simulations have been performed as per parameters shown in Table 2.

Table 2 Simulation parameters

Parameter	**Value**
Modulation	QPSK
OFDM samples	1e5
FFT length 'N'	512
Number of subblocks 'V'	4
Oversampling factor 'L'	1,4
Allowed phase factors 'W'	4 i.e. (1,j,-1,-j)
User defined variable 'D'	1 or 2

Fig. 3 shows the CCDF of three different types of phase sequences, interleaved, adjacent and random. From this figure PAPR reduction with random phase sequence outperforms the other types and hence this type of phase sequence is applied in the following simulations.

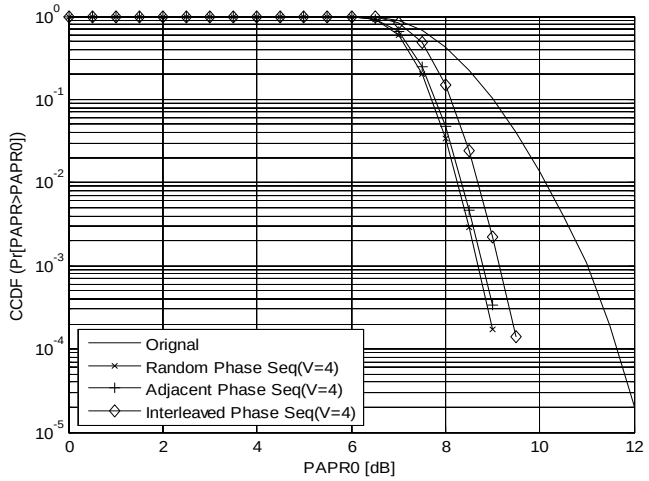

Fig. 3 CCDF of PAPR of the proposed method for different phase sequences when V=4 and D=2

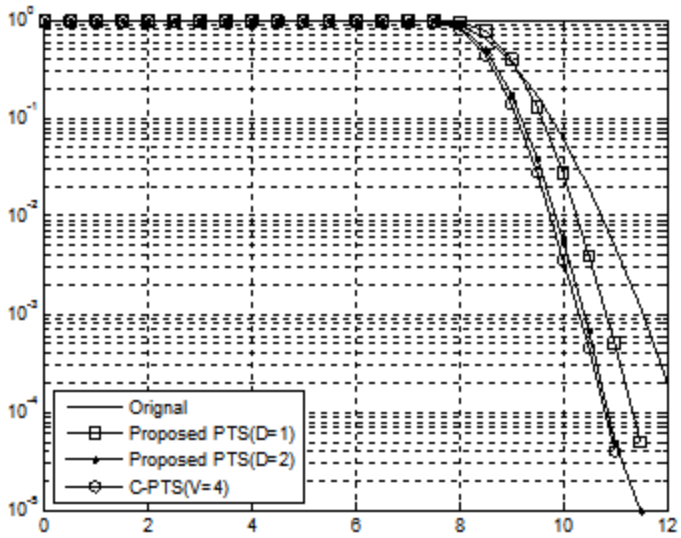

Fig.4 CCDF of PAPR of the proposed method compared to C-PTS for V=4

Fig. 4 shows a comparison of CCDF of the proposed method and C-PTS. It can be observed that the PAPR reduction for the proposed PTS scheme degrades slightly compared to C-PTS even though complexity is improved as shown in Table 1. The simulation is examined for V=4 and 8 and D=1 and 2. It is clear that when D=2 the PAPR reduction is improved and comparable to C-PTS for V=4, but this achievement is at the expense of complexity, nevertheless the CCRR is still positive which shows an improvement over that of C-PTS.

V. CONCLUSION AND FUTURE SCOPE

A new phase sequence of PTS scheme has been proposed in this paper. In this approach matrix of possible random phase factors are first generated and then multiplied point-wise with the input signal. By applying this technique the number of IFFT operation is halved which results in lower complexity compared to C-PTS at the expense of slightly PAPR degradation.

The performance of the out-of-band distortion can be also examined with the existence of nonlinear power amplifier (PA). By applying both PAPR reduction and digital predistortion (DPD) the power spectral density (PSD) of the output signal can further suppressed. This results in enhancement of power efficiency and therefore less power consumption and more battery life. The proposed method can be applied in recent wireless communications systems such as WiMAX and long term evolution (LTE).

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Mobile Wireless Peer-To-Peer Network with Higher End-To-End Throughput And Lower End-To-End Delay

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Abstract: **-** A mobile wireless Peer-to-Peer network (or MANET) is a collection of mobile, wireless nodes which together form a network without any fixed infrastructure or centralized administration. A MANET operates without base stations, where a node communicates directly with nodes within wireless coverage and indirectly with all other nodes using a multi-hop route through the other nodes of the MANET. In this research, a higher through-put but low-cost unstructured platform for wireless mobile Peer-to-Peer network has been proposed. The platform addresses the constraints of expensive bandwidth of wireless medium, and limited memory and computing power of mobile devices. It exploits an inexpensive gossip protocol as the main maintenance operation and uses (re)configuration algorithms which use the limited resources of the network in an efficient way, and thus improving the performance of the network. Simulation results show that this proposed platform reduces the average delay and increases average throughput. As a result the platform provides a higher through-put but low cost framework for different Peer-to-Peer applications.

Keywords: *- Delay, Peer-to-Peer, Performance, MANET, Throughput*

I. INTRODUCTION

A distributed computer system or architecture is called peer to peer that is basically intended to enable computer for sharing resources in such a way that they can exchange data directly without the help of any centralized system or server. This architecture is very reliable as it does not depend on central database rather every nodes are capable of providing necessary information to keep running the whole network by maintaining connectivity with each other and holding performance. P2P network or architecture has become popular because of its enormous applications and ability to share multifarious information or data. P2P network or system works extensively on some factors that prevent scalability and performance of the network. It maintains every disk spaces for efficient storage of information and utilizes bandwidth for transforming or exchanging them across the nodes within the system. These enable an efficient network without a central and high cost server where if the server is down in any case the whole network is useless. Though the Peer to Peer system has high prospects, it is not fully perfect and only networking system or architecture because of its some limitations. Those limitations need to be addressed to get wide acceptance as a reliable and high performance networking system. This paper is dedicated to propose a mobile wireless Peer to Peer network with negligible cost by considering the constriction of expensive bandwidth of wireless medium, less energy consumption in mobile wireless systems or networks as well as limited memory and computing power of mobile devices. To demonstrate the performance of the proposed network, several simulations have been carried out with the help of well known simulators such as NS-2 as well as some software such as MATLAB and Microsoft Excel.

II. BACKGROUND

Peer to Peer network has excellent future prospects as it is scalable and has numerous applications. Peer to Peer network operates within distributed application layer. In this network, peers work together in a goal oriented which is totally absent in client server based network. To achieve excellent performance from Peer to

Peer network, a cohesive logical structure among the participating peers has been established. Peer-to-Peer (P2P) networks have received attention because of their broad applications. P2P network is a distributed application layer network. Unlike traditional client-server based applications, peers in P2P network collaborate to achieve a certain goal. Design of a good P2P network requires a well thought logical structure among the participating peers. Structure-wise, P2P networks can be divided into three categories: (1) centralized, (2) decentralized but structured and (3) decentralized and unstructured [1]. In a centralized network, peers rely on a central host for a few services. As a result, the central host is subject to a single point of failure. The decentralized but structured network has been well studied and is still a very active area of research. The topology of the members in such a network is ruled by several constraints. Contents are distributed among the members using either some hints [2] or the topology of the members [3, 4]. The decentralized and unstructured network has neither any central host to provide some crucial services nor any precise control over resource distribution. The topology can be constructed using some knowledge about the physical or logical properties of the underlying physical network but, unlike the structured network, it puts no constraint on content distribution. A well known example of such a network is Gnutella.

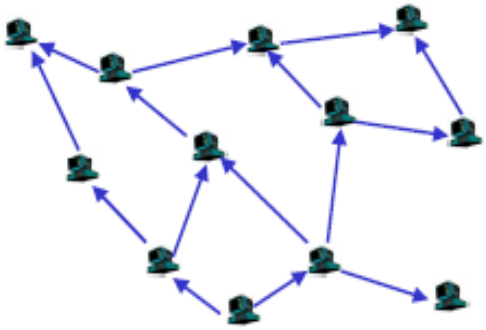


Figure 1. Content location in Gnutella.

Fig. 1 illustrates how content is located in Gnutella. A query initiated by the peer at the bottom is flooded to all peers in the system.With the exploitation of high bandwidth 3G (and expected deployment of 3.5G and 4G) cellular networks and wireless LANs, there is an increasing interest in wireless P2P networks. However, results obtained for the wired networks cannot be directly deployed in the wireless P2P networks due to the limitations of the wireless medium, expensive bandwidth, and the limitations of the mobile devices due to small memory and limited computation power. Significant research efforts have been put recently to use P2P networks in wireless environment to tackle management problems such as, routing [5], clustering[6], service discovery [7], and applications such as, multimedia distribution [8],file sharing [9] etc.

Inexpensive Peer-to-Peer Subsystem (IPPS) [10] is a location aware P2P network platform for dense wireless mobile networks. IPPS is unstructured in nature. It reduces the number of link level message flows in the network, and consumes less energy. IPPS employs a gossip protocol to maintain the P2P network and uses information about the locations of the neighbors to minimize the number of hops between peers. At each gossip iteration, a peer builds up neighborhood relation with nearer peers and discards the peers at distant. Furthermore, the IPPS platform is cheap in connection with computation and memory requirement.

In mobile wireless network, the entire available channel capacity may not be available to a wireless application, and the actual throughput is also determined by the forwarding load generated by other wireless nodes. Besides, mobile devices are battery operated. Unlike electronics, advances in battery technology still lag behind. Minimizing the number of link-level wireless hops helps in increasing the capacity available to the applications. Reduced number of link-level hops also means less number of transmissions and less power consumption for a mobile node. Along with being thrifty about bandwidth consumption, a suitable application for mobile devices is required to be computationally inexpensive to ensure prolonged battery life, and memory requirement-wise economical to confirm accommodation in the small system memory.

In spite of the limitations of wireless mobile networks, P2P over high capacity cellular networks and wireless LANs can provide a wide range of services such as sharing files [9]. In scenarios where accessing a commercial network is expensive, members of a P2P network can share downloaded objects with each other or even can collaborate to download a large popular object. This not only provides a cheaper way of sharing resources, but also enables low latency access to remote objects. Dissemination of rescue or strategic information in a disaster or war zone can be accomplished using mobile wireless P2P network. Short message broadcast, multimedia broadcast, text, audio and / or video based conference are some other examples. Recently, large numbers of research articles on P2P networks have been appeared in the literature. At the same time,

several implementations of different P2P became available for the users. Some of the highly structured P2P networks are CAN [3], Chord [11], Past [4], SCRIBE [12] and Tapestry [13].Those networks employ specific resource placement algorithms which are tightly coupled with the P2P topology. To retrieve or query for a resource, they use topology specific (in turn, resource distribution specific) routing mechanism. As a result, a search can be performed very efficiently in this type of networks. However, if the identification of a resource is partially available (i.e., not all properties of the Meta data are available), a search fails. Moreover, due to this impractical assumption about the resource distribution policies, those networks have not been widely deployed. Freenet [2] and Tarzan [14] are examples of loosely coupled distributed P2P networks. Some of those networks use a centralized directory which is not robust. Others use hint-based resource distribution which cannot support searching of objects whose information is partially available. Besides simple resource sharing, some of the loosely coupled P2P networks have considered issues like trust and security.

Some researches proposed to use existing or modified structured networks in wireless and ad-hoc networks. For example, XScribe [15] is modified from SCRIBE [12] to suite in ad-hoc networks. In general, structured P2P networks mandate that all the peers in the network fully conform to the system requirements. To satisfy that condition, all the peers must abide by the rules set by the administrative body. However, it is very difficult to achieve such a goal in a highly distributed environment. As a result, structured P2P networks are not able to gain popularity for resource sharing in an environment without any central administrative control such as, the Internet. However, success has been reported in developing large scale distributed storage system [16], scalable publish/subscribe system [12], and application level multicast or broadcast protocols [12].

On the other hand, a structured P2P network faces a high cost of maintenance of the network and the ability of this type of networks to work with extremely unreliable environments has not yet been investigated. On the contrary, an unstructured P2P network is a low cost network which can sustain any extreme environment [17]. Although such a benefit can be achieved at the expense of higher search cost, the network assumptions and the overall gain have made this kind of P2P networks so attractive that several unstructured P2P networks have been deployed and are being used by huge user communities. For instance, an unstructured P2P network, named PROOFS [17], has been proposed to share hot Web content. The heart of PROOFS is a periodic gossip protocol, called shuffle, where two random neighboring peers rearrange their P2P neighbor sets through an exchange of randomly selected neighboring peers. Though the shuffle operation is simple and inexpensive, query success rate for popular objects is excellent (more than 95%). With a strong theoretical background, PROOFS is an excellent unstructured P2P network for wired systems where computing power and network bandwidth are ample, and changes to the membership of the P2P network are rare. With the limitations of wireless medium and mobile devices, and dynamic join and leave of the mobile peers in the P2P networks, the benefit of randomness in PROOFS diminishes. In a wired network, due to the abundance of resources, performance metrics of many applications are abstract. However, P2P networks in wireless mobile environment should be very economic about the resources of the wireless medium and devices.

III. SYSTEM MODEL

The proposed system model consists of a set of collaborative computing nodes, each equipped with a wireless interface. It is believed that nodes can form a network on-the-fly using an ad-hoc networking technology.

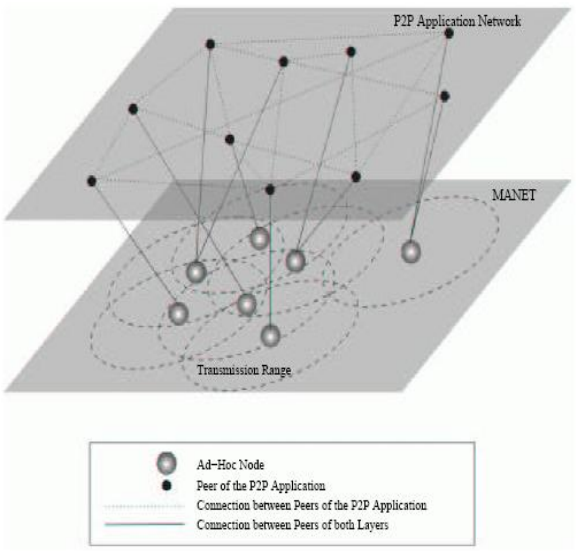


Figure 2. A diagram of a P2P application over a MANET [18]

In this research, we consider GeRaf [19], an efficient location aware transmission (MAC) and forwarding (routing) scheme, to manage the network. In our model, for each node, participation in the P2P network is discretionary. However, irrespective of its membership in the P2P network, each node participates in routing messages from one node to another as a low level service. It is being assumed that the network is equipped with low level (lower than application level) point-to point unicast primitives, and each of the devices mobile has access to some forms of location service [20]. Through this location service, a node in the network can obtain the physical location of itself or other nodes. The information from the location service is used by the lower level network management (i.e., GeRaf) as well as by the P2P modules. As a result, either the network management modules expose interfaces to share the location information or can be combined with the P2P modules as a cross-layer application.

3.1. Multi hop cellular networks (MCN)

In the field of mobile communications, an important model is multi hop ad hoc networks [21], unlike traditional single hop cellular networks (SCN); this paradigm is based on the infrastructure which is less, self-organizing and rapidly deployable without any site planning. In multi hop ad hoc networks consisting exclusively of mobile users (also known as mobile ad hoc networks or MANETs), each node relays the packets that need multiple hop transmissions, and other nodes towards their destination by acting as an intermediary station. Otherwise they can't be reached with single-hop transmission. The real world MANETs which are available today, are deployed widely based on the ad hoc mode of IEEE 802.11 standard for wireless local area networks(WLAN) with the high data rate of 54 Mbps for internet access and multimedia applications. Another concept of MCN was first proposed by Lin and Hsu [21] as an architecture that would preserve the benefits of traditional SCNs with infrastructure and incorporating the flexibility of ad hoc networking. To simplify the concept of MCN in this paper, we would introduce MCN as a general networking paradigm that combines the traditional SCNs and ad hoc networks by means of multi hop transmission, unless we specifically refer to the MCN architectures proposed in [21].

The underpinning idea of using a multi hop communication is to split an original long communication link into two or more shorter links and it thus results less requirement of transmission power of each node participating in the communication scenario. Also this reduction in transmission power could also lead to a lower interference level and shorter frequency reuse distance. In addition, the need for short-range transmission in MCNs opens the possibility of using other higher data rate wireless technologies such as IEEE 802.11, Bluetooth, or Ultra-Wideband (UWB), in conjunction with the cellular technology.

3.2. Comparison between MANETs and P2P application networks

Mobile ad hoc network is characterized as multi-hop wireless communications among mobile devices. As P2P applications and mobile ad hoc networks follow the same model, some aspects of both are common but have some jarring contrasts. General differences between both technologies are described in TABLE 1.

Table 1. Differences between P2P application networks and MANETs

	P2P Network	**MANET**
Motivation for creating the network	Create a logical infrastructure to provide a service	Create a physical infra-structure to provide connectivity
Connection between two nodes	fixed medium and direct	wireless and indirect
Connection confidence	high (physical connections, many paths)	low (wireless connections)
Peer location	any Internet point	restricted area
Structure	physical apart from logical structure	physical structure corresponds to logical structure
Routing	only reactive algorithms possible, reliable algorithms not implemented yet	reactive, pro-active and reliable algorithms exist
Peer behaviour	Fixed	mobile
Broadcast	virtual, multiple uncast	physical, to all nodes in transmission range area

3.3. Peer-to-Peer multi hop cellular

Mobile ad hoc and Peer-to-Peer networks have encountered two challenges in common: peer detection and packet routing. To mitigate these challenges, synergies between P2P networks and MANET can be used to reduce the administrational effort and to increase the performance and reliability of mobile peer to peer (MPP)

[22]. The MPP protocol suite comprises the MPP protocol as the application layer protocol, the Mobile Peer Control Protocol (MPCP) as the interlayer communication protocol and EDSR as the network routing protocol. MPP plays the roles of file transfers within the P2P network and resides in the P2P client application. MPP also gets the data upload and download facilities through use of HTTP. A communication channel, the MPCP, between the application (MPP) and the network layer (EDSR) is needed to exploit the P2P functionality in the network layer. Fig. 3 shows the layer model of the mobile P2P network.

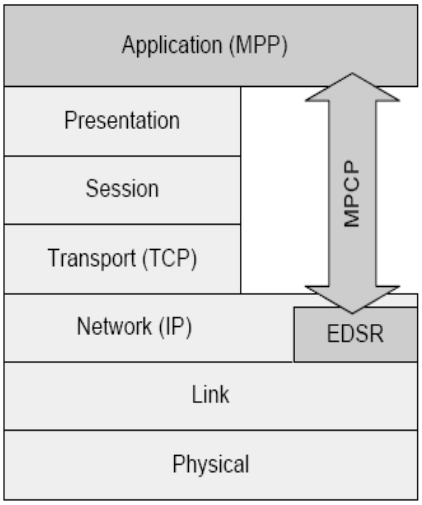


Figure 3. Network layer and protocols [22].

3.4. Physical and network layer significance of Peer-to-Peer multi hop cellular

Initially, the P2P application on the mobile device announces itself to the EDSR layer with the MPCP. Fig. 4 shows the process of searching and transferring files within the mobile Peer-to-Peer network as a message sequence chart. MPCP forwards the request to EDSR which transforms it into a search request (SREQ) upon the initialization of data search. As with DSR route requests (RREQ), EDSR floods SREQs through the MANET. EDSR nodes receiving the request, forward the request to the registered P2P application over MPCP. Consequently the P2P application can determine data satisfying the request's criteria. If a file on the node matches to a request, the application initializes an EDSR file reply to be sent back to the source node containing all necessary information for the file transfer. In a similar way to DSR route replies (RREP), a file reply (FREP) includes the complete path between source and destination.

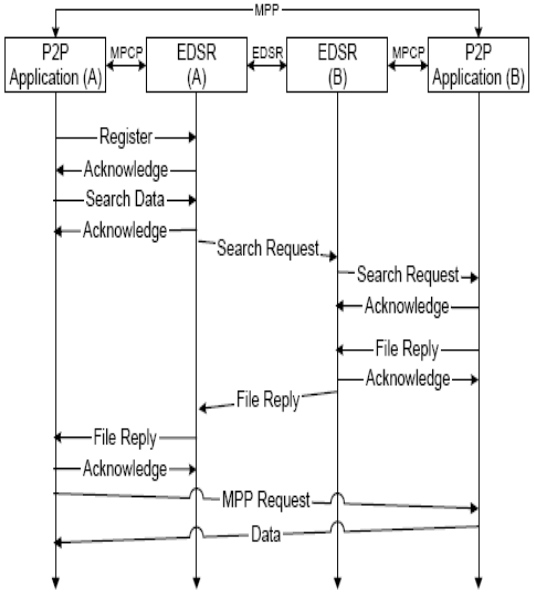


Figure 4. Message sequence chart for data search and download process in the mobile P2P network[21]

3.5. Optimizing P2P over MANETs

Our proposed modifications to the unstructured approaches are proposed to this section. As mentioned before, the performance of the unstructured P2P approaches depends on the amount of messages sent. As noted by J. Borg, content searching in P2P is similar to routing in MANETs [23]. So, we used concepts of routing to improve unstructured P2P networks. A classic routing algorithm named Gossiping is introduced where each node forwards its requests to each of its neighbors according to a pre-defined probability [24]. This operation significantly reduces energy consumption and network load due to a smaller number of messages sent, however the number of hops travelled increases [25]. Reconfiguration of gossip protocol by exchanging a number of neighbors between peers will make neighbors closer to each other. The concept of exchanging neighbors follows from the shuffle operation of PROOFS [17]. It is done to provide randomness in the network, whereas, reconfiguration makes attempts to being neighboring peers closer to each other. We hope that reconfiguration reduces link level hop count between neighboring peers. Firstly if a neighbor is located at a nearby location then it results in reduction in number of hops between the peers. So that helps in reducing of number of link level messages which helps in reducing the total bandwidth consumption to forward P2P messages. Furthermore, lower hops mean reduced message latency. As reduced number of link level messages slows down energy consumption and boosts battery life of mobile devices and these two properties are appeared extensively in wireless mobile application.

Indicate the nodes in the network as *v*1, *v*2, *vNtotal*. Distance between nodes *vi* and *vj* can be defined as *Dij* = |*dist (vi, vj)*|. Let *E*[*nij*] is the expected number of link level hops between *vi* and *vj*. From [19], it can be shown that,

$$\frac{D_{ij}/R-1}{E[\zeta(D_{ij}/R)]}+1 \leqslant E[n_{ij}] \leqslant \frac{D_{ij}/R}{E[\zeta(1)]}+1$$

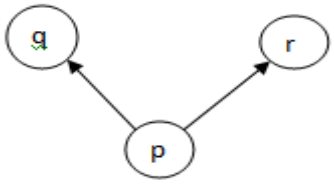
Where *R* is the radio range of a node. *E* [*ζ (D)*] is the expected one hop advancement towards the destination where D (expressed in unit radio range) is the distance between the current and the destination nodes. The average link level hop count can then be defined as,

$$\frac{1}{N_{total}(N_{total}-1)}\sum_{i=1}^{N_{total}}\sum_{\substack{j=1\\ j\neq i}}^{N_{total}}E[n_{ij}]$$

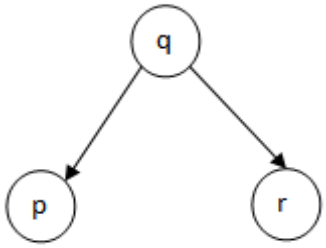
We introduce the concept of **'distance gain'** to have peers located at a close geographic area. During a (re)configuration procedure between peers *p* and *q*, if the initiating peer *p* forwards another P2P neighbor *r* to *q*, the distance gain is the reduction of the distances between the pairs *p* and *r* and the second pair *q* and *r*. Fig. 5 shows a (re)configuration step where a directed edge from any peer *x* to another peer *y* means that *y* is a neighbor of *x*. Now, the distance gain is formally given by:

$$d^{p}_{q,r} = |dist(p,r)| - |dist(q,r)|$$

Where *dist(x, y)* is the distance between *x* and *y*. When a peer *p* wants to engage in a reconfiguration process, it finds the peer so that it results the maximum distance gain.



(a) Before (re)configuration



(b) After (re)configuration

Figure 5. (Re) configuration process.

3.6. The function of (Re) configuration in P2P over mobile ad hoc networks

Generally the wireless devices have a restricted transmission range due to its limited power supply. So, data search should preferentially be made within a small distance. It can be happened in two ways. In general, the first solution provides continuous access to an information network like the Internet or a private intranet with high costs, using a fixed infrastructure. The second way does not need a fixed infrastructure: a set of mobile devices, on their own, forms the ad hoc network and nearby devices become important sources of data for each other. This is similar to the P2P paradigm that incorporates a network element which acts as client, server and router at the same time. Once the ad hoc and the P2P networks take place in different layers, they do not substitute each other.

Conversely, they seem to be naturally complementary**.** The easiness of forming the network is one of the main advantages of a P2P network, since it is not necessary to have an infrastructure nor it depends on a central server. Examples of possible uses of P2P over ad hoc networks include applications that alert us to the presence of friends at a crowded public space or identify people we want to meet taking into account our preferences and interests; systems that spread rumors, facilitate the exchange of personal information, or support us in more complex tasks.

Another thing is that P2P over ad hoc networks is a very dynamic combination that demands, among other things, special attention regarding (re)configuration [23] issues as discussed below. P2P networks are virtual networks which focus on sharing data. For a better performance in the search mechanism the protocols are designed so that data can be found more rapidly and more frequently. The P2P network topology, however, might be very different from the physical one, that is, an efficient P2P protocol may have a negative impact on the ad hoc network. Generally, P2P protocols have in common a mechanism that consists in having a list of neighbors to which the queries can be forwarded. In fixed networks, the status of a neighbor would usually vary between is available and is not available. In mobile scenarios, however, a close peer may become distant in a short period of time, maintaining it's is available status. In this case, the P2P distance, measured in hops, would be the same but the ad hoc distance would increase which in turn generating a greater traffic on the physical layer. Data search could even perform as before but the ad hoc network would be overloaded and nodes would demand much more of their power supply. It is important to monitor the references between nodes, (re)configuring the P2P network taking into account the ad hoc topology. The (re)configuration algorithms [23] are described below:

3.7. (Re) configuration algorithms

(Re) configuration algorithms [23] for decentralized P2P network being proposed. There are three different decentralized algorithms, which are called Basic, Regular and Random[42].In the description of all these algorithms, it will be said that the nodes are connected, trying to connect, maintaining a connection and other similar terms. It is important to notice, however, that we are dealing with wireless networks and, thus, there are no real connections, e.g., a TCP connection, between nodes. Here connections actually mean references, that is, they represent the knowledge of the addresses of some reachable nodes. Thus, if a node A keeps a reference to node B whereas B also refers A, then it is considered as regular connection. On the other hand, Irregular connections also exist and are used in the Basic algorithm.

3.7.1. Decentralized algorithms

The proposed system's model forwards the message over different hops from a peer to the next in order to establish connections and search for data. In spite of having the same proposition, the three decentralized algorithms have distinct behaviors, as we have shown below. The Basic algorithm has been discussed in the next section. Another unavoidable concept will be briefly described after that: the small-world effect, which is the key point for turning the Regular algorithm into the Random algorithm. The Random algorithm has been described at the end.

3.7.2. The basic algorithm

The Basic algorithm is the basis for comparison and serves as a simple (re)configuration algorithm. It partially ignores the dynamic nature of the network. The Basic algorithm which is shown below uses three constants named MAX_N_CONN, N_HOPS and TTL. MAX_N_CONN represents the maximum number of connections per node. N_HOPS is the number of hops a message can travel and TTL stands for the time interval between two attempts to establish connections. The algorithm works as described below. When a node is starting to participate in the P2P network, it broadcasts a message to discover other nodes within N_HOPS away in the neighborhood. Each and every node that listens to this message answers it. The node establishes a connection to the neighbor which sent the response, as soon as the response arrives, until the limit of MAX_N_CONN connections. In case the number of responses is less than MAX_N_CONN and whenever else it has less than MAX_N_CONN connections then the node keeps trying to create the rest of the connections. Here the time interval is the rescue for network to avoid the traffic overload during consecutive trials. The node

waits for a time interval—TTL—in order to avoid traffic overload in the network. The validity of a connection or reference is frequently checked by sending ping once upon it is established. Whenever a node receives a ping it answers with a pong. The pong signal represents the existence of a connection whereas its absence means the neighbor is not reachable anymore and then the connection is over.

Basic algorithm:

A_Basic: Establishing connections:
While the node belongs to P2P network
If number of connections < MAX_N_CONN
Try to establish new connections to nodes within N_HOPS away up to the limit of MAX_N_CONN connections;
Wait TTL before next try;
End if
End while

Maintaining connections:
While this connection exists
Send a *ping* to the connected node;
Wait some time for the *pong*;
If the *pong* was received then
Wait some time before sending next *ping*;
Else
Close this connection;
End if
End while

3.7.3. The small-world model

In a regular graph its n vertices are connected to their nearest k neighbors but in a random graph, the connections are randomly established and k stands for the average number of edges per vertex. In this way two neighbors of a node have a greater chance of being connected to each other in regular graphs, that is, the average clustering coefficient is much greater in regular graphs. This coefficient is obtained as follows: let real_conn be the number of existent connections between all the neighbors of a node (these neighbors are connected to this given node); and let possible_conn be the number of all connections that could exist between these neighbors. The clustering coefficient is given by real_conn/possible_conn. Besides the clustering coefficient, the regular and random graphs also have very distinct characteristic path lengths. In large regular graphs with n much larger than k—for a k much larger than 1— the path length is approximately n/2k. In large random graphs this value decreases substantially and is given by log n/ log k. Interestingly, little changes in regular graphs connections are sufficient to achieve short global path lengths as in random graphs. The rewiring of some connections from neighbors to randomly chosen vertices creates bridges between clusters that are distant. These bridges diminish the path length without any considerable change in the clustering coefficient.

Graphs that have high clustering coefficients and, at the same time, short global path lengths are called small world graphs. Our Random (re)configuration algorithm, presented next, aims to construct a Peer-to-Peer network as a small-world graph. Before presenting the Regular and Random algorithms, we will list their variables and constants, most of which are present in both algorithms. There are three variables: hops, randhops and timer. The first one represents the number of hops a message looking for a regular connection can travel. It is initialized with the value N_HOPS_INITIAL, which is greater than 1, and has MAX_N_HOPS as an upper limit. The Second one has a similar meaning but it is only applied to random connections; it does not need to be initialized. The third variable stands for the time interval a node waits between two attempts to establish connections. It is initialized with TTL_INITIAL and can increase up to MAXTIMER. Finally, there are two remaining constants not explained yet: MAX_N_CONN, which is the maximum number of connections per node, and MAX_DIST, which is the maximum distance allowed between two connected neighbors (measured in number of hops).

3.7.4. The regular algorithm

Initially, there is the ad hoc network and some (or all) of its nodes that want to build the P2P network execute the algorithm. In this case, the node broadcasts a message saying that it is available to establish connections. Messages are expected to travel a specific number of hops (nhops). When receiving this message, a node willing to connect starts a three-way handshake with the sender, aiming to establish a regular connection. If, within that radius, less than MAX_N_CONN neighbors can be regularly connected, the node will make another broadcast with a larger number of hops (nhops +2). Before the new broadcast, however, it waits for a timer time interval. As in the Basic algorithm, this interval is an attempt to avoid traffic overload. This mechanism is repeated until the maximum of MAX_N_CONN connections or the maximum of MAX_N_HOPS hops is achieved, whichever occurs first. When nhops is set to 0 it means that the node tried all possible values for nhops without connecting to MAX_N_CONN neighbors. In this case, the time interval timer is doubled before the next cycle of trials, in which nhops will restart with the N_HOPS_INITIAL value. Once a connection is successfully built, the node starts its maintenance as presented below. The connection is frequently checked using pings. As we are dealing with regular connections, only the node that started the process of establishing the connection will send pings. The reception of pings is controlled by the other node with the use of a timer. Whenever it receives a ping, it answers with a pong and reinitializes the timer. In case a timeout occurs, it closes the connection. Upon receiving a pong, the other node knows its neighbor is still reachable, but this is not

enough to maintain the connection. To remain connected, the distance between the nodes must be less than MAX_N_HOPS hops. In case the distance is greater than that, the connection is closed. The same occurs in the absence of a pong.

Regular and random algorithm:

A_Regular: Establishing connections
While the node belongs to P2P network
If number of connections < MAX_N_CONN then
If nhops ≠ 0 then
Try to establish new and regular connections to
Nodes within nhops away up to the limit of
MAX_N_CONN connections;
Wait timer before next trial;
Else
Timer = min (timer × 2, MAX_TTL);
End if
Nhops = (nhops+2) mod (MAX_N_HOPS + 2);
End if
End while
A_Random: Establishing connections
While the node belongs to P2P network
If number of connections < MAX_N_CONN then
If nhops ≠ 0 then
Try to establish new and regular connections
To nodes within nhops away up to the limit of
MAX_N_CONN – 1 regular connection;
Wait timer before next trial;
Else
Timer = min (timer × 2, MAX_TTL);
End if
If a random connection is needed then
Set randhops to a randomly chosen value between
Nhops and 2 × MAX_N_HOPS;
Try to establish one new and regular random
Connection to the farest node possible within
Randhops away;
End if
Nhops = (nhops + 2) mod (MAX_N_HOPS + 2);
End if
End while
A_Regular and A_Random: Maintaining connections:
While this connection exists
If it is the node that asked for the connection
Send a ping to the connected node;
Wait some time for the pong;
If the pong was received then
If this is a random connection then
If the node is nearer than 2× MAX_DIST then
Wait some time before sending next ping;
Else close this connection;
End if
Else
If the node is nearer than MAX_DIST then
Wait some time before sending next ping;
Else close this connection;
End if
End if
Else close this connection;
End if
Else wait some time for the ping;
If the ping was received then
Send a pong;
Else close this connection;
End if
End if
End while

This algorithm has four improvements compared to the Basic algorithm. First, the number of hops a message that is looking for connections may travel is increased gradually. Once this kind of message is sent by broadcast, controlling the number of hops means less traffic in the network. The traffic is also potentially diminished by the control of the distance between connected nodes since the pings and pongs exchanged will span a narrower area. This was the second improvement, which is complemented by the third one: the number of pings and pongs was cut half because only one vertex checks whether the connection is active by sending pings. These three actions added together have a positive impact on wireless networks, which have bandwidth and energy constraints. Last, but not least, there is the fourth improvement, related to the timer and which was inspired by the dynamic nature of our network, together with the traffic concern. The time interval between two broadcasts has not a fixed value. Instead, it doubles every time a cycle of attempts to establish connections is over, diminishing the overall traffic. Besides, if it is being difficult to connect to other nodes, while waiting for a longer interval the network can change to a more favorable configuration. Then, it may be easier to establish the desired connections. One detail not presented in the pseudo-code is that, whenever a connection is done, the timer is reset to its initial value. This is because this new connection may indicate a better network configuration.

3.7.5. The random algorithm

Adopting the Regular algorithm, each node preferentially connects to its nearest neighbors. In a dense P2P network, the connections will be established within a low number of hops. Probably, this will lead to a network whose characteristics resemble regular graphs, mainly in the sense of long global path lengths. Aiming to avoid this and to gain the small-world characteristics, our Regular algorithm was changed to the Random algorithm. The establishment of the first MAX_N_CONN−1 connections follows exactly the same steps mentioned in the Regular algorithm. For this reason, they will be called regular connections. The difference of

the two algorithms lies in the last connection, as it can be seen in the algorithm .As discussed before, few rewiring can turn a regular graph into a small-world graph. To promote this rewiring, the node does not try to establish its last connection within nhops away. Instead, it chooses a random number (randhops) between nhops and2 × MAX_N_HOPS. Then, it broadcasts a message looking for connections to all nodes within randhops hops away. It waits some time for responses to arrive, analyzes them, and only continues the three-way handshake with the most distant neighbor. Once a connection is established this way, it is called a random connection and, whenever it goes down, it must be replaced by another random connection. The maintenance of the existing connections follows the scheme presented in algorithm. The final effect expected is that some of the overall connections will link distant peers, and, therefore, will act as bridges. This will turn the path length shorter while maintaining the clustering coefficient high, and achieving the small world Effect.

IV. SIMULATIONS

Simulation can be defined as the process of designing a model of a real system and conducting experiments with this model for the purpose of understanding the behaviour of the system and/or evaluating various strategies for its control. To make this process useful, the behaviour of the model is expected to realistically initiate the response of the system under study. The operation of wireless applications or protocols in the perspective of Mobile Ad-hoc Networks (MANETs) frequently requires moving through a simulation phase. For the results of the simulation to be significant, it is important that the model on which is based the simulator matches as strictly as possible the reality. There exist several popular simulators, such as OPNET Modeller, NS-2 or GloMoSim MATLAB. In this paper the simulation results being presented of a straightforward algorithm using NS-2 and MATLAB. We have used Microsoft Excel to performance evaluation to generate graph from the extracted data of NS-2.

4.1. Matrices for performance evaluation

In order to measure the performance of our proposed platform, we have used the following matrices:
Average End-to-end Throughput: Throughput is the average bit rate at the destination node. The end-to-end throughput is measured as the average of the end-to-end throughputs of all flows in the network. Throughput= (total no of bytes received/simulation time)*(8/1000) kbps.
For calculating Average end-to-end Throughput from our extracted data of NS-2 we have used the following formula:
Average end-to-end Throughput is the total of all bits (or packets) successfully delivered to individual destinations over total-time / total-time (or over bits-total / total time)
Average End-to-end Delay: The average delay is the delay a packet takes to travel from the source to the destination node. The end-to-end delay is the end-to-end delay experienced by flows in the network. Since flows traverse multiple hops in an ad-hoc network, this metric gains importance as the delay is directly proportional to the hop length of the path and inversely proportional to the end-to-end throughput.
For calculating average end-to-end delay from our extracted data of NS-2 we have used the following formula:
Average end-to-end Delay=Sum of delay experienced by each packet making up the flow) / number of packets

4.2. Simulation environments

In order to evaluate the proposed platform, we performed simulations in the NS-2 simulator version 2.29.3 and MATLAB. NS-2 is a highly modular discrete event simulator, developed for simulating the behaviour of network and transport layer protocols in a complex network topology. It is freely available and has been extensively enhanced by the Monarch project at CMU for using simulating mobile ad hoc networks. In our NS-2 simulations the P2P applications run on top of the UDP protocol, since TCP does not perform well in this type of environment. We choose DSDV for routing for its best performance under a P2P applications in the most common MANET scenarios[35]. Nodes are configured with typical PDA network parameters(11 Mbps IEEE 802.11b with 50m of range). The interface queue (IFQ) length is set to 50 packets and energy consumption is 230 mW for reception and 330mW for transmission. Radio propagation follows the two-ray-ground model. We assume a network of varying number of nodes scattered in a 500mX500m grid area. Nodes move accordingly to the random way-point mobility model, with a pause time of 2.0s and maximum speed of 10.0m/s. The application traffic pattern consists of CBR sources running on UDP that start at staggered times.CBR source destination pairs are generated randomly. In our simulations we fixed the packet size and the number of CBR flows. We made the variation in the node number from 5 to 20. These 4 variations were combined with 5 mobility scenarios as input files to the network simulators. Altogether we performed 20 simulations.

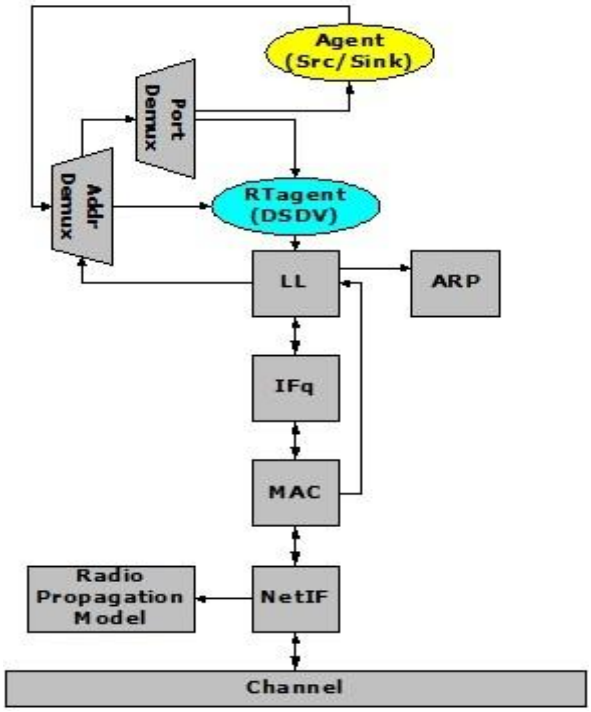


Figure 6. Wireless simulation in NS-2(mobile node diagram-DSDV)[ns manual].

4.2.1. Simulation parameters

TABLE 2. Summaries of all the constant parameters of the simulations

Table 2. Static parameters.

Parameters	Value
Terrain size	500mx500m
Node placement	Uniform
MAC protocol	802.11 without RTS/CTS
Bit rate	4.0 kbps
Wireless Propagation model	Two-ray-ground
Antenna type	Omni directional
Mobility Model	Random waypoint
Pause time	2.0s
Maximum node speed	10.0m/s
Simulation time	200s

4.2.2. Creating random traffic pattern for wireless scenarios

Random traffic connections of TCP and CBR can be setup between mobile nodes using a traffic-scenario generator script. This traffic generator script is available under ~ns/indep-utils/cmu-scen-gen and is called cbrgen.tcl. It can be used to create CBR and TCP traffics connections between wireless mobile nodes. In order to create a traffic-connection file, we need to define the type of traffic connection (CBR or TCP), the number of nodes and maximum number of connections to be setup between them, a random seed and incase of CBR connections, a rate whose inverse value is used to compute the interval time between the CBR pkts. So the command line looks like the following:

cbrgen.tcl [-type cbr|tcp] [-nn nodes] [-seed seed] [-mc connections] [-rate rate]

For our simulations we generated five scripts varying the number of nodes.

4.2.3. Creating node-movements for wireless scenarios

The node-movement generator is available under ~ns/indep-utils/cmu-scen-gen/setdest directory and consists of setdest {.cc, .h} and Makefile. For creating node movement scenarios the command looks like this,

/setdest [-n num_of_nodes] [-p pause time] [-s max speed] [-t sim time] \[-x max x] [-y max y] >[out dir/movement-file]

Five scenarios with varying number of nodes have been considered.

4.2.4. Extracting data from trace files

We extracted data from the trace files for calculating throughput and delay by the following OTcl command-
awk '/^s/ && /AGT/ {print}' filename.tr > output file

4.3. Performance evaluation of simulation results

This section presents the results collected during simulation with NS-2 and MATLAB simulators. The simulation was performed for five different scenarios by varying node number. We varied node number from five to twenty. We focused our analysis on two metrics: Average end-to-end delay and average end-to-end throughput.

4.3.1. Average end-to-end delay analysis

This includes delay perceived by a user requesting some content, including the time for transmitting the query to the network, locating the desired content in the network, and returning a response back to the user.

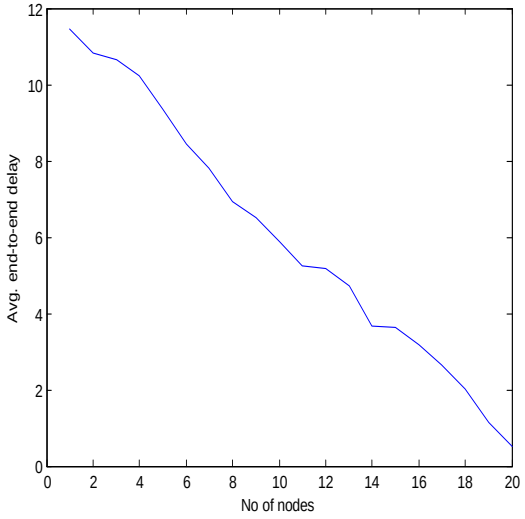


Figure 7. MATLAB result for average end-to-end delay.

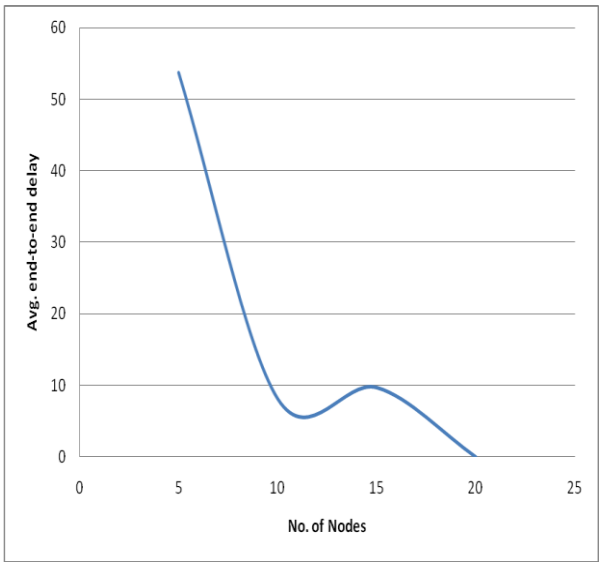


Figure 8. NS-2 result for average end-to-end delay.

From the result it can be seen that average end-to-end delay decreases as the number of node increases. These in terms reduce the no of link hops.

4.3.2. Average end-to-end throughput analysis

Throughput in this research is calculated for the total no. of packets received during the simulation time of 200sec.

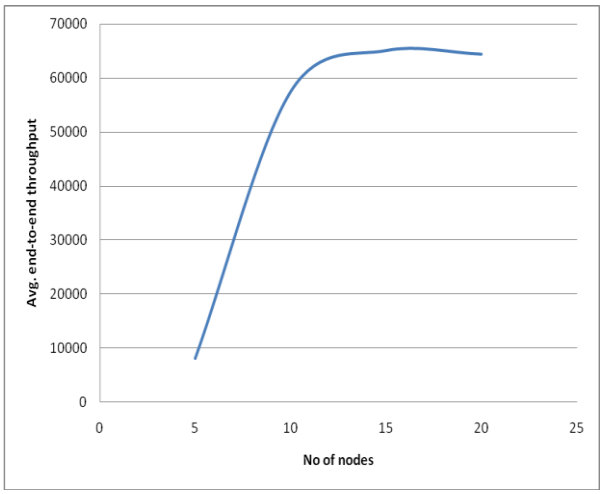


Figure 9. NS-2 result for average end-to-end throughput.

From the result it can be seen that average end-to-end throughput increases as the number of node increases. This in terms increases the throughput.

4.3.3. Discussion of simulation results

Our study is based on Gnutella. Due to use of flooding Gnutella is inefficient in large-scale networks or in situations where no. of nodes is high. Using gossiping reduces number of messages sent, however number of hop travel increases[25].We have used (re)configuration algorithm[23] for reducing number of hop count. It is expected that reformation reduces link level hop count between neighboring peers [10].From the simulation results it is clear that the as the no. of nodes increases the throughput increases and delay decreases. Reduced delay means reduction in the number of hops between the peers. Increased throughput means increase of bandwidth as bandwidth is proportional to throughput. Note that both of these properties are very much desirable for wireless mobile applications. As reduced number of hops reduces number of link level messages which slows down energy consumption and boosts battery life of mobile devices.

V. CONCLUSIONS

Mobile ad hoc networks (MANETs) are infrastructure less and nodes may act as both clients and servers, which increases fault tolerance and data availability. That's why Peer-to-Peer (P2P) networks are a well fit for content distribution on such networks. The contribution of this proposed platform is to reduce the cost of Peer-to-Peer mobile wireless networks. According to the existing theory it is possible to minimize the consumption of bandwidth and energy of mobile wireless devices and to increase the throughput of the network. This proposed platform has presented different viewpoints to improve the performance of Peer-to-Peer networks. We have used inexpensive gossip protocol to manage the network. We have considered distance between neighbours as a biasing factor. In ado wireless networks, each node is able to setup a point-to-point communication to other nodes within its radio signal range, without the need of a fixed infrastructure. To uphold an efficient sharing of information and improve network durability, we have implemented (re)configuration [23] algorithms that provide configuration, maintenance and reformation of the P2P network over an ad hoc network. To analyze the performance of the algorithms we have performed some simulations using the NS-2 and MATLAB. The proposed platform is robust and flexible with high fault tolerance.

5.1 Future work

As our future work, we will study different approaches to design a low cost platform by improving the performance of P2P networks over MANETs. We are most interested in analyzing the effects of response time, density of nodes, energy, mobility of nodes in ad hoc and P2P layers. Caching [24] is one promising approach, where nodes would pro-actively store the most frequently accessed items. This would reduce the response time and the number of messages in the on the network by resolving queries in less hops. Variable transmit power into ad hoc routing protocols allows nodes some control over their local densities.

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LZW Data Compression

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Abstract: **- Lempel–Ziv–Welch (LZW)** is a universal lossless data compression algorithm created by Abraham Lempel, Jacob Ziv, and Terry Welch. LZW compression is one of the Adaptive Dictionary techniques. The dictionary is created while the data are being encoded. So encoding can be done on the fly. The dictionary need not be transmitted. Dictionary can be built up at receiving end on the fly. If the dictionary overflows then we have to reinitialize the dictionary and add a bit to each one of the code words. Choosing a large dictionary size avoids overflow, but spoils compressions. A codebook or dictionary containing the source symbols is constructed. For 8-bit monochrome images, the first 256 words of the dictionary are assigned to the gray levels 0-255. Remaining part of the dictionary is filled with sequences of the gray levels.LZW compression works best when applied on monochrome images and text files that contain repetitive text/patterns.

Keywords: *- Encoding,Decoding,Compression Ratio*

I. ENCODING

A dictionary is initialized to contain the single-character strings corresponding to all the possible input characters (and nothing else except the clear and stop codes if they're being used). The algorithm works by scanning through the input string for successively longer substrings until it finds one that is not in the dictionary. When such a string is found, the index for the string less the last character (i.e., the longest substring that *is* in the dictionary) is retrieved from the dictionary and sent to output, and the new string (including the last character) is added to the dictionary with the next available code. The last input character is then used as the next starting point to scan for substrings.

In this way, successively longer strings are registered in the dictionary and made available for subsequent encoding as single output values. The algorithm works best on data with repeated patterns, so the initial parts of a message will see little compression. As the message grows, however, the compression ratio tends asymptotically to the maximum.

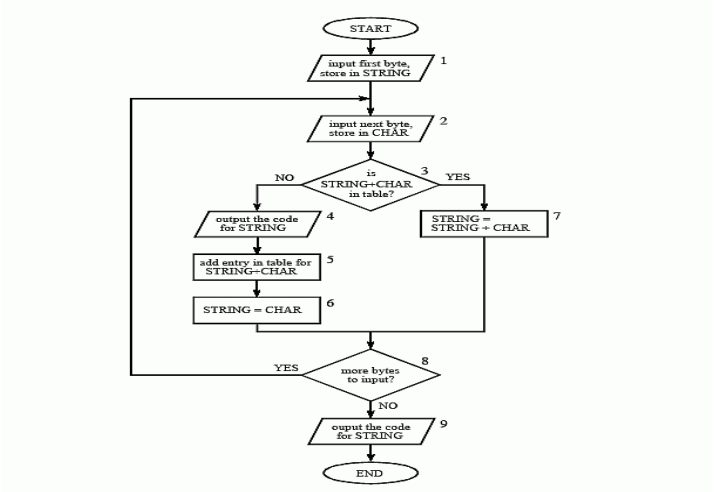


FIGURE 27-7
LZW compression flowchart. The variable, *CHAR*, is a single byte. The variable, *STRING*, is a variable length sequence of bytes. Data are read from the input file (box 1 & 2) as single bytes, and written to the compressed file (box 4) as 12 bit codes. Table 27-3 shows an example of this algorithm.

II. EXAMPLE FOR AN ENCODING PROCESS

A sample string used to demonstrate the algorithm is shown in below chart. The input string is a short list of English words separated by the '/' character. Stepping through the start of the algorithm for this string, you can see that the first pass through the loop, a check is performed to see if the string "/W" is in the table. Since it isn't, the code for '/' is output, and the string "/W" is added to the table. Since we have 256 characters already defined for codes 0-255, the first string definition can be assigned to code 256. After the third letter, 'E', has been read in, the second string code, "WE" is added to the table, and the code for letter 'W' is output. This continues until in the second word, the characters '/' and 'W' are read in, matching string number 256. In this case, the code 256 is output, and a three character string is added to the string table. The process continues until the string is exhausted and all of the codes have been output.

Input String = /WED/WE/WEE/WEB/WET			
Character Input	Code Output	New code value	New String
/W	/	256	/W
E	W	257	WE
D	E	258	ED
/	D	259	D/
WE	256	260	/WE
/	E	261	E/
WEE	260	262	/WEE
/W	261	263	E/W
EB	257	264	WEB
/	B	265	B/
WET	260	266	/WET
EOF	T		

The Compression Process:

The sample output for the string is shown in above chart along with the resulting string table. As can be seen, the string table fills up rapidly, since a new string is added to the table each time a code is output.

III. DECODING

The decoding algorithm works by reading a value from the encoded input and outputting the corresponding string from the initialized dictionary. At the same time it obtains the next value from the input, and adds to the dictionary the concatenation of the string just output and the first character of the string obtained by decoding the next input value.

The decoder then proceeds to the next input value (which was already read in as the "next value" in the previous pass) and repeats the process until there is no more input, at which point the final input value is decoded without any more additions to the dictionary.

In this way the decoder builds up a dictionary which is identical to that used by the encoder, and uses it to decode subsequent input values. Thus the full dictionary does not need be sent with the encoded data; just the initial dictionary containing the single-character strings is sufficient (and is typically defined beforehand within the encoder and decoder rather than being explicitly sent with the encoded data.)

The Decompression Algorithm

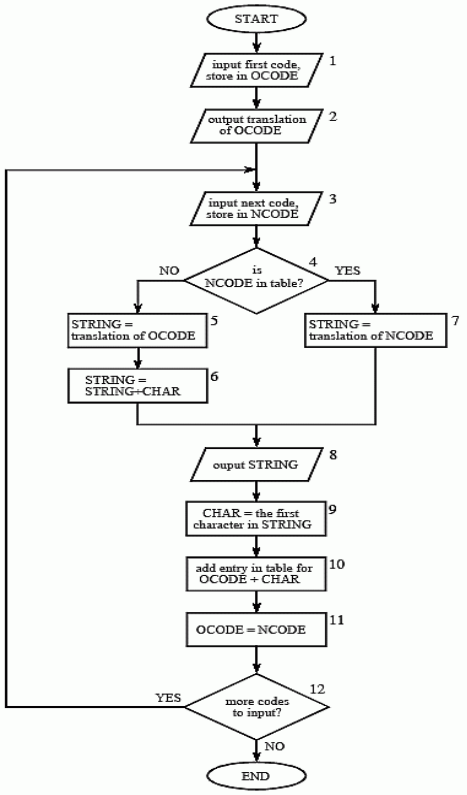


FIGURE 27-8
LZW uncompression flowchart. The variables, *OCODE* and *NCODE* (oldcode and newcode), hold the 12 bit codes from the compressed file, *CHAR* holds a single byte, *STRING* holds a string of bytes.

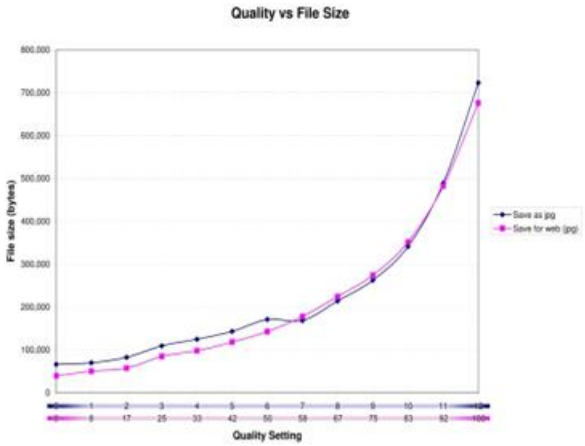
IV. DECOMPRESSION FLOWCHART

AN EXAMPLE FOR DECODING PROCESS

Just like the compression algorithm, it adds a new string to the string table each time it reads in a new code. All it needs to do in addition to that is translate each incoming code into a string and send it to the output. Below chart shows the output of the algorithm given the input created by the compression earlier in the article. The important thing to note is that the string table ends up looking exactly like the table built up during compression. The output string is identical to the input string from the compression algorithm. Note that the first 256 codes are already defined to translate to single character strings, just like in the compression code.

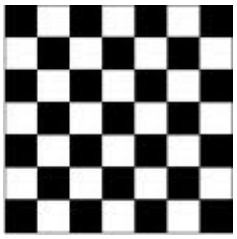
Input Codes: / W E D 256 E 260 261 257 B 260 T				
Input/ NEW_CODE	OLD_CODE	STRING/ Output	CHARACTER	New table entry
/	/	/		
W	/	W	W	256 = /W
E	W	E	E	257 = WE
D	E	D	D	258 = ED
256	D	/W	/	259 = D/
E	256	E	E	260 = /WE
260	E	/WE	/	261 = E/
261	260	E/	E	262 = /WEE
257	261	WE	W	263 = E/W
B	257	B	B	264 = WEB
260	B	/WE	/	265 = B/
T	260	T	T	266 = /WET

IMAGE QUALITY VS IMAGE FILE SIZE GRAPH :



(image quality in x-axis, file size in y-axis)

CHECKER BOARD IMAGE:



LZW compression works best when applied on monochrome images and text files that contain repetitive text/patterns.
For instance, Using LZW compression, a checker board image consisting of repetitive black and white patterns can be compressed upto 70% of its original file size.Thus a high compression ratio can be achieved.

Compression Ratio:

The **compression ratio** expresses the difference between the file size of an uncompressed image, and the file size of the same image when compressed.The compression ratio is equal to the size of the original image divided by the size of the compressed image. This ratio gives an indication of how much compression is achieved for a particular image. Most algorithms have a typical range of compression ratios that they can achieve over a variety of images. Because of this, it is usually more useful to look at an average compression ratio for a particular method.

The compression ratio typically affects the picture quality. Generally, the higher the compression ratio, the poorer the quality of the resulting image. The tradeoff between compression ratio and picture quality is an important one to consider when compressing images.

$$\text{Compression Ratio} = \frac{\text{Size of the original image}}{\text{Size of the compressed image}}$$

Using LZW, 60-70 % of compression ratio can be achieved for monochrome images and text files with repeated data.

Compression/Decompression Speed :

Compression and decompression time is defined as the amount of time required to encode and decode a picture, respectively.

Compression/decompression speed depends on:
- The complexity of the compression algorithm
- The efficiency of the implementation of the algorithm
- The speed of the processor hardware

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Remarks on one S.S. Dragomir's Result

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Abstract: *- In theorem* 1 [1], *S.S. Dragomir gave bounds for the normalized Jensen functional defined by convex function* f *, which one is defined on strictly convex subset* C *of vector space* X *. Further, using inequality* (2.1) *of normed space* $(X,\|\cdot\|)$ *he proved the inequalities* (3.1), (3.2) *and* (3.3), *and after that from inequality* (3.3) *he performed inequality* (3.6), *which was previously proved in* [2]. *In this paper we'll give an example, which shows that inequalities* (3.3) *are not correct and will show how the inequality* (3.2) *implies* (3.6) *given in* [1].

2010 ***Mathematics Subject Classification*****.** Primary 46B20, 46B99; Secondary 51M16.

Keywords: *- Convex function, Jensen's inequality, triangle inequality*

I. INTRODUCTION

Let X be a vector space, C convex subset of X, P_n set of all nonnegative $n-$tuples $(p_1, p_2, ..., p_n)$ such that $\sum_{i=1}^{n} p_i = 1$, $f: C \to \mathbf{R}$ a convex function, $\mathbf{x} = (x_1, x_2, ..., x_n) \in C$, $\mathbf{p} \in P_n$ and

$$J_n(f, \mathbf{x}, \mathbf{p}) = \sum_{i=1}^{n} p_i f(x_i) - f\left(\sum_{i=1}^{n} p_i x_i\right) \geq 0 \tag{1}$$

be the normalized Jensen functional. In [1], for functional (1), S.S. Dragomir gave elementary proof of the following theorem (theorem of bounds for the normalized Jensen functional).

Theorem 1. If $\mathbf{p}, \mathbf{q} \in P_n$, $q_i > 0$, for each $i = 1, 2, ..., n$ then

$$J_n(f, \mathbf{x}, \mathbf{q}) \max_{1 \leq i \leq n} \left\{\frac{p_i}{q_i}\right\} \geq J_n(f, \mathbf{x}, \mathbf{p}) \geq J_n(f, \mathbf{x}, \mathbf{q}) \min_{1 \leq i \leq n} \left\{\frac{p_i}{q_i}\right\}. \blacksquare \tag{2}$$

Furthermore, using the fact, that in normed space $(X,\|\cdot\|)$, the function $f_p: X \to \mathbf{R}$, $f_p(x) = \|x\|^p$, $p \geq 1$ is convex on X, S.S. Dragomir proved that inequality (2) implies the following inequalities

$$\begin{aligned} &\left[\sum_{j=1}^{n} q_j \|x_j\|^p - \left\|\sum_{j=1}^{n} q_j x_j\right\|^p\right] \max_{1 \leq i \leq n} \left\{\frac{p_i}{q_i}\right\} \geq \sum_{j=1}^{n} p_j \|x_j\|^p - \left\|\sum_{j=1}^{n} p_j x_j\right\|^p, \\ &\sum_{j=1}^{n} p_j \|x_j\|^p - \left\|\sum_{j=1}^{n} p_j x_j\right\|^p \geq \left[\sum_{j=1}^{n} q_j \|x_j\|^p - \left\|\sum_{j=1}^{n} q_j x_j\right\|^p\right] \min_{1 \leq i \leq n} \left\{\frac{p_i}{q_i}\right\}, \end{aligned} \tag{3}$$

And letting $q_j = \frac{1}{n}$, for $j = 1, 2, ..., n$ he get the following inequalities

$$[\sum_{j=1}^{n}\| x_j \|^p - n^{1-p}\| \sum_{j=1}^{n} x_j \|^p]\max_{1\le i\le n}\{p_i\} \ge \sum_{j=1}^{n} p_j \| x_j \|^p - \| \sum_{j=1}^{n} p_j x_j \|^p,$$
$$\sum_{j=1}^{n} p_j \| x_j \|^p - \| \sum_{j=1}^{n} p_j x_j \|^p \ge [\sum_{j=1}^{n}\| x_j \|^p - n^{1-p}\| \sum_{j=1}^{n} x_j \|^p]\min_{1\le i\le n}\{p_i\}. \quad (4)$$

Finally, letting $p_i = \frac{1}{\|x_i\|}$, for $x_i \in X\setminus\{0\}, i = 1,2,...,n$ and also using the inequalities (4) S.S. Dragomir get the following :

$$[\sum_{j=1}^{n}\| x_j \|^{p-1} - \| \sum_{j=1}^{n} \frac{x_j}{\|x_j\|} \|^p]\max_{1\le i\le n}\{\| x_i \|\} \ge \sum_{j=1}^{n}\| x_j \|^p - n^{1-p}\| \sum_{j=1}^{n} x_j \|^p,$$
$$\sum_{j=1}^{n}\| x_j \|^p - n^{1-p}\| \sum_{j=1}^{n} x_j \|^p \ge [\sum_{j=1}^{n}\| x_j \|^{p-1} - \| \sum_{j=1}^{n} \frac{x_j}{\|x_j\|} \|^p]\min_{1\le i\le n}\{\| x_i \|\}, \quad (5)$$

By which for $p = 1$ he get the following

$$[n - \| \sum_{j=1}^{n} \frac{x_j}{\|x_j\|} \|]\max_{1\le i\le n}\{\| x_i \|\} \ge \sum_{j=1}^{n}\| x_j \| - \| \sum_{j=1}^{n} x_j \|,$$
$$\sum_{j=1}^{n}\| x_j \| - \| \sum_{j=1}^{n} x_j \| \ge [n - \| \sum_{j=1}^{n} \frac{x_j}{\|x_j\|} \|]\min_{1\le i\le n}\{\| x_i \|\}, \quad (6)$$

proved in [2], and their generalization was given by Mitani, Saito, Kato and Tamura, [3] and also by Pečarić and Rajić, [4].

II. MAIN COMMENT

Example 1. Let $X = \mathbf{R}^n$, $n \ge 2$ and $\|\cdot\|$ be an Euclid's norm. Then the vertex $x_i = (0,...,0,\underset{i}{1},0,...,0)$, $i = 1,2,...,n$ satisfy the following

$$\| x_i \| = 1, \frac{x_i}{\|x_i\|} = x_i \text{, for } i = 1,2,...,n \text{ and } \| \sum_{i=1}^{n} \frac{x_i}{\|x_i\|} \| = \| \sum_{i=1}^{n} x_i \| = \sqrt{n}.$$

According to this, for $p > 1$ the inequalities (5) applies the following ones

$$n - n^{\frac{p}{2}} \ge n - n^{1-p} n^{\frac{p}{2}} \ge n - n^{\frac{p}{2}},$$

So, we get that for $n \ge 2$ and $p > 1$ is true that $n^{p-1} = 1$, and that is contradiction. ■

At first, it seemed that inequalities (3) - (6) get correct by (2). So this procedure [2] is citated by L. Maligranda. However, the example 1 shows that inequality (5) is not correct if $p > 1$. The error occurred in a choice of numbers $p_i = \frac{1}{\|x_i\|}$, $x_i \in X\setminus\{0\}$, $i = 1,2,...,n$. In fact, according to Theorem 1 these numbers have to satisfy the condition $\sum_{i=1}^{n} p_i = 1$. The mentioned condition is not satisfied for arbitrary vectors $x_i \in X\setminus\{0\}$, $i = 1,2,...,n$ and for thus selected numbers $p_i, i = 1,2,...,n$

Anyway, Theorem 1, i.e. inequality (4) implies (6).

Let $\alpha_i > 0$, for $i = 1,2,...,n$, and $p_i = \frac{\alpha_i}{\sum_{k=1}^{n}\alpha_k}, i = 1,2,...,n$. So, $\mathbf{p} \in P_n$ and If we take that $p_i = \frac{\alpha_i}{\sum_{k=1}^{n}\alpha_k}, i = 1,2,...,n$ in (4), we get the following inequalities:

$$[\sum_{i=1}^{n}\| x_i \|^p - n^{1-p}\| \sum_{i=1}^{n} x_i \|^p]\max_{1\le i\le n}\{\alpha_i\} \ge \sum_{i=1}^{n}\alpha_i \| x_i \|^p - (\sum_{i=1}^{n}\alpha_i)^{1-p}\| \sum_{i=1}^{n}\alpha_i x_i \|^p,$$
$$\sum_{i=1}^{n}\alpha_i \| x_i \|^p - (\sum_{i=1}^{n}\alpha_i)^{1-p}\| \sum_{i=1}^{n}\alpha_i x_i \|^p \ge [\sum_{i=1}^{n}\| x_i \|^p - n^{1-p}\| \sum_{i=1}^{n} x_i \|^p]\min_{1\le i\le n}\{\alpha_i\}. \quad (7)$$

Letting $\alpha_i = \frac{1}{\|x_i\|}$, for $x_i \in X \setminus \{0\}, i = 1,2,...,n$, in inequalities (7) we get the following:

$$\sum_{i=1}^{n} \| x_i \|^p - n^{1-p} \| \sum_{i=1}^{n} x_i \|^p \geq [\sum_{i=1}^{n} \| x_i \|^{p-1} - (\sum_{i=1}^{n} \frac{1}{\|x_i\|})^{1-p} \| \sum_{i=1}^{n} \frac{x_i}{\|x_i\|} \|^p] \min_{1 \leq i \leq n} \{\| x_i \|\},$$

$$[\sum_{i=1}^{n} \| x_i \|^{p-1} - (\sum_{i=1}^{n} \frac{1}{\|x_i\|})^{1-p} \| \sum_{i=1}^{n} \frac{x_i}{\|x_i\|} \|^p] \max_{1 \leq i \leq n} \{\| x_i \|\} \geq \sum_{i=1}^{n} \| x_i \|^p - n^{1-p} \| \sum_{i=1}^{n} x_i \|^p .$$

Finally, by using the inequalities above for $p = 1$, we get inequalities (6).

Remarks. In the end, we can note that for $\alpha_i = \| x_i \|$, $x_i \in X, i = 1,2,...,n$, inequality (7) implies the following inequalities

$$[\sum_{i=1}^{n} \| x_i \|^p - n^{1-p} \| \sum_{i=1}^{n} x_i \|^p] \max_{1 \leq i \leq n} \{\| x_i \|\} \geq \sum_{i=1}^{n} \| x_i \|^{p+1} - (\sum_{i=1}^{n} \| x_i \|)^{1-p} \| \sum_{i=1}^{n} \| x_i \| x_i \|^p,$$

$$\sum_{i=1}^{n} \| x_i \|^{p+1} - (\sum_{i=1}^{n} \| x_i \|)^{1-p} \| \sum_{i=1}^{n} \| x_i \| x_i \|^p \geq [\sum_{i=1}^{n} \| x_i \|^p - n^{1-p} \| \sum_{i=1}^{n} x_i \|^p] \min_{1 \leq i \leq n} \{\| x_i \|\},$$

In which, for $p = 1$ we get the inequalities below:

$$[\sum_{i=1}^{n} \| x_i \| - \| \sum_{i=1}^{n} x_i \|] \max_{1 \leq i \leq n} \{\| x_i \|\} \geq \sum_{i=1}^{n} \| x_i \|^2 - \| \sum_{i=1}^{n} \| x_i \| x_i \|,$$

$$\sum_{i=1}^{n} \| x_i \|^2 - \| \sum_{i=1}^{n} \| x_i \| x_i \| \geq [\sum_{i=1}^{n} \| x_i \| - \| \sum_{i=1}^{n} x_i \|] \min_{1 \leq i \leq n} \{\| x_i \|\}.$$

Similarly, as (6), if the vertex $x_i \in X, i = 1,2,...,n$ are such that $\| x_i \| = 1$, then they become equalities.

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Confined Photonic Modes in the Fabry-Pérot Based Photonic Crystal Nanobeam Cavity Structures with Mixed Tapered Air-Holes and Curved-Wall Cavity

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Abstract: - In this paper, confined photonic TE modes in different nanobeam (NB) cavity structures are presented. These structures were the Fabry-Pérot based narrow waveguide system with distributed Bragg reflectors (DBRs) combined with air-holes tapers adjacent to and faraway from the nanocavity (NC). In some parts of simulations the NC side-walls were curved in parabolic form. The tapered air-holes and parabolic narrowed cavity walls provide small modal volume and high quality factor (Q) TE modes. Simulations were done by finite difference frequency method via COMSOL Multiphysics 4.3 software, and results were additionally analyzed by OriginPro 9.0. High Q values $>10^4$ and modal volume as small as $0.7(\lambda/n)^3$ are obtained in the optimized structures.

Keywords: *-Nanobeam Cavity, Confined Modes, Tapered Air-Holes, Curved-Wall Cavity*

I. INTRODUCTION

Light applications of nanometer-scale structures in a half-century ago were unthinkable or hardly possible. Photonic crystals (PhCs) idea was first proposed by Eli Yablonovitch in 1987. The PhC's structures can be designed and created by employing periodic dielectric constant in a variety of lattice, in one, two and three dimensions. The PhCs cavity which is fabricated by introducing a defect in the normal lattice, due to the strong interaction between light and matter has attracted much attention in the recent decades [1]. Photonic crystal nanocavities (NCs) fabricated in the dielectric-semiconductor materials are able to confine light in a volume scale as small as a fraction of cube of the wavelength of light in the medium [2-5]. Very high quality factor (Q) and small modal volume in such nanostructures release new applications in a wide variety of areas such as low-threshold lasers [1, 6-9], the nonlinear Optics phenomena [10-14], realization of cavity quantum electrodynamics experiments in thesolid state materials [15], and quantum information processing and high precision filters [16-17].

In this paper, we investigate the photonic modes in the PhC nanobeam (NB) cavity structures which are the Fabry-Pérot based system with sort of distributed Bragg reflectors accomplished by series of mixed tapered air-holes in combinations with curved-wall cavity. For simulations and analysis of the results we used COMSOL Multiphysics 4.3 and OriginPro 9.0 Commercial softwares.

II. SIMULATION OF NANOBEAM CAVITY MODES USING FINITE DIFFERENCE FREQUENCY DOMAIN (FDFD) METHOD

The photonic crystal nanobeam (PhC-NB) cavity structures, as shown in the Fig. 1-a, consists of a row of air-holes (vertical cylinder shape), along axis of a narrow photonic waveguide (e.g. Silicon) width 500 nm, which is suspended like as a bridge with air in its underneath [18], and the effective refractive index here is considered 3.19. In this paper, TE polarization of the modes has been studied. High quality factor (Q) values obtained in our simulations depend on the correct choices of air-holes parameters, including the hole diameter, holes spacing/period in the mirrors, variation of the lattice size and air-holes' diameters in the taper sections, and the cavity length. Number of air-holes in the taper sections nearby the cavity (N_{TI}) is optimized to $N_{TI}=4$. Due to

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wave reflection from the walls and cavity arrays of air-holes, coherency of the circulated waves would be modified. So, for compensating the phase shifts, the tapering air-holes' diameters sections have been used nearby and far from NB cavity.

The couple of four holes set in the neighboring cavity (N_{TI}=4), had diameters of 170, 180, 166, and 131 nm respectively, with the hole lattice (center to center distances) of 342, 304, 310, and 290 nm respectively. Whereas couple of four holes set in the farther than cavity place (N_{TO}=4), had contrariwise diameters of 131, 166, 180 and 170 nm respectively, with the hole lattice of 290, 310, 304 and 342 nm respectively [18].

The calculations by finite difference frequency domain (FDFD) method, for a cavity with length 440 nm, resulted quality factor ~2260 for a photonic mode at a wavelength of 1471.8 nm. Typical schematic and computational two and three dimensional energy flux distribution patterns of these modes, via Poynting vector components S_x and S_y are plotted and shown in the Fig. 1. Second-order mode has wider intensity distribution pattern and therefore larger modal volume than first-order / fundamental mode.

By plotting the electric field intensity profile across NB cavity which is resulted from embedded emitters within the cavity, we are able to study properties such as light confinement, and thus allow to estimating of modal volume. The Fabry-Pérot modes formation can also be explored in such structures [19-20]. According to the boundary conditions at the upper and lower surfaces of the NB and estimation of the intensity profile in the vertical direction, height of less than half the wavelength of light in the medium, $<1/2(\lambda/n)$, is adopted. Estimated values along the longitudinal axis and the transversedirection of the waveguide can be calculated from mode intensity profile, using the full width at half maximum (FWHM) of intensity distribution peak. Thus, estimation value of modal volume, as small as $0.7(\lambda/n)^3$ is achieved.

The At one of the stages of calculations, diameters of the four air-holes in the tapers nearby and away from the cavity have been altered simultaneously from initial values which mentioned previously, while the distance between the holes' centers kept fixed and same as initial values. As can be seen in the Fig. 2, the mode wavelength would be reducing by detuning diameters with associated quality factor experiencing fluctuations. The highest maximum Q value is 9850 at the mode wavelength of 1522.79 nm, which corresponds to NB with nearby cavity tapers holes diameters of 140, 150, 136, and 101 nm; While the far away cavity tapers holes diameters were contrariwise taken 101, 136, 150 and 140 nm respectively.

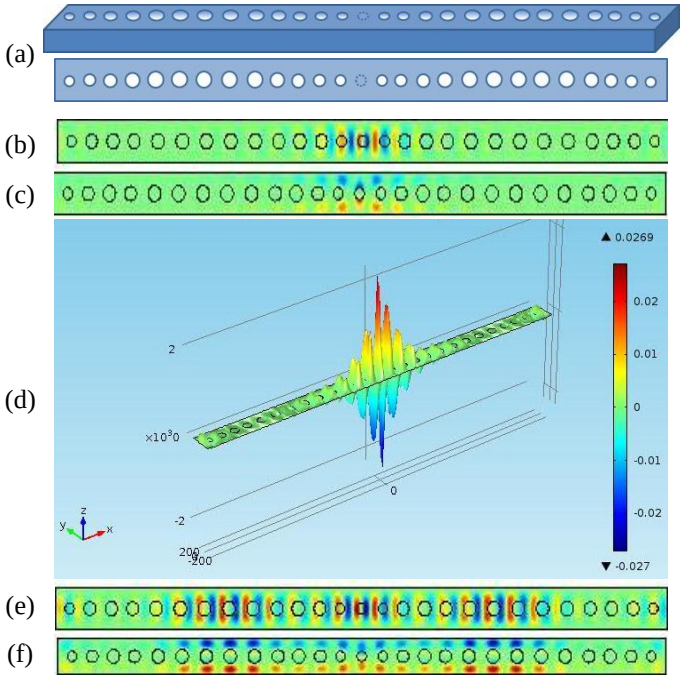

Figure1. a) Schematic diagrams of PhC-NB with couple of four air-holes tapering sets in the neighboring and away from the cavity. The middle dotted circle shows the location of the center of the cavity where quantum dots as light source are put for simulations. b) and c) The 2D energy flux intensity distribution pattern, S_x and S_y of the fundamental mode respectively. d) The 3D distribution profile S_y of the fundamental mode. e) and f) The 2D energy flux intensity distribution pattern, S_x and S_y of the second mode respectively.

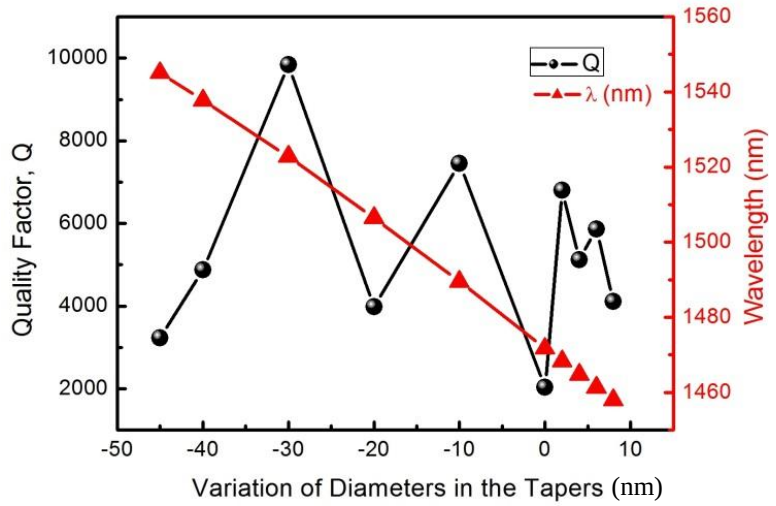

Figure 2: Diagram of wavelength and quality factor of fundamental mode versus detuning of diameters of the four air-holes in the tapers nearby and away from the cavity that are changed simultaneously from initial values which mentioned in the text.

Now, we change lattice period of the four air-holes in the tapers nearby and away from the cavity simultaneously, from their initial values (which mentioned previously), while their diameters kept fixed and same as the initial values. By this means, increasing wavelength can be seen as shown in the Fig. 3, which is due to enlarged cavity volume (unlike of the result explained in the Fig. 2. Albeit, as the wavelength increase, associated quality factor experiencing smaller fluctuations and demonstrate considerably overall increase.

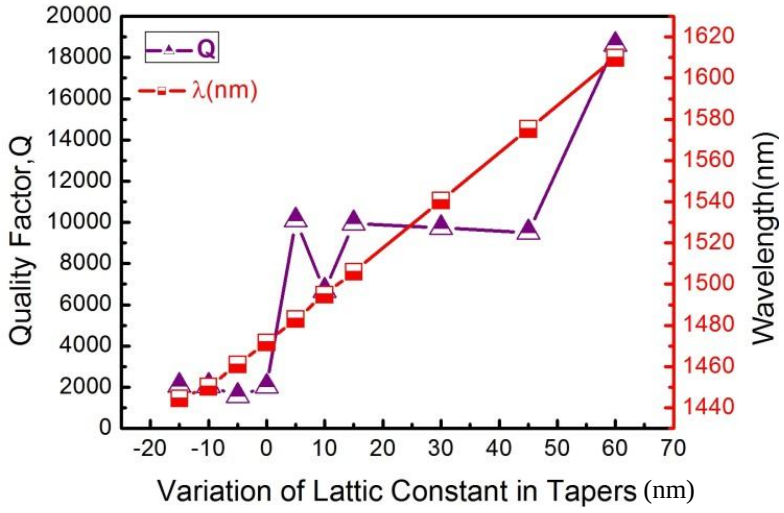

Figure 3: Variation of Q and wavelength of mode in terms of change in the lattice period of the four air-holes in the tapers nearby and away from the cavity simultaneously.

Then, for four air-holes in the far away tapers from cavity N_{TO}=4 and five air-holes as mirrors, N=5, the diameter of the five holes on the sides of the cavity mirrors has been altered. As shown in the Fig. 4, with the increase of the hole diameter up to d=280 nm, a decreasing trend for wavelengths of the fundamental mode is observed. In this situation, quality factors for diameters in the range 200-280 nm show increasing and stabilized values, while there are fluctuations and decreased values out of this range. The maximum Q value of the mode ~20550 happens at wavelength 1459.1 nm and the minimum Q value ~1850 occurs at wavelength 1474.0 nm. One of the most important issues in the light confinement process is the cavity's neighboring tapers as an integral part of the DBRs; the optimized values in theFigure 4 show the role of constructive interference and coherency of light which are reflected from the tapered mirrors.

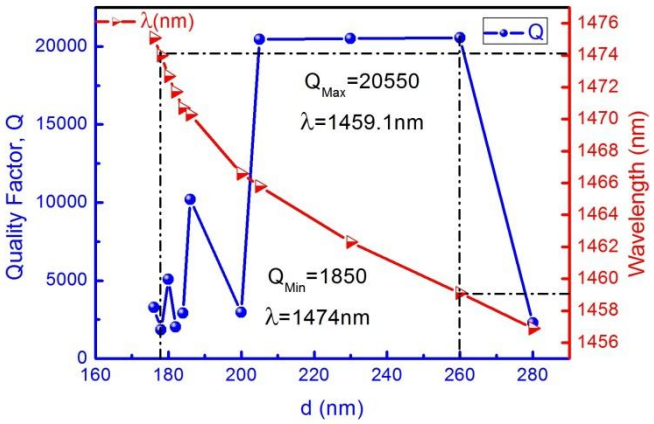

Figure 4: Variation of the resonance wavelength and quality factor of the fundamental mode versus change in the diameter of the air-holes in the mirrors N_{TO}=4 and N=5.

For the second order mode, as shown in the Fig. 5, by increasing the diameter of the holes in the mirrors, wavelength of the mode are decreased, but the quality factor demonstrates increasing up to ten-fold, which highlights aim of our optimization.

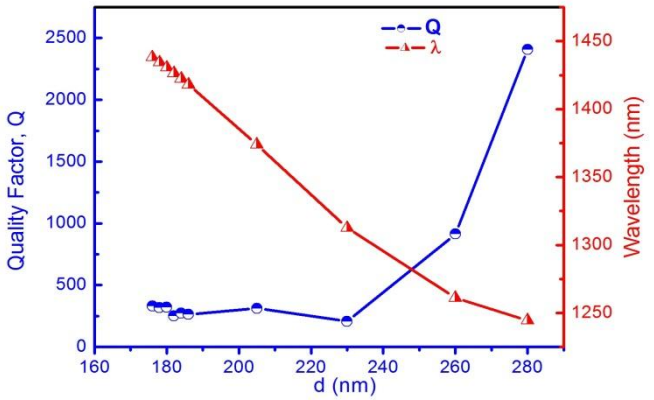

Figure 5: Variation of wavelength and quality factor of the second mode versus change in the diameter of the air-holes in the mirrors N_{TO}=4 and N=5.

Since optimization of the Q factor and cavity modal volume is the concern, thus shrinking the central part of the nanocavity can be one of the tools, achieving with softened curved cavity [7]. In the Fig. 6-a, schematic of a PhC parabolic NB (parabolic-shaped cavity wall) is given accompanied by a typical mesh for simulations (Fig.6-e).

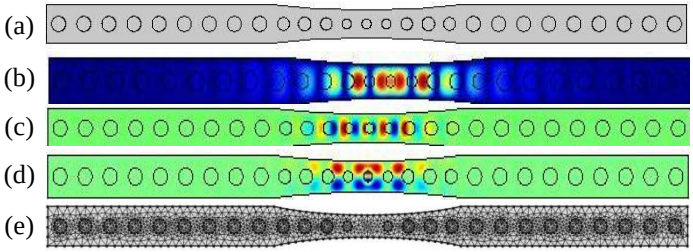

Figure 6: a) Schematic diagram of the PhC-NB parabolic cavity structure, with the minimum central width of W_0=400 nm; number of air-holes in sides mirrors is N=9, with couple of four air-holes tapers adjacent to the cavity. The middle dotted circle shows the center of the cavity. b) Normalized electric field distribution of optical cavity mode. The 2D pattern of c) S_x , d) S_y . e) A typical Mesh for PhC-NB parabolic cavity consisting air-holes tapers, and comprising mirrors with N=7, holes radii=200 nm, period=500 nm, and cavity length=440 nm.

As we can see in the schematic of the Fig.6-a, PhC-NB cavity is created by mixed air-holes tapers and changing the width of central cavity part of NB (width taper), plus controlling lattice constant. In this structure, by changing cavity width, center to center distance and size of the air-holes in the tapers, we could minimize optical loss and therefore increase quality factor. In the schematic and structure shown in the Fig. 6, the mirrors

consists of nine air-holes with diameter d=200 nm, and period a=360 nm, and NB width W=500 nm. Diameters of air-holes in the tapers around cavity were chosen 170, 180, 166 and 131 nm, with distance of the holes 342, 304, 310 and 290 nm respectively. Minimum width of the central cavity region was W_0=400 nm. The middle circle shows the center of the cavity. The calculated fundamental mode's frequency and its peak width were f_0=2.0824 THz and FWHM=Δf_0=0.0002 THz respectively.

In the following carrying out computational steps, wavelength and quality factor variation were observed through change in the period constant of the air-holes in the mirrors. The results in the Fig. 7 show that by increasing the distance between the holes, an increase in wavelength would be observed due to the increasing in the real cavity size. On the other hand, although maximum Q value (>10^4) obtains at a=360 nm, the graph shows slight reduction for Q in the ranges a=365-382 nm (from 0.7×10^4), and then suffer larger reductions due to more losses through cavity Bragg mirrors (equivalent to more phase mismatch in the reflected lights).

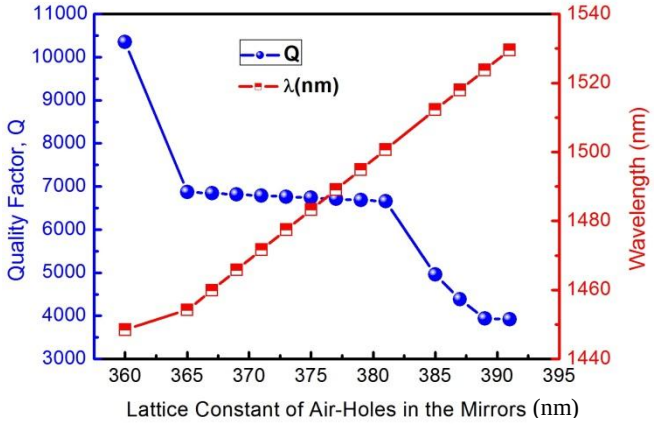

Figure 7: Variation of the quality factor and wavelength of mode in terms of changes in the lattice constant of the air-holes in the mirrors.

In the Fig. 8, quality factor variations for displacement of adjacent 4 air-holes tapers in the NB are shown, where parabolic cavity width is narrowed from 500 nm to 400 nm at the cavity center. In this case, by negative and positive location detuning of couple of adjacent 4 air-holes tapers in the vicinity of cavity NB, the graph likewise shows almost uniformly increasing in wavelength of mode, associated with increasing in cavity size. Moreover, the optimized quality factor was 10,410, which obtained by a decrease of 25 nm in placement of 4 air-holes around the cavity.

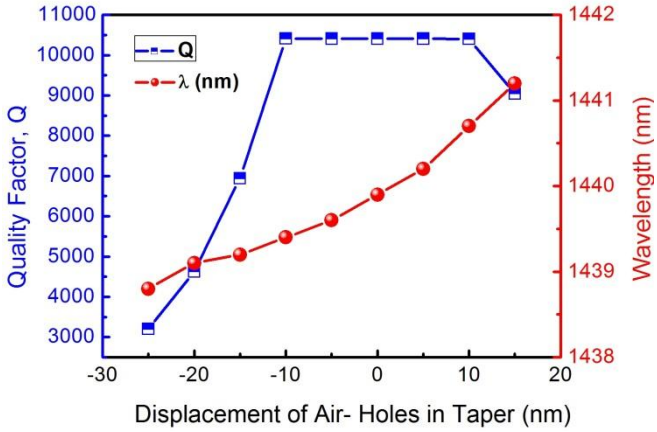

Figure 8: Diagram of the wavelength and related quality factor of cavity mode versus location detuning of adjacent 4 air-holes tapers in the vicinity of cavity NB; the initial values are listed in the text.

III. SUMMARY AND CONCLUSIONS

The Variety of PhC-NB cavity design, in this paper are considered to simulate and investigate the photonic modes in the NC structures which are the Fabry-Pérot based system with distributed Bragg reflectors, included in a narrow semiconductor waveguide. Series of tapered air-holes in combinations with curved-wall cavity are employed to have better confinement. High quality factor TE modes are obtained in our simulations depends on the optimized choices of air-holes parameters, including the holes' diameters, holes spacing/period in the combined tapered mirrors, the cavity length and wall-shape. Coherency of the circulated waves could be

altering due to wave reflection from the walls and cavity arrays of air-holes. For compensation of the phase mismatch of the reflected light from different parts of NB system, the tapering air-holes' diameters sections have been used nearby and far from NB cavity. Moreover, cavity modal volume is optimized by using parabolic side-walls. Simulations and analysis of the results by FDFD method for photonic modes of the NC are done using COMSOL Multiphysics 4.3 and OriginPro 9.0 Commercial softwares. By plotting the electric field intensity profile across NB cavity which is resulted from embedded emitters within the cavity, properties such as light confinement were studied, and thus it allowed us to estimate modal volume. In the optimized PhC-NB structure, Q values $>10^4$ for a very confined mode $\sim 0.7(\lambda/n)^3$ are achieved.

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Correlation of social enviroment with parameters of management white managing entrepreneurship

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Abstract: - Social environment favorable for the development of entrepreneurship in developed countries. This is because, in terms of entrepreneurship, looking at the environment in terms of general economic conditions significantly more favorable and stable environment in the transition and in particular in developing countries. Exposed assessment entrepreneurial-minded managers in transition and developing countries must be taken into account, particularly in the establishment of sales, capital, and collaborative relationships with partners from the developed countries.

Keywords: - *social environment, management, entrepreneurship.*

I. INTRODUCTION- RELATIONSHIP BETWEEN ENVIRONMENT AND ENTREPRENEURSHIP

Starting from the fact that each market represent dependency variable in relation to the requirements and development of a specific social environment, which, in turn applies to the relationship between market and entrepreneurship. This relationship stems from the fact that position and the functioning of the market determines the social system to which it belongs. In this context, relative to the market, entrepreneurship has the character of the dependent variable - which in turn means that its operations and development determines the specific community.

For these reasons, our and every other entrepreneur should know the general relationship between entrepreneurship and social environment, because social environment their legislation and their needs for products and services decisive effect on the establishment and operation of businesses. Accordingly, in view of our increasingly intensive international exchange of goods and services, our entrepreneur, basically, has to know the nature of this relationship, not only in our country but also abroad (Figure 1.).

Figure 1. Correlation between environment and entrepreneurship

II. INTERNATIONAL ENVIRONMENT AND ENTREPRENEURSHIP

According to the current characteristics of the international community as an environment in which entrepreneurship is achieved, it is usually divided into:

- developed,
- transitional,
- undeveloped.

Developed countries: has a leading role in the world established international economic and political relations. Its leadership position primarily generates through the exchange of goods and services with the transition and developing countries. Through this exchange, with a smaller share of work, developed countries their products/services with higher quality and level of processing basically share for the products/services of other countries whose quality and levels of processing significantly lower. In addition, using its scientific and technological advantages, developed countries and their business subjects are in a position to and otherwise enhance the non-equivalence of that exchange.
Complete this exchange is realized:

- directly,
- using regulations of International Organization for Standardization and the economy, and
- through action the so-called Multinational companies.

All this, in fact, cause and dictate applied scientific - technological advances in which are developed countries through time have gained a significant advantage.
That is why, under the influence of a highly developed science and technology enterprises in developed countries are faced with the rapid obsolescence of the equipment and the need of more intensive professional regulation of employees by technological transformations.

The profit function of a developed country in various ways (through the sale of commodities, capacity building, technology sales, joint ventures, etc..) more intensely penetrating transition and developing countries. Of course, it must take into account businesses managers in less developed countries, and in particular cooperation with partners from the developed countries, emphasizes and assess their comparative advantages.

The advantage of the developed countries are primarily reflected in the field of all kinds of businesses, within which one:

- provide a simplified procedure for the establishment of the company,
- starting many tax breaks,
- various possibilities of obtaining favorable loans
- rich supply of business ideas, etc.

Social environment for market development and entrepreneurship in transition countries is unfavorable. This from the fact that countries in transition, including our country, has a negative legacy from the perspective of a market economy, especially when it comes to:

- levels of applied technologies,
- construction of ownership,
- treatment of entrepreneurship.

They are now characterized by the reforms of economy and adequate organization of social relations - which accompany many difficulties, especially when it comes to the establishment of capital and technological relationships with entities of developed countries and the penetration of the world market. This situation is even worse in developing countries where efforts are made to reduce the techno-economic gap between them and developed countries.

III. DOMESTIC ENVIRONMENT AND ENTREPRENEURSHIP

The current environment of entrepreneurial activity in our country basically is complex. It is currently characterized by unfavorable legacy caused by the long duration of international economic sanctions, war devastation and like. In such circumstances, the stage reached in the economy is very difficult, primarily due to:

- unresolved ownership,
- narrow market,
- outdated technology,
- low level of utilization of available capacity,
- a substantial scale redundancies among employees,
- not directed entrepreneurial management.

This condition, by the initiated transition process (privatization of social capital, the creation of attractive conditions for the inflow of foreign capital, encouraging the establishment of small businesses, etc.), it is difficult to overcome.

In a goal for better inform current and potential entrepreneurs, we need to be exposed to the effect of local environment brought on key factors of potential and actual entrepreneurship. The structure of these factors are:

- prepare potential entrepreneurs,
- selection and testing business ideas,
- financial support of the founder,
- simplify business registration,
- start providing relief and
- professional help in managing core business.

Government assistance and specialized services in preparing entrepreneurs to start a business is now insufficient. They would be modeled on the part of the developed world, should include checking personal characteristics of persons interested for entrepreneurship and help supplement their expertise in this area. In our country, no state organizations or specialized services are not do it. Therefore, potential entrepreneurs, in effect, left to themselves, or their own subjective measurement of entrepreneurial traits and abilities. There no better situation in the field of education of potential entrepreneurs to conduct business. Therefore, the potential and current entrepreneurs use the necessary entrepreneurial skills that are acquired individually from scarce resources. Recently, local publishers are somewhat more accepting of publishing research papers about entrepreneurship, and we can see the emergence of organizing some seminars (especially for making a business plan).

Providing data banks on active business ideas for interested potential and current entrepreneurs, as an important way of promoting entrepreneurship in the developed world, also followed by the problems in our country. Them, the first consisting of:

- disorganization generating business ideas by State,
- lower availability of ideas to interested entrepreneurs,
- information scarcity held of ideas and similar.

Financial support for the founding of entrepreneurship is also a stimulating factor. Lead role in this country must have its own funds through the organization. They should support certain commercial financial institutions. However, in the domestic practice, due to the scarcity of accumulation, financial and operational support for the founding of entrepreneurship is practically negligible. This situation discourages entrepreneurs, which is why they often do not pursue implementing real viable business ideas.

Registration of new and existing companies usually is followed by a complicated and costly administrative procedures that take a long time and, as such, particularly discourage potential entrepreneurs. It is true, that some entrepreneurs are helping professional services (lawyers offices, etc.), but they are not able to quickly and efficiently overcome a multitude of obstacles to the registration administrative authority (commercial courts and administrative authorities).

Starting tax and other relief start-up companies represent a current international trend, which takes into consideration the lack of domestic legislation. On the contrary, international experiences suggest that the first two or three years are critical for the survival of the business of the new company. Therefore, our legislators to start-up companies in the early years should waive not only income tax, but also many other fiscal duties (sales tax, inventory tax, personal income, customs duties, etc.).

External expert guidance of established firms is also an important factor in their survival and successful development. That help, logically, should provide specialized services to assist the professional development and consulting. Professional assistance for registration and accounting, and consulting services for marketing advisory, financial consulting, and so on. Exposed condition represented factors of our environment through which it affects the enterprise as a whole can be described as very delicate. Such a situation exists in other countries in transition.

IV. PARAMETERS OF MANAGING ENTREPRENEURSHIP

4.1. Necessity of managing entrepreneurship

Each market subject has its own mission and goals. The realization of these sets is the need to manage the market subject. More specifically, for economic subject is required adequate management (union of board and directors that makes the so-called synergy administration), whose mission is to whith their competence, authority and acting achieve key interests of that entity. These interests and objectives of the enterprise market, in the final showdown comes down to maximizing profit in the long run.

4.2. The essence and the definition of managing

The function of entrepreneurial business management (or managerial functions) has the main task to lead and motivate employees so that they more effectively implemented major objectives of the subject. In this function, modern management is based on the structuring the appropriate authority in decision-making and managerial control in a dominant position which now occupy the decentralized decision-making model. Effects of management in the enterprise business is continuously exercised in internal and external conflict of interest. In doing so, it inters internal management striving to maximize profits, which also interferes with the interests of customers to products and services that pay less. This problem is most efficiently solved with modern management training and changing their products, as a rule, with regard to new investments. Because managerial subjects may not unilaterally rigid and insist only on profits, but also the survival of the enterprise.

Current literature operates various definitions of management in the enterprise business. Among them is probably the most appropriate one according to which management is defined as the input to achieve business goals (and other entrepreneurs) through other concerned parties. In this sense, menagement activates factors involved (people and funds) to the realization of the final goals of the company. He, in this sense, determines the internal organization of firms that activates and coordinates the adoption of certain business decisions.

4.3. Management organs

Due to their greater efficiency, the management of the enterprise is articulated on two complementary functions: administrative, and managerial. Administrative office first implemented business owners and managers engaged exercise leadership (managers). Accordingly, the current legislative and practical experience have led to the management function assembly achieves its owner with the help of an administrative body (board of directors). Governing authority makes the company manager (director), who is assisted by a smaller or larger number of lower managers as his associates. In this context, as already noted, the unity of board of directors and management is called - basically corresponds to the management of the firm. The following diagram (Figure 2.) shows the management organs of firms with more equity.

When it is word about assembly of owner, it consists of a number of selected representatives of the owner. In the case of a small number of owners (eg. up to 30) our legislation allows that they are all members of the assembly. However, if the number is even decreases (eg. up to 10), the assembly fails to elect its executive and supervisory board itself already assumes this function.

The company's assembly, the supreme body of mostly indirect management, performs most massive control activities, which include in particular: making and changing the statute, the determination of business policy, the adoption of the report on operations, scheduling and covering the losses of profit, changing the structure of the initial capital, the choice of the management and supervisory bodies and so on.

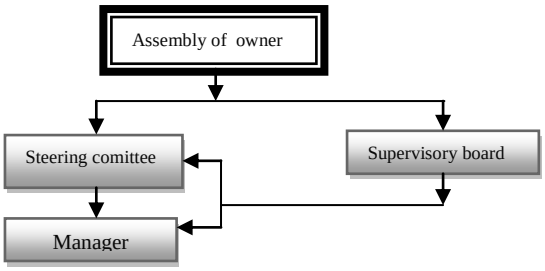

Figure 2. Management of economic subjects (medium enterprises)

The Steering Committee is the executive body of the assembly, and he is primarily responsible for: preparation of parliamentary decisions, election and removal of directors, the adoption of certain laws, business connections and significant contracting, authorizing larger entrepreneurial activities associated with investments and others.

The supervisory board is responsible for the legality of the company, executing parliamentary decisions, review of accounting and others.

Director, as an authorized person for the continuous management of the companies in a particular mandate, exercised virtually all business decisions of the assembly and its agencies, and concerned about the legality of the company.

Its main tasks are reduced to:

- presentation of the company,
- implementation of decisions of the assembly and the board of directors,
- organization and control of the process,
- adoption of systematization,
- receipt and firing workers, and so on.

Depending on the size and complexity of specifically company, it is part of their powers and responsibilities can be transferred to a number of his associates (lower managers). For his work, the director is directly responsable to the board of directors, a indirectly to company assembly.
All these comparisons are valid within the original management for large businesses with a large number of structure owners. However, with a reduction in the number of owner management organs are necessarily reduced, and there are two cases.
In the first case, where the number of owners ranging from 2 to 10, the function of management immediately realized the assembly of all owners, except that it influence the decision-making depends on the property rights of individuals. In such a small number of owners, the assembly from among its members or from the environment directly elected directors, which work direct and control.
The second case, in which the owner of the company appears as one person, applied management can be integrated or differentiated form.
Integrated management form where owner operates and manages the company, which he, as an individual performing the functions of all differentiated organs of managing and operating. This function is very direct and the person who implemented requires certain traits and general knowledge.
Differentiated managerial function represents a situation in which a singular owner of reserves management function, and the function of leadership is entrusted professional managers.

4.4. Managing approaches

Entrepreneurial business management characterized by a certain process that lead and directed by the managerial organs. In practice, there are basically two approaches to managing entrepreneurship, namely: individual and team.

Individual approach to management was referred to a case in which singular owner as an individual performs all managerial jobs (entrepreneurial and executive). This approach is present in smaller companies (enterprises and shops), which leads to their full or majority ownership. This approach is also called the venture, a company in which it happens to be classified in entrepreneurship. However, such a classification is wrong, because it is implies that larger company to which the team manage did not entrepreneurial-minded - which is certainly false. Entrepreneurial function in this management approach, as previously discussed, done by the owner - manager as an independent contractor.

Team approach to the management of entrepreneurial business makes the situation in which they are differentiated managerial jobs in management and leadership (management). It is mainly used in large companies with numerous owners. Of course, here it should be noted that by mistake the management of such companies are called, from which it can draw incorrect view that the market conditions there are companies that have no manager.
The following diagram (Figure 3.) shows an entrepreneurial approach to business.
During the growth of economic subject, especially when he goes from small to mid-sized firms, implicitly there is a need replacing individual with team management. It makes that moment in which a singular manager begins to lose control of established businesses and is available initially has the following options.

- to stop the further growth of the company, allowing it to retain full control over its operations,
- to continue with individual performance of management, regardless of the increasing difficulty in controlling and directing the development of a growing company,
- to sell the company, thus avoiding the problem independently solve in its upward trend, or
- to involves in business profissional manager, retaining for itself the function of management.

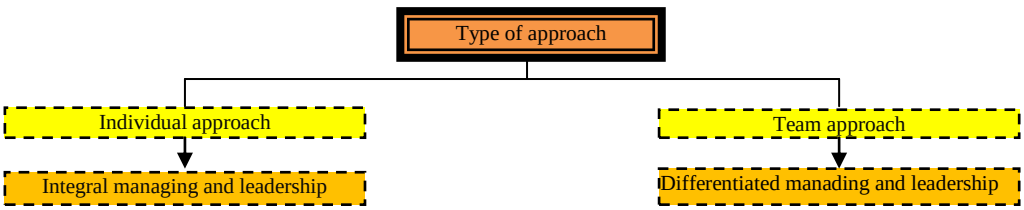

Figure 3. Team approach to the management of small or medium-sized enterprise

Among the exhibited options the least favorable option is the one where a singular owner and manager of continuing with the same approach to the management company, even though it grew from a small to mid-sized companies category. In fact, in this situation, the owner, as a singular controller and manager, inertia continues to control and direct all processes in the company. However, due to the fact that the scope of these processes is rapidly growing individual power to control them, became more and more frequent failures in

management and applied to an implicit fall of business firms results. This often happens in the so-called family businesses in which the singular owner, together with adequately allocated their families in the inner company insists on maintaining its leadership position in the company, no matter what time it is in a very enlarged.

Successful resolution of the problem through the separation of managerial control functions in the small becoming middle business depends first of owner's awareness of the situation and his willingness to new circumstances its previous full authority and responsibility share with professional managers. Only the separation of a single management control and managerial functions most owners accept with great effort, and that's why in practice very often is case with a singular continuation of running the company, which results in the weakening of the applied quality management and the consequent decline of business results of the company.

4.5. Management areas

Since the division is made earlier, to areas of action for management in the enterprise business includes:

- creating business management and
- exercise management business.

As already author finds, the first area relates to the choice of a particular business idea and consequently the establishment of an adequate business, while in others they are monitoring and directing the implementation of a specific business. Of course, both of these areas, as complementary, should be adequate to cover the entrepreneurial-oriented management. Comparatively speaking, the two areas differ in particular by: job content, the schedule of implementation, duration and implementers.

From the standpoint of content of management jobs, areas of creating business is characterized by making decisions about:

- market research,
- selection of the best business ideas,
- development and acceptance of the business plan,
- providing conditions for the realization of the planned business.

The resultant managerial tasks makes organizing and controlling the implementation of the above managing activities.

On the other hand, works in the field of business content managerial activities primarily comes down to control, evaluation and correction of internal and external factors and established business processes.

According to the order of realization of entrepreneurial business is first created and then realizes business. However, the implementation itself is an area in which entrepreneurial minded management constantly strives, through certain internal creation, streamline and improve business constitutive factors. This applies in particular to: applied marketing, an established technology and organization structure of the engaged employees and similar. So we can say that at the beginning of a new business management of the company made its first creation in general, and then continually strives to improve its established businesses through partial creation.

In terms of the duration of the observed field, it should be noted that the creation of a business usually much shorter than the duration of its achievement. The only business in the creation of practices ends usually within a few days or months, while achieving the established business can practically take an indefinite period of time (from one year to several decades).

Finally, in terms of managerial activities carriers, it should be noted that in the business of creating and collaborating extensively involved the management organs. Beyond that, in the exercise of business, management works continuously, while the management functions expressed through periodic activities.

4.6. Cyclicality of entrepreneurial business

Cyclical control of entrepreneurial business comes from a cyclicality his leadership and life. In terms of management, it was stated that any business created first and then realized. On the other hand, its duration is always temporary, and it is directly related to the so-called life cycle of selected products/services. Hence the conclusion at which the duration and conduct of the cyclic of entrepreneurial business, and therefore its management must also take the form of cyclicity.

When it comes to the life cycle of entrepreneurial business should note that products must be offered to the market as a brand new or already won. In this respect, the very first new product increases, then stagnation, and falling sales.

In doing so, the management of the company should continuously monitor the market and to adapt to its changes. It is particularly delicate issue of placement of new products or services, where the first phase of their sales must make specific marketing efforts. In addition, the board of directors, is the imperative to constantly worry about adjusting the selling prices of their products/services to market conditions and the timely abandonment of these products/services that are in demand and decreasing prices which are significantly closer

playback selling prices. Market-worn cycle of a particular business replace with a new cycle with modified products/services, which confirms the general cyclicality of entrepreneurial business.

Cycle management of entrepreneurial business, according to an earlier division, includes the creation and implementation of a specific business. Creating may be further divided on the design and planning of business, while achieving articulate to articulate and valuation of business. These four cyclic and complementary phases in conducting business are also subject to the management of entrepreneurial business throughout his life - ie. from the moment of its conception to the moment of his leaving.

Cycle management scheme entrepreneurial business appearance (Figure 4.):

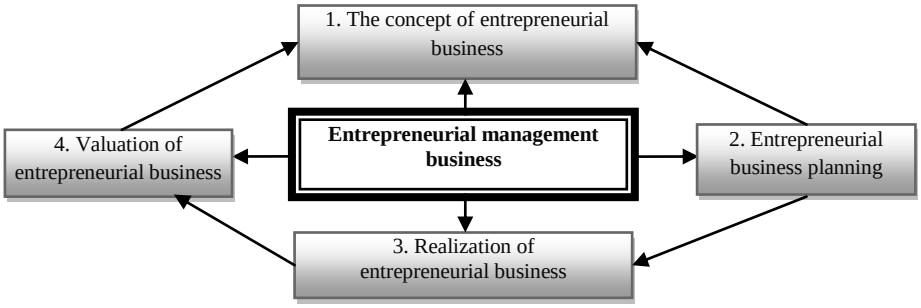

Figure 4. Scheme of entrepreneurial business

The exposed phase structure of conduction of each entrepreneurial business in profitable implementation period is a matter dealt with in a particular market management entity, and hence the total further consideration be directed to the processing of each of these phases - which practically covers the whole field of modern entrepreneurial business. Such a process approach to the study of entrepreneurship has been chosen because it most efficiently reflects systematism of this area and in this way they overcome weaknesses and fragmentary mosaic observations of entrepreneurship of which "suffers" big part of the entrepreneurship literature available today. At the same time, considering the cycle of entrepreneurship through his guidance, implicitly gets all the answers about the life cycle of concrete entrepreneurial business - which leads to the conclusion that comparative quality management cycle directly affects to the duration of entrepreneurial business.

V. CONCLUSION

Started transitions in the former socialist countries towards market economy and the construction of adequate regulation of social relations is certainly exhausting and difficult, but it is our transition process is further burdened by the consequences of sanctions and war. In this sense, the initial shortage of capital, entrepreneurs need to put emphasis on its business education and selection of appropriate business idea that suits their finances, rather than expect them very insecure foreign capital conveniently and automatically resolve personal and family living. Our entrepreneurs are, therefore, must first turn activates its own resources (personal and material), which states its regulatory measures to facilitate and encourage.

In its essence, the necessity of entrepreneurial business management, which comes down to the actions of management, stems from the fact that each market subject is a complex organization of the material and subjective factors that can easily lead to achieving a particular goal. These factors are heterogeneous in nature, with the task of management is to bring them the purpose of achieving certain socially useful production or delivery of needed services whose effects valorize particular market. Otherwise, if are engaged manufacturing/service factors not through co-ordinated management in relation to the ultimate goal of the undertaking, the effects would certainly be dysfunctional and ineffective. Therefore, the factors involved in the actual production/utility work should certainly be arranged in a suitable system of mutual relations and coordination, which can only be achieved through the establishment and operation of appropriate management.

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Availability Assessment of Generating Units of Balimela Hydro Electric Power Station (510 MW) – A Markovian Approach

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Abstract: - Reliability and availability of the individual generating units of Balimela Hydro Electric Power Station have been evaluated and presented in this paper from April 2007 to March 2013. The operational data for the above period was collected and analyzed by using Markov model. From the collected data and based on the type of faults faced by each generating unit, different states are defined known as Markov states. The reliability indices such as repair rate (μ), failure rate (λ), mean time to repair (MTTR), mean time to failure (MTTF) and mean time between failures (MTBF) have been determined. The state probabilities for each of these states have also been calculated, and finally reliability and availability have been determined leading to establishing the reasons behind the poor availability.

Keywords: - *Markov model, Hydro electric power station, availability, reliability.*

I. INTRODUCTION

Balimela Hydro Electric Power station (BHEP) is Odisha's one of the oldest hydro power station and presently is the second largest hydro power project of the state. The Balimela Reservoir on the river Sileru is situated in the Malkangiri District of Odisha State. The capacity of the Reservoir is 2676 Mm^3. From the reservoir, 50% of water is diverted through a tunnel to Balimela Power House and the balance 50% is let off in the river for utilization by Andhra Pradesh. The rated head of Balimela Power House is 274.5 meters. The Power House has six (06) Generating Units of 60 MW each providing an installed capacity of 360 MW was initially installed between the years 1973 and 1977. Recently two more identical Units of 75 MW each were commissioned during the years 2008 and 2009 increasing the installed capacity up to 510 MW. The units 1 to 6 of BHEP, Balimela (6×60 MW) have been operating for more than 36 years [1].

Table 1: Commissioning dates of generating units of Balimela

Unit No.	Commissioning date	Age(in years)
1	August 14, 1973	40
2	January 25, 1974	40
3	August 24, 1974	39
4	March 26, 1975	38
5	May 7, 1976	37
6	January 5, 1977	37
7	December 23, 2008	5
8	January 23, 2009	5

The objective of this paper is to evaluate the reliability and availability of the older six generating units (i.e. unit no. 1 to 6) so as to conclude regarding necessity of renovation and modernization (R & M).

II. METHODOLOGY AND APPROACH

Reliability may be defined as the probability of a device or system performing its function adequately for the period of time intended under the operating conditions intended [2]. But this definition of reliability is applicable to a particular kind of performance, where a device is successful if it has not failed during its intended time of service. The possibility of repairs after failures and of continued service after repairs is not considered. However, there is a class of devices and systems (e.g. generators) which undergoes repair when failed, then returns to service and is expected to function in this manner indefinitely. Hence it is clear that the reliability of such a device needs to be expressed by a measure different from the one defined above. An index of reliability in such cases is the availability. The availability of a repairable device is defined as the proportion of time, in the long run, that is in or ready for service [2]. To evaluate the reliability and availability of the individual generating units of Balimela Hydro Electric Station, the operational data from April 2007 to March 2013 were collected and analyzed by using Markov model. From the collected data and based on the type of faults faced by each generating unit, different states are defined known as Markov states. Then the reliability indices such as repair rate (μ), failure rate (λ), mean time to repair (MTTR), mean time to failure (MTTF) and mean time between failures (MTBF) have been determined for each of these states.[3]The state probabilities for each of these states are also calculated. Thus reliability and availability are determined subsequently as per their definitions [3].

Hydro Unit Modeling

To model a hydro unit, the states can broadly be classified into up-state and down-state [4].

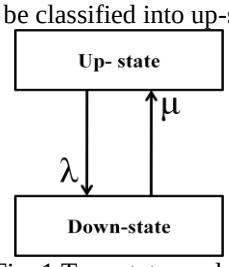


Fig. 1 Two-state model

A unit is said to be in up-state if it is either in or ready for service. It transits from up-state to down-state due to forced or scheduled outages. Forced outage means the shutdown of a generating unit for emergency reasons or a condition in which the generating equipment is unavailable for load due to unanticipated breakdown. Scheduled outage means the shutdown of a generating unit for inspection or maintenance, in accordance with an advance schedule. To carry out Markov model for the generating units it is assumed that the failure and repair rates are exponentially distributed. There is no transition between the scheduled and forced outages. The unit after repairing is immediately returning to up-state. From this, a developed Markov model is given as follows known as three state Markov model [4].

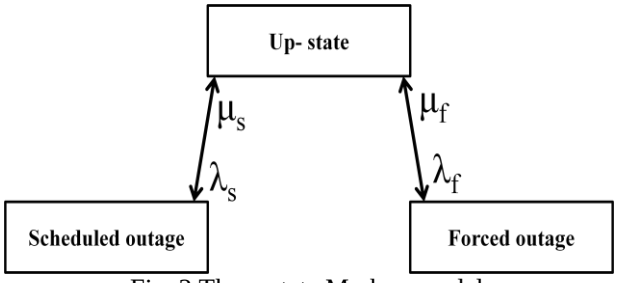


Fig. 2 Three-state Markov model

We can classify events of Hydro-unit and it's down states into:

1. Scheduled outage (Reserve, Preventive maintenance, and overhaul)
2. Generator
3. Governing system (servo motors, wicket gates, speed governor, and etc.)
4. Excitation system
5. Thrust bearing overheat
6. External Effects
7. Main Unit Circuit Breaker
8. Turbine (penstock, spiral case, butterfly valve, turbine bearing, and runner)

More developed model is driven as follows:

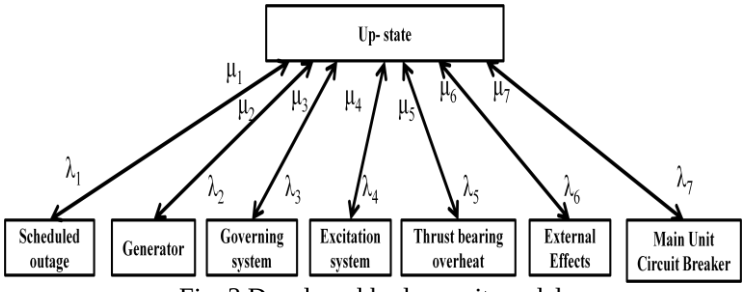


Fig. 3 Developed hydro- unit model

Table 2: State Probability Value

State Number	State Probability	
0	$\mu_1 \mu_2 \mu_3 \mu_4 \mu_5 \mu_6 \mu_7 \mu_8 / D$	d_0 / D
1	$\lambda_1 \mu_2 \mu_3 \mu_4 \mu_5 \mu_6 \mu_7 \mu_8 / D$	d_1 / D
2	$\mu_1 \lambda_2 \mu_3 \mu_4 \mu_5 \mu_6 \mu_7 \mu_8 / D$	d_2 / D
3	$\mu_1 \mu_2 \lambda_3 \mu_4 \mu_5 \mu_6 \mu_7 \mu_8 / D$	d_3 / D
4	$\mu_1 \mu_2 \mu_3 \lambda_4 \mu_5 \mu_6 \mu_7 \mu_8 / D$	d_4 / D
5	$\mu_1 \mu_2 \mu_3 \mu_4 \lambda_5 \mu_6 \mu_7 \mu_8 / D$	d_5 / D
6	$\mu_1 \mu_2 \mu_3 \mu_4 \mu_5 \lambda_6 \mu_7 \mu_8 / D$	d_6 / D
7	$\mu_1 \mu_2 \mu_3 \mu_4 \mu_5 \mu_6 \lambda_7 \mu_8 / D$	d_7 / D
8	$\mu_1 \mu_2 \mu_3 \mu_4 \mu_5 \mu_6 \mu_7 \lambda_8 / D$	d_8 / D
Where $D = d_0+d_1+d_2+d_3+d_4+d_5+d_6+d_7+d_8$		

III. RESULTS

Mean time to repair (mean down time, MTTR) = FOH / N
Mean time to failure (mean up time, MTTF) = SH / N
Mean time between failures (MTBF) = MTTR + MTTF
Repair rate (μ) = 1 / MTTR
Failure rate (λ) = 1 / MTTF
Where, N (Number of failures) - number of times a unit experience forced outage
FOH (forced outage hours) – time in hours during which a unit or major equipment was unavailable due to a forced outage [5]
SH (service hours) – total number of hours the unit was actually operated with breakers closed to the station [5]

According to the definition of reliability the reliability is considered as the probability of the unit without failure [3]. States 0 and 1 are the two states that are without failure and availability is the probability that the unit is in state 0, thus:
Reliability, $R = P_0 + P_1$ and Availability, $A = P_0$

The reliability and availability for Unit No. 4 have been calculated for the year 2007-08 and presented in Table 3 below.

Table 3: Failure Rates, Repair Rates and State Probabilities of Unit No. 4 of BHEP

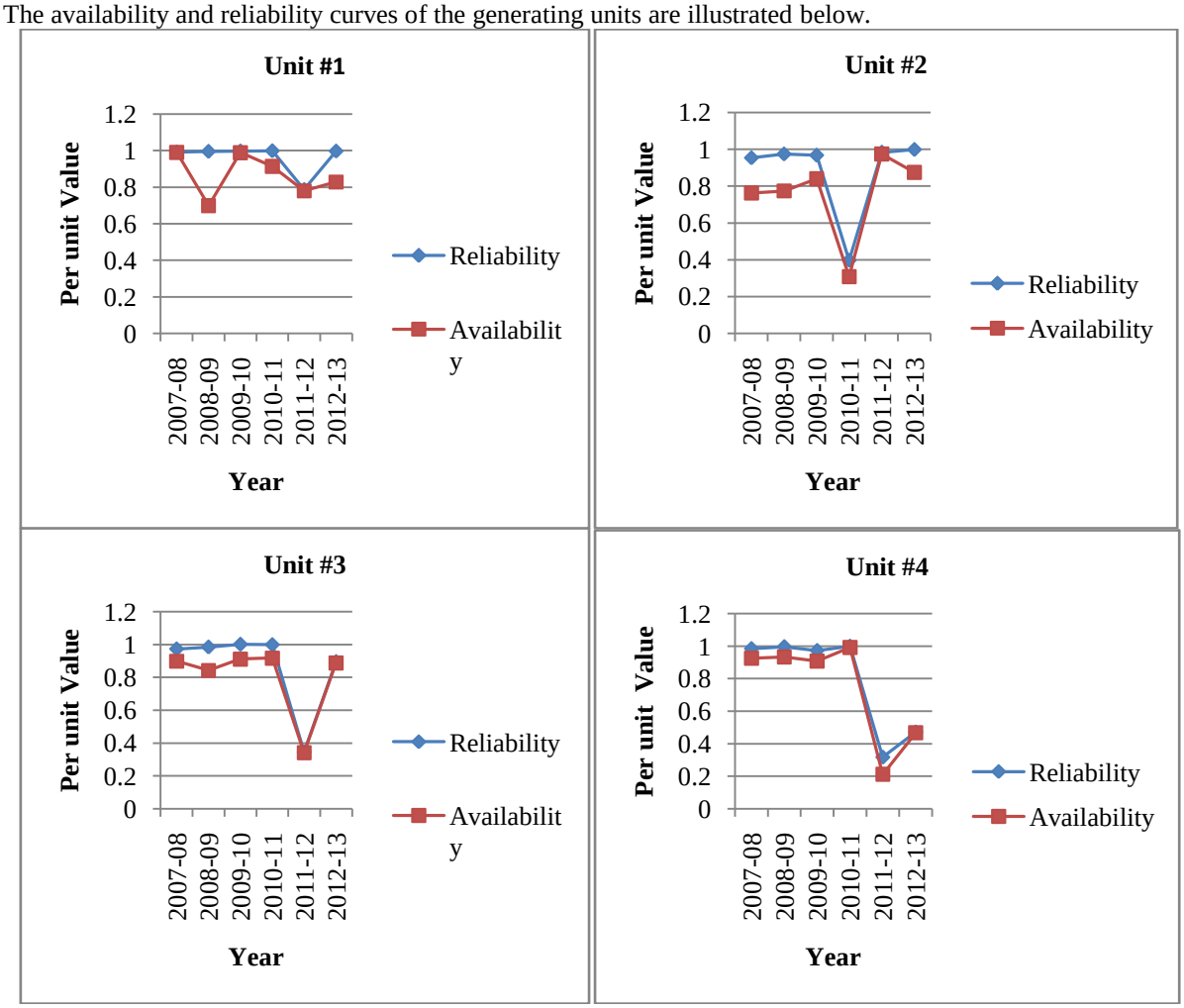
2007-08									
State Number	Basic Event	No. of Occurrence	Total Repair times(hrs)	MTTR in hrs	MTBF in hrs	MTTF in hrs	Repair Rate μ	Failure Rate λ	State Probability
0	Up State								0.9242
1	scheduled Outage	1	520	520	8614	8094	0.0019230	0.0001235	0.0593
2	Generator	4	44.38	11.09	2034.59	2023.5	0.0901306	0.0004941	0.0050
3	Governing System	4	35.28	8.82	2032.32	2023.5	0.1133786	0.0004941	0.0040
4	Excitation System	1	1.5	1.5	8095.5	8094	0.6666666	0.0001235	0.0001
6	External Effects	4	62.35	15.58	2039.08	2023.5	0.0641539	0.0004941	0.0071
Reliability= 0.983612922 Availability= 0.92423531									

On similar lines reliability and availability of all the six units for the years 2007-08 to 2012-13 (six years) were evaluated and summarized in Table 4.

Table 4: Reliability (R) and Availability (A) values for unit no. 1 to 6 of BHEP from 2007 – 2013

Unit No	2007-08		2008-09		2009-10		2010-11		2011-12		2012-13	
	R	A	R	A	R	A	R	A	R	A	R	A
1	0.9929	0.9918	0.9967	0.6995	0.9986	0.9895	1	0.9147	0.7876	0.7808	0.9982	0.8293
2	0.9531	0.7622	0.9738	0.7730	0.9671	0.8396	0.3963	0.3078	0.9835	0.9736	0.9982	0.8735
3	0.9718	0.8981	0.9833	0.8419	1	0.9111	0.9976	0.9169	0.3450	0.3410	0.8946	0.8873
4	0.9836	0.9242	0.9955	0.9313	0.9721	0.9060	0.9986	0.9902	0.3166	0.2105	0.4705	0.4659
5	0.9938	0.9075	0.9802	0.9769	0.9946	0.9226	0.9954	0.9867	0.4805	0.4750	0.9859	0.9777
6	0.9759	0.8870	0.9925	0.9898	0.9953	0.9099	0.9913	0.9829	0.9971	0.9874	1	0.9602

The availability and reliability curves of the generating units are illustrated below.



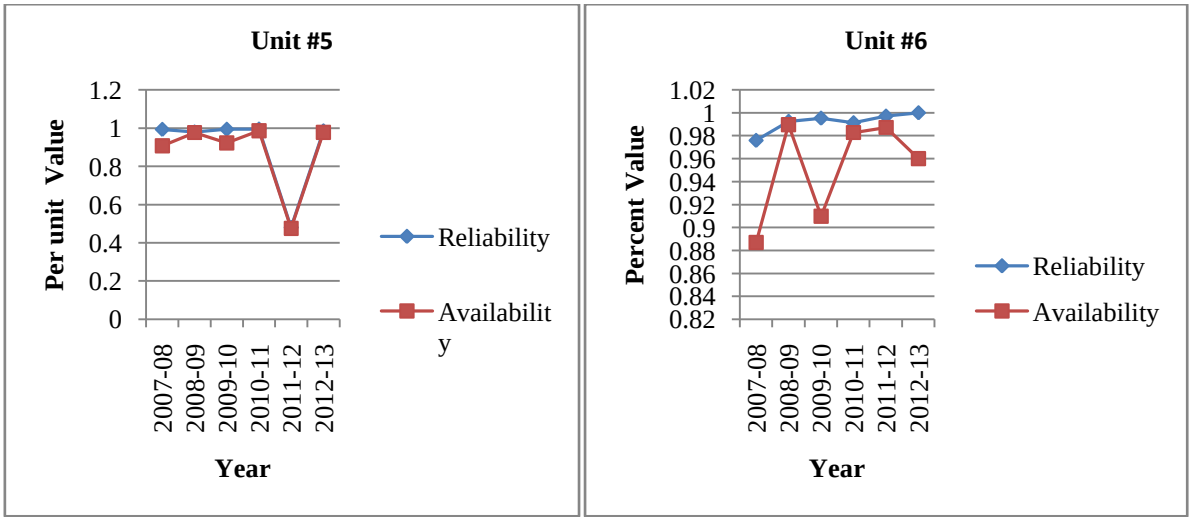


Fig. 4 Availability and Reliability curves

IV. DISCUSSIONS AND CONCLUSIONS

Table 5: Down time in Hrs (D) and Number of occurrence (N) for all down state events from April 2007 to March 2013

Events → / Unit No. ↓	Scheduled outage		Generator		Governing System		Excitation system		Thrust bearing overheat		External effects		Main unit circuit breaker	
	D	N	D	N	D	N	D	N	D	N	D	N	D	N
UNIT #1	4980	41	4	1	4	2	8	1	3261	2	116	10	0	0
UNIT #2	6501	40	505	4	23	2	9	1	6332	2	534	12	0	0
UNIT #3	3469	38	42	1	123	3	0	0	6634	2	230	11	46	4
UNIT #4	2704	30	119	5	36	4	4	2	10517	3	270	14	120	1
UNIT #5	1612	40	149	3	3	1	0	0	4525	1	311	19	0	0
UNIT #6	2059	46	48	1	76	3	0	0	0	0	254	24	42	3

Table 6: Total Forced outage Hours versus Total Scheduled outage Hours and Availability (in %age) considering the entire six years data (i.e. from Apr 2007 to Mar 2013)

UNIT NO.	Total Scheduled Outage hours	Total Forced Outage hours	Availability (in %age)
1	4980	3393	84%
2	6501	7403	74%
3	3469	7075	80%
4	2704	11066	74%
5	1612	4988	87%
6	2059	420	95%

From the analysis, it is clear that the fault that results maximum down time of a unit is the thrust bearing over heat. Apart from this there are other faults which appear on a regular basis are excitation system faults and governing system faults. Even though these faults do not necessarily result in longer down time but they affect the continuity of service.

So to analyze above mentioned faults, a closer look of the system was taken. After going through the details of the site, it was clear that there are many factors which have caused the above mentioned faults. The key points are described below:

1. The speed governing system (electro hydraulic governor) was not working in “auto” mode satisfactorily. Every time there is a failure of the auto governing system, they were switched to manual mode because of non-availability of the spare parts. If in this state (i.e. governor in manual mode) a sudden full load throw

off takes place due to some system disturbance, the unit trips attending the over speed limit. To ensure fast response quick acting digital governors should be employed.

2. The excitation system is of conventional type (i.e. shaft mounted excitation system). Hence, there is more wear and tear requiring frequent maintenance. Since the system has been working for more than 36 years, the response of the AVR (automatic voltage regulator) has become very sluggish resulting in over voltage in case of full load throw-off. Frequent sparking has been also observed at the slip rings. For better control and reliability static excitation system (thyristor type) should be preferred.
3. Forced oil – supply system for the generator thrust bearing is effected by pumping oil through the thrust bearing oil bath via a closed circuit. The closed circuit comprises motor (requiring A.C. supply) driven oil pumps – oil coolers – filters (strainers) –a pressure header – an oil bath of the thrust bearing – over flow oil pipes – drain tank pumps and instrumentation (for checking oil pressure, temperature and levels in the drain tank etc.). Oil is supplied into the thrust bearing bath by means of centrifugal pumps, one which is in operation and the other is a stand-by one. The oil pumps are electrically interlocked in such a way that if one of the pump fails to operate, the stand-by pump starts automatically due to a pulse generated by an electrical contact pressure gauge. In case of failure of A.C. supply to both these motors (i.e. say a system disturbance or failure of grid) there is no alternative arrangement to avail power supply for the station auxiliary instantly. If because of some reason both these pumps fail to operate, another stand-by emergency D.C. Lubricating oil pump operates which is also not reliable and often fails to serve when desired. Hence it would be preferable to have the thrust bearing immersed in an oil bath of adequate volume through which cooling water is circulated for effecting cooling of the lubricating oil. The old babbited thrust bearing segments should be replaced by fluoraplast coated pads to ensure less friction and less bearing oil temperature during running.
4. After observing the above facts, the trends of the availability of the generating units and looking at the age of this hydro electric project it may be an attractive proposition to go for Renovation and Modernization of the generating units to ensure better availability and reliability.

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Use of Water Extract of Moringa Oleifera Seeds (WEMOS) in Raw Water Treatment in Makurdi, Nigeria.

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Abstract: - Availability of clean water is a serious problem, especially in developing countries like Nigeria, where conventional treatment methods are inappropriate due to high cost and low availability of chemical coagulants like alum. The paper presents the use of moringa seeds extract as alternative to alum in raw water treatment. Preliminary engineering properties such as jar test, speeds of flocculation; 98, 196 and 260rpm; detention and setting times were conducted to determine the integrity of moringa extract as a natural coagulant. The results shows that at the speed of 98rpm and settling time of 1 hour, 85 – 89% removal of solids was achieved, while 41 – 59%, 63 – 80% removal of solids were possible at 260rpm and 196rpm respectively. Similarly, after 2 hours of settling time, 93 – 96%, 64 – 75%, 65 – 80% removal of solids were obtained at 98rpm, 260rpm and 196rpm respectively. The treatment suggests optimum performance at low and medium speeds better than maximum speed of flocculation. It is suggested that further investigation be carried out on particle sizes of moringa oleifera seeds powder.

Keywords: - *Moringa-oleifera, seeds, extract, raw water, treatment.*

I. INTRODUCTION

The conventional methods of water treatment involves various water clarification processes which includes coagulation, flocculation, sedimentation and disinfection. These methods are often not suitable because of the high cost and low availability of chemical coagulants and disinfectants. Moreso, the dosages and techniques involved are too cumbersome for use in most rural areas (Aho, and and Lagasi, 2012). Alum used as coagulant at local levels can have adverse effects on water (Folkard et al, 2006). These problems are well recognized by the international community, such that Governments and non-governmental organizations (NGOs) have been making massive worldwide efforts over the years to solve it; yet, the problems still remains (Kalogo & Verstraete, 2000). In order to alleviate these difficulties, new approaches are now being adopted, to focus on sustainable water treatment systems that are low cost and robust with minimal maintenance and operational skills. It is in the light of the above that this study is set up to experiment on the use of moringa seeds extract in raw water treatment in Benue State.

Moringa oleifera according to Lowel (2001), is a small, fast growing, drought "deciduous" tree that ranges in height from 5 – 12m with an open, umbrella shaped trunk which when fully grown is straight with corky and whitish bark. The evergreen foliage has leaflets 1-2cm in diameter, the flowers are white or cream coloured. The fruits are initially light green slim and tender, eventually becoming dark green, firm and up to 120cm long.

Moringa oleifera can easily be planted by transplanting or by seed. The seed can be sown either directly or in containers with no seed treatment necessary. The plants raised from 1 mere beat, pods from the second year. Thereafter, it grows with maximum production of 4 to 5 years.

In a favourable environment like Southern Nigeria, an individual tree can yield 50 to 70kg of pods in one year. Originally considered a tree of hot semi-arid regions (annual rainfall 250 – 1500mm), but now found to be well adapted to humid and wet conditions with annual rainfall in excess of 3000mm. In most states of Northern Nigeria especially Benue, fresh moringa leaves are eaten as vegetables, roots for medicinal purposes while the seeds are usually thrown away.

II. MATERIALS AND METHODS

Seed sampling and preparation

Seeds of moringa oleifera plant were obtained within Makurdi metropolis. The seedpods were allowed to mature and dry naturally to a brown colour on the trees before harvesting. To obtain the water extract of moringa, the finely crushed seed powder 10grams were mixed with 100ml of clean water to form paste. The insoluble material was removed by filtering the paste through a funnel containing cotton wool into 100ml containers.

Jar test

Varying amounts of water extract of moringa oleifera seeds (WEMOs) were flocculated rapidly and slowly for 15minutes. The settled turbidity and suspended solids were measured and correct coagulant dosages determined.

Determination of suspended solids (SS), turbidity, temperature and pH of water samples

Photometric method was adopted in the measurement of suspended solids as described by Baker (1980).
For turbidity, a DR/2000 model 1990 spectrophotometer was adopted. A long stem thermometer was used by inserting into the water samples. The values of the temperatures were read after allowing in for 5 minutes. Similarly, pH readings were taken with a pH meter model 1–125.

III. RESULTS AND DISCUSSION

The result of the jar test analysis gave optimum dosage as presented in figure 1.0. The analysis shows that 8 milliliters of the extract coagulant is capable of treating raw water that has slight to moderate turbidity not exceeding 250 NTU. Consequently, the assessed water parameters after 1 hour of settling time is presented as shown in figures 2 – 5. At 98rpm, 196rpm and 260rpm, 85 – 89%, 41 – 59%, 63 – 80% removal of suspended solids were observed. After two hours of detention period, the treatment efficiencies were increased for both parameter removals as shown in figures 6 – 9. The treatment indicates optimum performance in the removal of solids and turbidity at the low speed of 96rpm, and at 2 hours of detention time. Furthermore, the use of the extract coagulant is capable of reducing the pH of the treated water marginally, but not significant enough to affect the quality of the water.

IV. CONCLUSION

From the study carried out, the coagulative efficiency of using moringa seed extract in raw water treatment is almost 100%, when compared with alum commonly used in conventional water treatment. But in terms of availability, moringa oleifera seed extract is considered a better alternative because of high cost and non-biodegradabiltiy of the organic alum coagulant. However, the use of moringa oleifera seed powder in particle sizes is recommended for further investigation.

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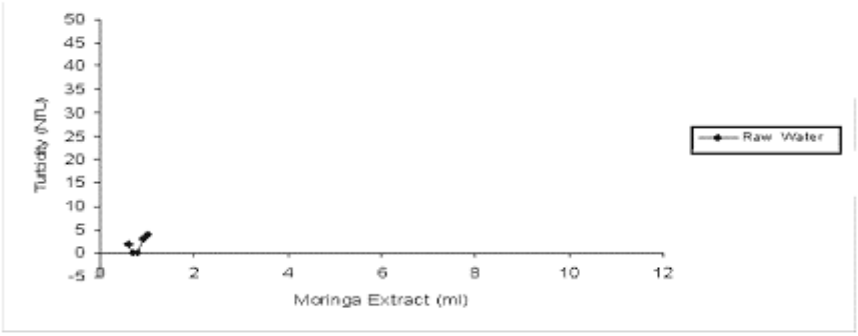

Fig. 1: *Jar test analysis for raw and waste water using moringa extract*

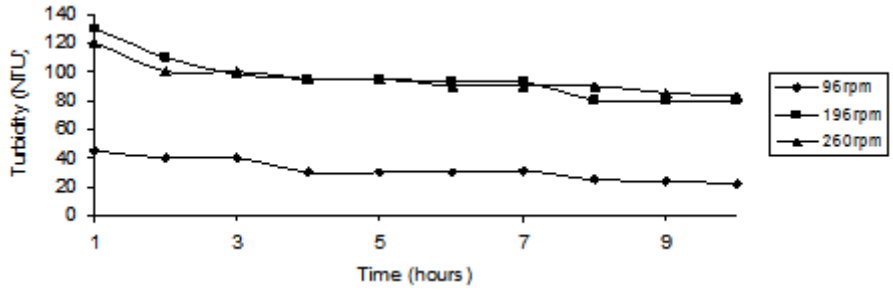

Fig 2. *Suspended solids versus time after 1hour of settling time of moringa extract in waste water*

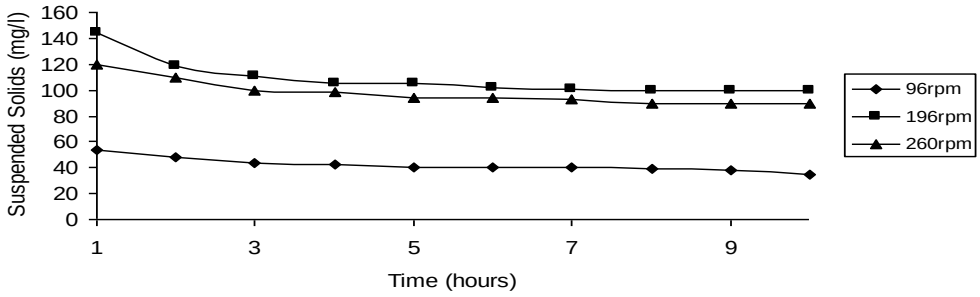

Fig. 3. *Turbidity versus time after 1hour of settling time of moringa extract in waste water*

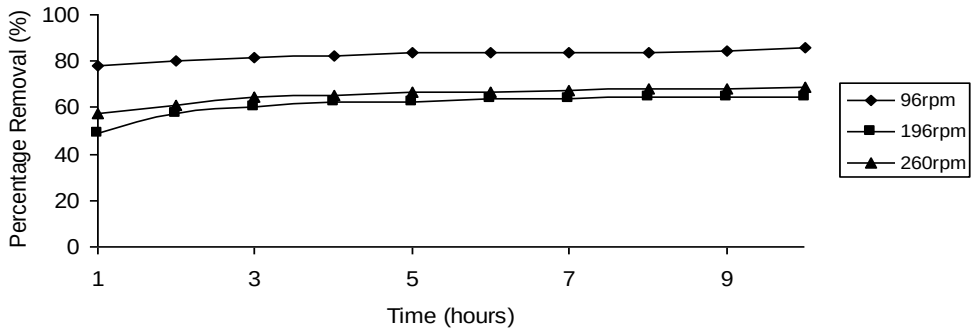

Fig. 4. Percentage removal of suspended solids versus time after 1hour of settling time of moringa extract in waste water.

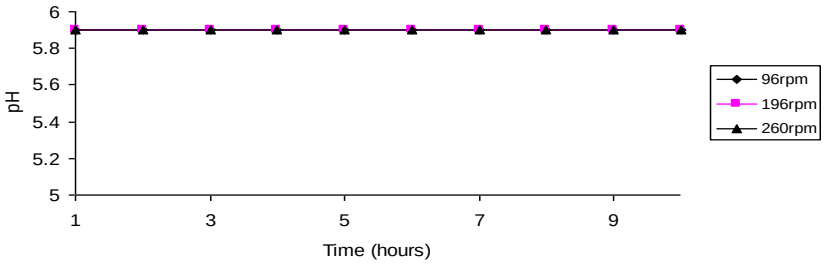

Fig. 5 pH versus time after 1 hour of settling time of moringa extract in waste water.

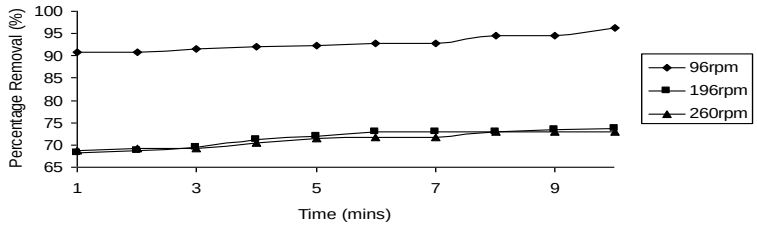

Fig.6 Suspended solids versus time after 2 hours of settling time of *moringa* extract in waste water

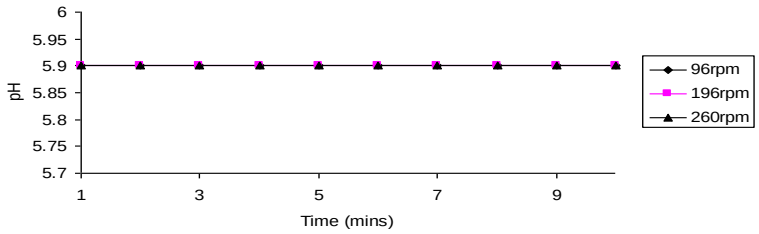

Fig. 7: Turbidity versus time after 2 hours of settling time of *moringa* extract in waste water

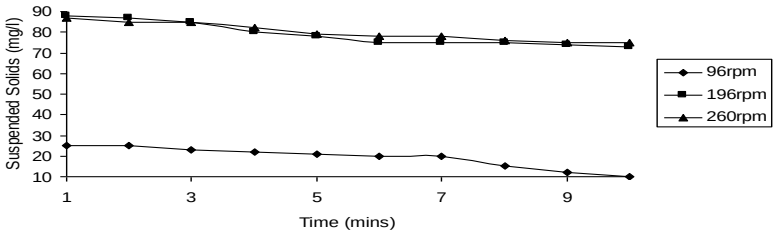

Fig. 8: Percentage removal of suspended solids versus time after 2 hours of settling time of *moringa* extract in waste water.

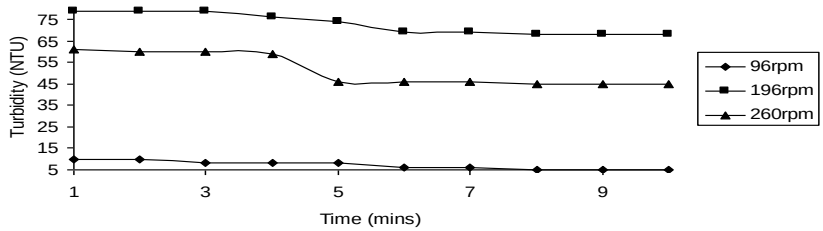

Fig.9 pH versus time after 2 hours of settling time of *moringa* extract in waste water.

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Improving Condensate Recovery Using Water Injection Model at Dew-Point Pressure

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Abstract: - Mathematical model equation was successfully developed for improving oil recovery in Gas-Condensate Reservoirs. The condensable hydrocarbons recovery modelling using water injection at dew-point pressure was developed based on traditional simulation and can be used in condensable hydrocarbons recovery evaluations. The primary input data of the model are injected water invasion factor and permeability uniformity factor of the reservoir. The techniques for monitoring proper pressure maintenance were also developed using daily reservoir voidage out replacement by the injected water volume. The estimated cumulative liquid (oil) recovery was high and encouraging. The recovery factor (percentage oil recovery value) ranges from 62 to 76% for 80% water invasion factor and uniformity factor.

Keywords:- *Gas-Condensate, Condensate-Liquid (Oil) Water-Injection, Dew-point Pressure, Invasion-Factor, Molar Volume and Voidage-Out Replacement*

I. INTRODUCTION

Gas condensate (called Liquid or Distillates Oil) reservoirs are those which produce lighter coloured or colourless stock tank liquids with gravities above 45°API at gas-oil ratios in the range 3,000 to 100,000scf/bbl. The gas condensate production is predominately gas from which liquid (called oil or distillate) is condensed at the surface separator. [***Allen, et al, 1950***]

Liquids recovery in gas-condensate reservoirs is classified under low hydrocarbons fluids reservoirs (marginal oil field), because the techniques, quantity and expenses for liquid (oil) recovery in gas condensate reservoir are off the conventional recovery methods. The quantity oil to be recovered depends on the quantity of the injected water invasion. The water invasion value depends on the void spaces in a reservoir to be replaced as a displacing agent. Water injection at dew-point pressure gears towards an overall recovery factor of 0.62 to 0.76. The control or dependant parameters are rock permeability uniformity, displacement and injected-water invasion/swept efficiencies. The high recovery value is due to better pressure maintenance by the injected water and vapour condensation at the dew-point pressure. If pressure is not enhanced (maintained), low recovery would establish itself through retrograde condensation in the gas-condensate reservoir. Gas re-cycling is only fairly good in a gas condensate with gas-cap, which is overlying by an oil-zone that is also overlain by an active water-drive. In this case the pressure is supported by the aquifer. In the absence of active water-drive, oil-zone can be depleted first, allowing the gas-cap to expand and sweep through the oil-zone, maximizing the recovery. This is because in the absence of active water-drive, the application of gas re-cycling would cause oil to zone into shrink gas-cap and/or the original oil-zone initially displaced by gas, resulting in low recovery. In order to predict the recovery value using this technique in gas-condensate reservoir, validation through field inspection is required. This involves the techniques for studying geological data, reservoir, rocks and fluids characterizations applications to aid history matching. ***[Williams, 1996]***

II. SIMULATION & MODELLING IN GAS-CONDENSATE

The objective of this work is to develop models equations for studying and improving oil recovery factor in gas condensate reservoir, at reduced cost. The models would assist us to maximize pressure maintenance in any gas condensate reservoir and avoid retrograde condensation, which could result in low recovery. The simulator consists of a single well with injection properties and reservoir characterization. The effects of varying permeability uniformity and injected fluids invasion factors calculation are included in the model program. Single-phase flow is considered in single production and injection well system, which could be integrated into multiple production and injection wells system. The success of this model relies mainly on the following factors:

-
- Pressure maintenance in condensate reservoirs - Invasion factor of the injected fluid
- Permeability uniformity/efficiency of the reservoir - Displacement efficiency of each fluid used

Standing, (1952) worked on the methods for adjusting equilibrium ratio. He used data from gas-condensate reservoir and applied to different compositions. In his work he gave step by step calculation methods for volumetric performances. His method started with a unit volume of the initial reservoir vapour and a known composition. An increment of vapour phase material was assumed to be removed from the initial volume at constant temperature. The remaining fluid expanded to the initial volume. The final pressure, division in the volume between the vapour and the reservoir liquid phase and the individual composition of vapour and liquid phase are then calculated using the adjusted equilibrium ratio. A second increment of vapour was removed at a lower pressure and the pressure, volume and composition were calculated again. The moles of each component were recorded, so as to determine the total moles of any remaining at each pressure by subtracting from the initial volumes. The calculation was repeated to abandonment pressure and he found out that the prediction of condensate reservoir performance from equilibrium ratio alone is likely to be in considerably error. He recommended that some laboratory test data should be used for comparison. He added that the equilibrium ratios are changing, because the composition of the reservoir or cell system changed or more so the heptanes-plus ($\mathbf{C^{7+}}$) composition changes could affect the calculation.

Rodger et al, (1957) tried to improve standing's work and came out with the conclusion that there must be need to improve procedure in developing the equilibrium ratios for the heavier hydrocarbons. This would improve the overall accuracy of the calculation.

Jacoby et al (1958) worked on the effects of composition, temperature of the fluid phase and depletion performance of gas-condensate systems. They studied the phase behaviours of eight mixtures of separator-oil & gas from lean gas condensate reservoir at recombined ratio in the range of 2,000 to 25,000scf/bbl and temperature range of 100 to 200°F. They found out that the results would be useful in predicting the depletion performance of gas-condensate reservoirs in the absence of laboratory studies. They also found out that there would be a gradual change in the surface production performance from the volatile oil to wet (***rich***) gas-condensate reservoirs. They recommended that a laboratory examination would be necessary to distinguish between a dew-point and bubble point reservoir, especially in the range of 2,000 to 6,000scf/d gas-oil ratios.

Craft, and Hawkin, (1958) studied the laboratory test data and equilibrium ratio calculated results of a gas-condensate reservoir and compared with the actual field depletion performance history. That was a controlled experiment where 4,000cu.cm cell sample at the reservoir temperature and pressure was used. The cell was pressure depleted, so that only the gas phase passed through the miniature three-phase separator operated at optimum field pressure and temperature. The calculated performance was also obtained from equation involving equilibrium ratio, assuming differential process. They found out that the laboratory model study could adequately predict the gas condensate reservoir behaviour. The performance could as well be calculated from the composition of the initial reservoir fluids, provided representative equilibrium ratios are available. The composition of differential process (constant volume, but changing composition) showed that only the gas would be produced and it could be removed from the liquid contact with the liquid phase in the reservoir while in the flash process (constant composition, but changing volume) showed that all the gas would remain in contact with the retrograde liquid. To this effect they recommended that, for it to be so the volume of the system must increase as the pressure declines.

Allens, et al (1950) worked compared the predicted and the actual production histories of volumetric gas-condensate reservoir and found out that retrograde condensate reservoirs with initial gas-oil ratios produce higher condensate at lower pressure than the theoretical calculations based equilibrium ratios techniques only. They suggested that the difference in recovery was due to sampling error or retrograde condensed liquid of the heavier hydrocarbons near the wellbore, which might be immobile. They equally looked at the omission of nitrogen as a constituent of the gas-condensate from the calculations. They stated that a small amount of nitrogen was found in several samples, during the life of the reservoirs study.

Craze, and Buckley, (1945) developed a material balance equation (MBE) for fluids recovery from water-drive reservoir where he assumed not appreciable decline in pressure. Their volumetric material balance equation was given as:

$$E_R = \frac{(1 - S_{wi})B_{gi} - S_{gr}B_g}{(1 - S_{wi})B_{gi}} \qquad 1$$

Thompson, et al, (1993) worked on gas condensate recovery using well test data

Eilerts, (1957), showed the distribution of gas-oil ratio and gas gravity (API) for 172 gas and gas condensate fields of 3-senerios. He found no correlation between the gas-oil ratio or the API of the tank liquid (oil) in these fields. Table 1 below shows his (Eilerts) experimental result of the gas-oil ratio in the 3-fields and table 2 shows the phase relation to tank oil gravity.

Table 1 Phase Relation to Gas-Oil Ratios in 3 Fields

LGR GPM.SCF	GOR MScf/bbl	Fields			Total	% of Total
		A	B	C		
< 0.4	> 105	38	12	7	57	31.10
0.4 - 0.8	52.5 – 1.05	33	18	4	55	32.00
0.8 – 1.2	35.0 – 52.5	12	15	5	32	18.60
1.2 – 1.6	26.2 – 35.0	1	8	1	10	5.80
1.6 - 2.0	21.0 – 26.2	1	3	1	5	3.90
> 2.0	< 21.0	2	5	6	13	7.60
Total		87	61	24	172	100

Table 2 Phase Relation to Tank Oil Gravities in 3 Fields

LGR GPM.SCF	Gravity API	Fields			Total	% of Total
		A	B	C		
	< 40	2	1	0	3	1.80
	40 – 45	4	2	0	6	3.60
	45 – 50	12	12	0	24	14.60
	50 – 55	24	17	7	47	28.50
	55 – 60	19	13	12	49	29.70
	60 - 68	23	8	3	30	18.20
	> 68	3	1	2	6	3.60
Total		87	54	24	165	100

III. RESEARCH METHODOLOGY

a. *Models Development Procedure*

The principal method of postulating the evaluation model equations was based on Craze and Buckley volumetric Material Balance Equation (MBE) with no appreciable decline in pressure and the injected water invasion factor (F).

$$\begin{bmatrix} Gas \\ Recovery \end{bmatrix} = \left[\left(\begin{matrix} Initial \\ Gas \end{matrix}\right) - \left(\begin{matrix} Gas \\ Left \end{matrix}\right)\right]\begin{bmatrix} Invasion \\ Factor \end{bmatrix}$$

$$E_R = \left[\frac{(1 - S_{wi})B_{gi} - S_{gr}B_g}{(1 - S_{wi})B_{gi}}\right][F] \qquad 2$$

Assumptions:

For good accuracy the gas volume was collected based on the following assumptions.

i. Liquid recovery factor to be $25\%C_4$, $50\%C_5$, $75\%C_6$ and $100\%C_{7+}$
ii. Total area of the pay zone = a 1ac.ft. It can be integrated into any area
iii. Average pressure of all the separators was used
iv. Average gas gravity was used in this calculation
v. The gas deviation factor (Z) was estimated from the combined oil and gas gravity
vi. The reservoir pressure was above the dew-point pressure. This indicates that there was little or no oil-zone under it
vii. Field and laboratory estimated (displacement, permeability uniformity and sweep) efficiency was 80% each.

viii. In a pressure maintenance recovery, there is no retrograde condensation, so the gas-oil ratio remains fairly constant. The recovery depends on connate water (S_{wi}) expansion, residual gas saturation (S_{gr}) and injected water invasion fraction (F). Since the gas formation volume factor ($\boldsymbol{B_{gi}}\mathbf{scf/cu.ft}$) remains substantially constant, because the reservoir pressure does not decline, $\boldsymbol{B_{gi} = B_g}$. Substituting this into model equation eqn2 and multiply by the water invasion factor gives eqn3, the evaluation model equation.

$$E_R = \frac{F\,(1 - S_{wi} - S_{gr})}{1 - S_{wi}} \qquad \textbf{3}$$

Simplifying eqn3 gives eqn4, the evaluation model equation.

$$E_R = F\left[1 - \frac{S_{gr}}{1 - S_{wc}}\right] \qquad 4$$

Laboratory Test Data Validation Models

$$GLR = 1000\left(V_{gs} + V_{gt}\right) \qquad 5$$

$$\gamma_{avg} = \frac{V_{gs}\gamma_{gs} + V_{gt}\gamma_{gt}}{V_{gs} + V_{gt}} \qquad 6$$

$$\gamma_o = \frac{141.5}{API + 131.5} \qquad 7$$

$$\gamma_f = \frac{R_g\gamma_{avg} + V_{gs}\gamma_o}{R_g + \frac{132800\gamma_o}{M_o}} \qquad \textbf{8}$$

$$M_o = \frac{44.21\gamma_0}{1.03 - \gamma_0} = \frac{6084}{API - 5.9} \qquad \textbf{9}$$

$$Z = f(P_{Pr}, T_{Pr}) = f\left(\frac{P}{P_{PC}}, \frac{T}{T_{PC}}\right) \qquad 10$$

$$P_{PC} = f(\gamma_f)\ \&\ T_{PC} = f(\gamma_f) \qquad 11$$

$$G_b = \frac{43560\, V_m P_i\, \emptyset\, (1 - S_{wc})}{Z\ R\ T} \qquad 12$$

- $V_m = molar\ Volume = 379.4\ constant$

$$n_g = \frac{V_{gs} + V_{gt}}{V_{ot}} \quad \& \quad n_0 = \frac{350\,\gamma_g}{M_0} \qquad 13$$

$$S_{gr} = 1 - S_o - S_w \qquad 14$$

$$f_g = \frac{n_g}{n_g + n_0} = \frac{R_g/V_m}{\frac{R_g}{V_m} + \frac{350\gamma_g}{M_0}} \qquad 15$$

$$G_P = G_b f_g,\ Mscf/ac.ft \qquad 16$$

$$N_P = \frac{G_P}{R_g},\ bbl/ac.ft \qquad 17$$

Voidage out Replacement Modelling

$$\begin{bmatrix}\textbf{Voidage Out}\\ \textbf{is the Total}\\ \textbf{Oil Produced}\end{bmatrix} = \begin{bmatrix}\textbf{Voidage In, the}\\ \textbf{Required Water}\\ \textbf{Replacement}\end{bmatrix}$$

$$V_0 = \frac{ZP_sT_iG_p}{T_sP_i} = \frac{0.02827ZT_iG_p}{P_i}, cu.ft/d \qquad 18$$

b. ***Evaluated Model Equations Applications***

This model was applied on 121 samples data from 3 wells with connate waster saturation ($\boldsymbol{S_{wc}}$) reduced from 100% *to* $\mathbf{11, 13}$ & 15% residual gas saturation ($\boldsymbol{S_{gr}\ of\ 15, 20, 25, 30, 35}$ & 40%). The results showed that the liquid (oil) recovery increases with the injected water invasion factor and the quantity recovered depends on the residual gas saturation. The lower the residual gas saturation, the higher the recovery factor and the higher the injected water invasion factor the higher recovery factor. Table 4.3 shows this application results.

IV. RESULTS AND DISCUSSION

Results

Table 4.1 shows the confirmed water injection for reservoir pressure maintenance evaluation models. Table 4.2 shows the laboratory test data validation models for business viability and recovery management. Fig 4.1 shows Recovery Factor based on the Injected Water invasion

Table 3 Liquid Recovery using water injection models

Eqns	*Evaluation Model Equations*	Remarks
4	$E_R = F\left[1 - \frac{S_{gr}}{1-S_{wc}}\right]$	Liquid Recovery Factor is effective at dew-point Pressure
18	$V_w = \frac{0.02827ZT_iG_p}{P_i}$	Daily Volume of Water to be Injected, $cu.ft/d$

Table 4 Laboratory test data validation models

Eqns	Validation Evaluation Models
5	$GLR = 1000(V_{gs} + V_{gt})$
6	$\gamma_{avg} = \frac{V_{gs}\gamma_{gs}+V_{gt}\gamma_{gt}}{V_{gs}+V_{gt}}$ & $\gamma_o = \frac{141.5}{API+131.5}$
8	$\gamma_f = \frac{R_g\gamma_{avg}+V_{gs}\gamma_o}{R_g+\frac{132800\gamma_o}{M_o}}$
9	$M_o = \frac{44.21\gamma_0}{1.03-\gamma_0} = \frac{6084}{API-5.9}$
10	$Z = f(P_{Pr}, T_{Pr}) = f\left(\frac{P}{P_{PC}}, \frac{T}{T_{PC}}\right)$
11	$P_{PC} = f(\gamma_f)$ & $T_{PC} = f(\gamma_f)$
12	$G_b = \frac{43560\,V_m P_i\,\emptyset\,(1-S_{wc})}{Z\ R\ T}$
13	$n_g = \frac{V_{gs}+V_{gt}}{V_{ot}}$ & $n_0 = \frac{350\,\gamma_g}{M_0}$
14	$S_{gr} = 1 - S_o - S_w$
15	$f_g = \frac{n_g}{n_g+n_0} = \frac{R_g/V_m}{\frac{R_g}{V_m}+\frac{350\gamma_g}{M_0}}$
16	$G_P = G_b f_g,\ Mscf/ac.ft$
17	$N_P = \frac{G_P}{R_g},\ bbl/ac.ft$
*	$V_m = molar\ Volume = 379.4$

Table 5 Water at Dew-Point Pressure Application Results

		Injected Water Invasion Factor F, %						
S_{gr}	S_{wc}	0.4	0.5	0.6	0.7	0.8	0.9	1.0
15	11	33.3	41.6	49.9	58.2	66.5	74.8	83.2
	13	33.1	41.4	49.7	57.9	66.2	74.5	82.8
	15	32.9	41.2	49.4	57.7	65.9	74.1	82.4
20	11	31.0	38.8	46.5	54.3	62.0	69.8	77.5
	13	30.8	38.5	46.2	53.9	61.6	69.3	77.0
	15	30.6	38.2	45.9	53.5	61.2	68.8	76.5
25	11	28.8	36.0	43.2	50.3	57.5	64.7	71.9
	13	28.5	35.6	42.8	49.9	57.0	64.1	71.3
	15	28.2	35.3	42.4	49.4	56.5	63.5	70.6
30	11	26.5	33.2	39.8	46.4	53.0	59.7	66.3
	13	26.2	32.8	39.3	45.9	52.4	59.0	65.5
	15	25.9	32.4	38.8	45.3	51.8	58.2	64.7
35	11	24.3	30.3	36.4	42.5	48.5	54.6	60.7
	13	23.9	29.9	35.9	41.8	47.8	53.8	59.8
	15	23.5	29.4	35.3	41.2	47.1	52.9	58.8
40	11	22.0	27.5	33.0	38.5	44.0	49.6	55.1
	13	21.6	27.0	32.4	37.8	43.2	48.6	54.0
	15	21.2	26.5	31.8	37.1	42.4	47.7	52.9

Source: [Calculated Using Eq4 and the Prosy Model]

Source: [Generated Using Table 5]

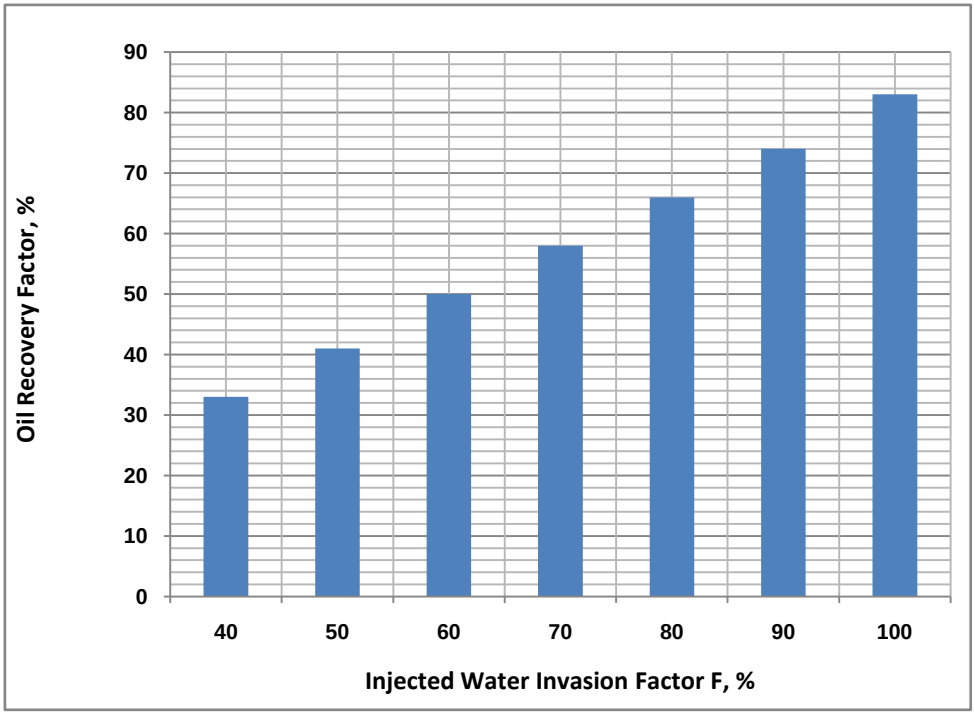

Fig 1: recovery Factor Based on the Injcted Water Invasion

Source (Result using Depletion Models)

Gas

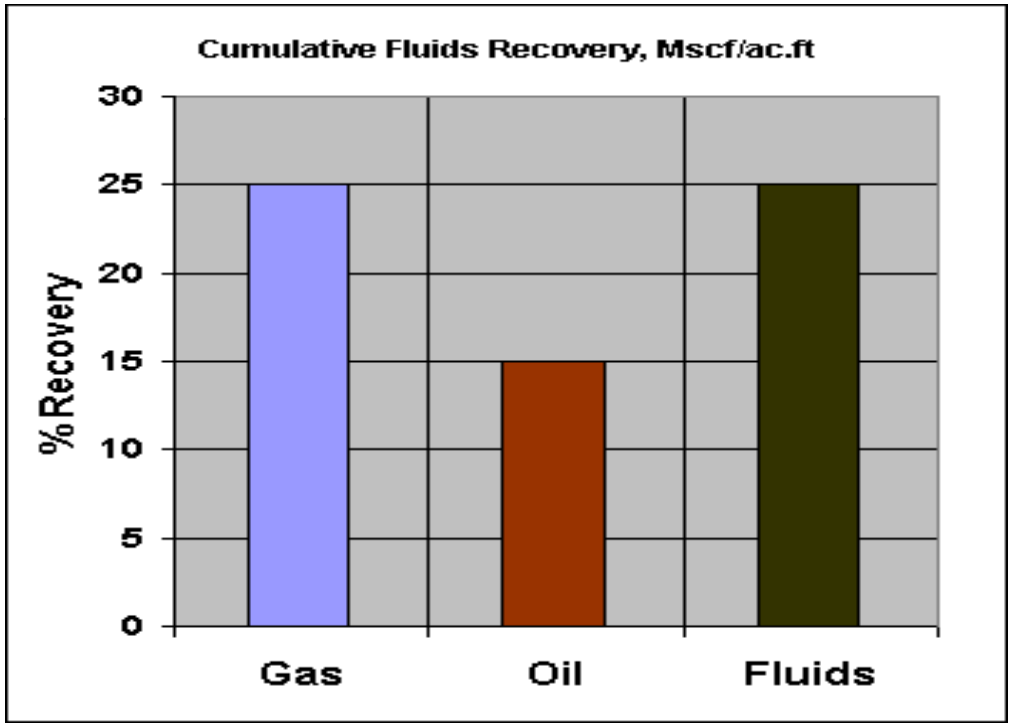

Figure 2 Cumulative Fluids Estimation by Depletion Technique

Source (Result from Depletion Models)

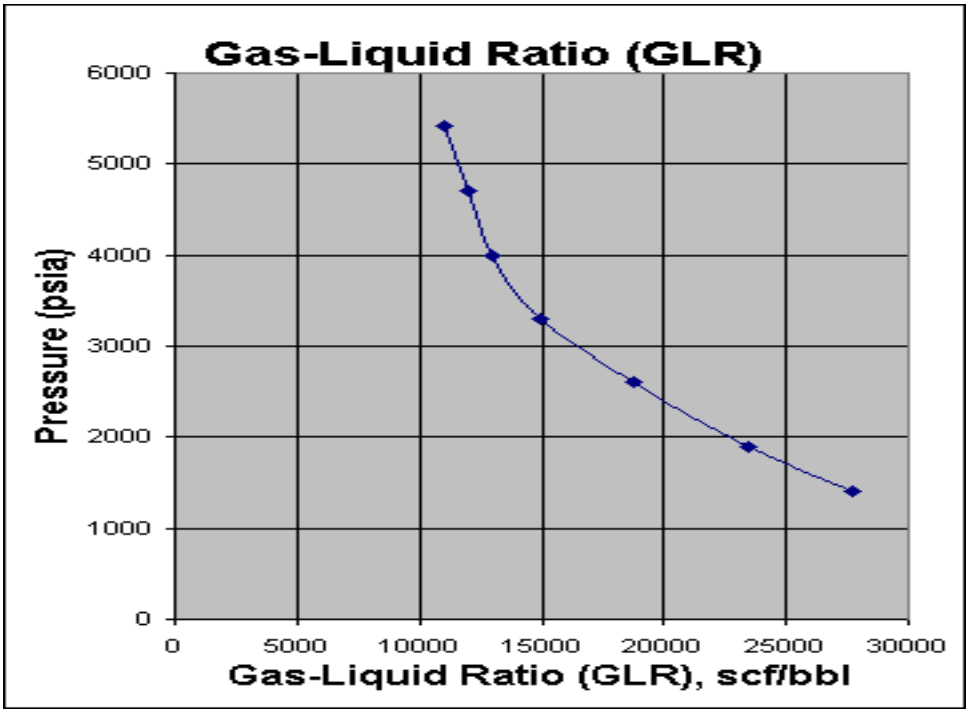

Figure 3 Estimated Gas-Liquid (GLR) by Depletion Technique

Source (Comparing Results with the Other Techniques)

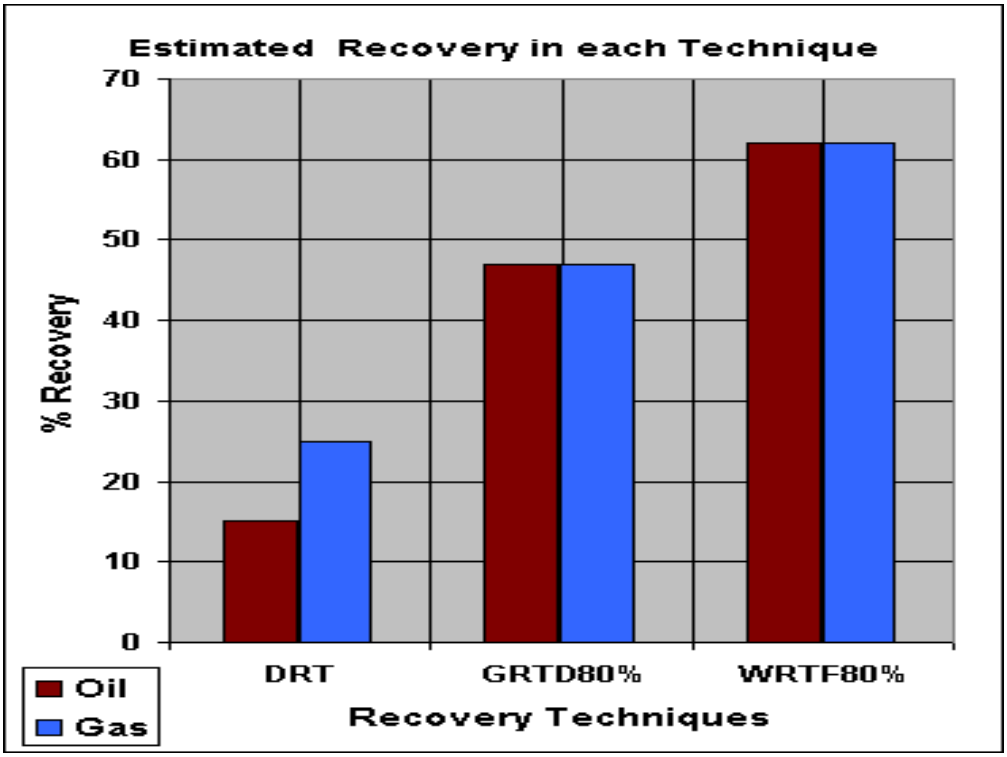

Figure 4: Comparison of Results from the 3 Techniques

Key

DRT = Volumetric Depletion Recovery Technique
GRTD80% = Gas Recycling Technique with 80% Displacement or Sweep Efficiency
WRTF80% = Water Injection Technique, with 80% Invasion Factor

V. DISCUSSION

The input data are residual gas saturation (S_{gr}), connate water saturation (S_{wc}) and injected water invasion factor. The sample data were grouped into residual saturation of 40%, 35%, 30%, 25%, 20% and 15% based on yearly production records. The total of 18 samples of residual gas saturations in 3 wells with connate water saturation 11%, 13% and 15% were used based on 121 samples of injected water invasion factor. Table 5 shows that when the residual gas saturation was reduced from 100% recoverable value to 15% in a well with 11% connate water saturation and invasion factor of 80%, 67% of the recoverably fluid was recovered. This model tool is so flexible and was designed with an incorporated provision for studying the field and laboratory test data, for good material balance and history matching. This insures accurate pressure management, fluid saturation, production and injected water replacement values estimations. The user requires just the basic knowledge of reservoir rock and fluids properties only to implement the model simulator.

VI. CONCLUSION AND RECOMMENDATIONS

Conclusion

Mathematical models were successfully derived for studying reservoirs fluids, estimating the recovery factor using water injection at dew-point pressure. The application of the model is good in most gas-condensate reservoirs to study the reservoir characterization, predict its performance, and estimate the overall fluid recovery factor. More so, the tool finds valuable applications results in analysis of reservoirs data, and monitoring plants for integrity. Validation of the model depends on successful forecast, using the field, and laboratory data available. Proper history matching is an added advantage.

Recommendations

This work assists us to maximize recovery in gas-condensate reservoirs, using various options, which maintain pressure, possibly at dew-point pressure to avoid retrograde condensations.

i. Water injection is recommended here, because it is cheap, good pressure maintenance and has high displacement efficiency with high recovery factor.

ii. The only force, which binds components in the subsurface, is an equilibrium system, so correct adjustment on the equilibrium ratio is a sure success in the results. So prediction of gas-condensate reservoir performance should be backed up with the available laboratory data. This insures accurate equilibrium ratio adjustment to give a close copy of the reservoir performance using this technique.

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Analysis of a queuing system in an organization (a case study of First Bank PLC, Nigeria)

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Abstract: **-** The analysis of the queuing system shows that the number of their servers was not adequate for the customer's service. It observed that they need 5 servers instead of the 3 at present. It suggests a need to increase the number of servers in order to serve the customer better.

Key word: **-** *Queuing System, waiting time, Arrival rate, Service rate, Probability, System Utilization, System Capacity, Server*

I. INTRODUCTION

Queuing theory is the mathematical study of waiting lines, or queues [1]. In queuing theory a model is constructed so that queue lengths and waiting times can be predicted [1]. Queuing theory is generally considered a branch of operations research because the results are often used when making business decisions about the resources needed to provide service.

Queuing theory started with research by Agner Krarup Erlang when he created models to describe the Copenhagen telephone exchange [1]. The ideas have since seen applications including telecommunications,[2] traffic engineering, computing[3] and the design of factories, shops, offices and hospitals.[4][5]

Etymology of Queuing System: The word queue comes, via French, from the Latin cauda, meaning tail. The spelling "queuing" over "queuing" is typically encountered in the academic research field. In fact, one of the flagship journals of the profession is named Queuing Systems.

Application of Queuing Theory: The public switched telephone network (PSTN) is designed to accommodate the offered traffic intensity with only a small loss. The performance of loss systems is quantified by their grade of service, driven by the assumption that if sufficient capacity is not available, the call is refused and lost.[13] Alternatively, overflow systems make use of alternative routes to divert calls via different paths — even these systems have a finite traffic carrying capacity.[13]

However, the use of queuing in PSTNs allows the systems to queue their customers' requests until free resources become available. This means that if traffic intensity levels exceed available capacity, customer's calls are not lost; customers instead wait until they can be served.[14] This method is used in queuing customers for the next available operator.

A queuing discipline determines the manner in which the exchange handles calls from customers.[14] It defines the way they will be served, the order in which they are served, and the way in which resources are divided among the customers.[14][15] Here are details of four queuing disciplines:

First in first out: This principle states that customers are served one at a time and that the customer that has been waiting the longest is served first.[15]

Last in first out: This principle also serves customers one at a time; however the customer with the shortest waiting time will be served first.[15] Also known as a **stack**.
Processor sharing: Service capacity is shared equally between customers.[15]
Priority: Customers with high priority are served first.[15]
Queuing is handled by control processes within exchanges, which can be modeled using state equations.[14][15]
Queuing systems use a particular form of state equations known as a Markov chain that models the system in each state.[14] Incoming traffic to these systems is modeled via a Poisson distribution and is subject to Erlang's queuing theory assumptions viz.[13]

- Pure-chance traffic – Call arrivals and departures are random and independent events.[13]
- Statistical equilibrium – Probabilities within the system do not change.[13]
- Full availability – All incoming traffic can be routed to any other customer within the network.[13]
- Congestion is cleared as soon as servers are free.[13]

Classic queuing theory involves complex calculations to determine waiting time, service time, server utilization and other metrics that are used to measure queuing performance.[14][15]
Queuing networks: Networks of queues are systems a number of queues are connected by customer routing. When a customer is serviced at one node it can join another node and queue for service, or leave the network. For a network of m the state of the system can be described by an m–dimensional vector $(x_1,x_2,...,x_m)$ where x_i represents the number of customers at each node. The first significant results in this area were Jackson networks, for which an efficient product-form stationary distribution exists and the mean value analysis which allows average metrics such as throughput and sojourn times to be computed.[16]
If the total number of customers in the network remains constant the network is called a closed network and has also been shown to have a product–form stationary distribution in the Gordon–Newell theorem. This result was extended to the BCMP network where a network with very general service time, regimes and customer routing is shown to also exhibit a product-form stationary distribution.
Networks of customers have also been investigated; Kelly networks where customers of different classes experience different priority levels at different service nodes.[17]
Mean field limits: Mean field models consider the limiting behavior of the empirical measure (proportion of queues in different states) as the number of queues (m above) goes to infinity. The impact of other queues on any given queue in the network is approximated by a differential equation. The deterministic model converges to the same stationary distribution as the original model.[18]
Fluid limits: Fluid models are continuous deterministic analogs of queuing networks obtained by taking the limit when the process is scaled in time and space, allowing heterogeneous objects. This scaled trajectory converges to a deterministic equation which allows us stability of the system to be proven. It is known that a queuing network can be stable, but have an unstable fluid limit.[19]
Heavy traffic: In a system with high occupancy rates (utilization) a heavy traffic approximation can be used to approximate the queuing length process by a reflected Brownian motion,[20] Ornstein–Uhlenbeck process or more general diffusion process.[6] The number of dimensions of the RBM is equal to the number of queuing nodes and the diffusion is restricted to the non-negative orthant.
Queuing System Utilization: Utilization is the proportion of the system's resources which is used by the traffic which arrives at it. It should be strictly less than one for the system to function well. It is usually represented by the symbol ρ. If $\rho \geq 1$ then the queue will continue to grow as time goes on. In the simplest case of an M/M/1 queue (Poisson arrivals and a single Poisson server) then it is given by the mean arrival rate over the mean service rate, that is,

$$\rho = \frac{\lambda}{\mu}$$

where λ is the mean arrival rate and μ is the mean service rate. More generally:

$$\rho = \frac{\lambda}{\mu \times c}$$

where λ is the mean arrival rate, μ is the mean service rate, and c is the number of servers, such as in an M/M/c queue.
In general, a lower utilization corresponds to less queuing for customers but means that the system is more idle, which may be considered inefficient.[7]
Role of Poisson process, exponential distributions
A useful queuing model represents a real-life system with sufficient accuracy and is analytically tractable. A queuing model based on the Poisson process and its companion exponential probability distribution often meets these two requirements. A Poisson process models random events (such as a customer arrival, a request for

action from a web server, or the completion of the actions requested of a web server) as emanating from a memoryless process. That is, the length of the time interval from the current time to the occurrence of the next event does not depend upon the time of occurrence of the last event. In the Poisson probability distribution, the observer records the number of events that occur in a time interval of fixed length. In the (negative) exponential probability distribution, the observer records the length of the time interval between consecutive events. In both, the underlying physical process is memoryless.

Models based on the Poisson process often respond to inputs from the environment in a manner that mimics the response of the system being modeled to those same inputs. Even a queuing model based on the Poisson process that does a relatively poor job of mimicking detailed system performance can be useful. The fact that such models often give "worst-case" scenario evaluations appeals to system designers who prefer to include a safety factor in their designs. Also, the form of the solution of models based on the Poisson process often provides insight into the form of the solution to a queuing problem whose detailed behavior is poorly mimicked. As a result, queuing models are frequently modeled as Poisson processes through the use of the exponential distribution. [8]

Limitations of queuing theory: The assumptions of classical queuing theory may be too restrictive to be able to model real-world situations exactly. The complexity of production lines with product-specific characteristics cannot be handled with those models. Therefore specialized tools have been developed to simulate, analyze, visualize and optimize time dynamic queuing line behavior. [9]

For example; the mathematical models often assume infinite numbers of customers, infinite queue capacity, or no bounds on inter-arrival or service times, when it is quite apparent that these bounds must exist in reality. Often, although the bounds do exist, they can be safely ignored because the differences between the real-world and theory is not statistically significant, as the probability that such boundary situations might occur is remote compared to the expected normal situation. Furthermore, several studies show the robustness of queuing models outside their assumptions. In other cases the theoretical solution may either prove intractable or insufficiently informative to be useful. [10]

Alternative means of analysis have thus been devised in order to provide some insight into problems that do not fall under the scope of queuing theory, although they are often scenario-specific because they generally consist of computer simulations or analysis of experimental data. See network traffic simulation. [9]

Research Method Used:

The research method used in this work is a quantitative research approach. The data gathered were the daily record of queuing system over a week. The method used in this research work were the analysis of queuing systems and techniques and also the development of queuing model for the analysis of queuing method and establish a method that will solve the problem of customers arrival rate. The model will establish the actual time it takes to serve the customer as at when due and estimate the actual working serves necessary in the organization. This model developed was used to predict the actual number of servers and time it takes to solve the problem of queuing or waiting before customers are been served as and at when due in the establishment for a week. The model developed was used to test the queuing system against the number of servers and customers arrival rate of the establishment.

Table 1: Day (One) 1 Queuing System Analysis of the Servers

Monday						
	Server 1		Server 2		Server 3	
Time	Arrival Rate	Service Rate	Arrival Rate	Service Rate	Arrival Rate	Service Rate
9:00-10:00am	16	5	17	10	25	13
10:00-11:00am	19	10	24	21	29	31
11:00-12:00 noon	20	19	28	17	37	28
12:00-1:00pm	19	19	24	24	29	29
1:00-2:00pm	14	11	19	17	26	24
2:00-3:00pm	4	4	14	13	20	14

Table 2: Day (Two) 2 Queuing System Analysis of the Servers

Tuesday						
	Server 1		Server 2		Server 3	
Time	Arrival Rate	Service Rate	Arrival Rate	Service Rate	Arrival Rate	Service Rate

9:00-10:00am	17	12	19	21	18	11
10:00-11:00am	25	20	31	23	27	24
11:00-12:00	31	27	31	25	37	29
12:00-1:00pm	30	24	24	24	29	29
1:00-2:00pm	36	35	31	23	26	24
2:00-3:00pm	19	18	19	14	14	8

Table 3: Day (Three) 3 Queuing System Analysis of the Servers

Wednesday						
	Server 1		Server 2		Server 3	
Time	Arrival Rate	Service Rate	Arrival Rate	Service Rate	Arrival Rate	Service Rate
9:00-10:00am	12	11	17	13	24	18
10:00-11:00am	19	15	24	21	29	31
11:00-12:00	29	24	28	24	27	26
12:00-1:00pm	23	23	23	24	27	25
1:00-2:00pm	17	13	21	17	26	23
2:00-3:00pm	10	7	12	13	17	13

Table 4: Day (Four) 4 Queuing System Analysis of the Servers

Thursday						
	Server 1		Server 2		Server 3	
Time	Arrival Rate	Service Rate	Arrival Rate	Service Rate	Arrival Rate	Service Rate
9:00-10:00am	9	6	19	14	27	23
10:00-11:00am	18	15	24	21	29	26
11:00-12:00	22	19	29	23	28	25
12:00-1:00pm	20	21	25	23	31	28
1:00-2:00pm	12	9	21	15	26	23
2:30-3:00pm	8	6	15	11	17	16

Table 4: Day (Five) 5 Queuing System Analysis of the Servers

Friday						
	Server 1		Server 2		Server 3	
Time	Arrival Rate	Service Rate	Arrival Rate	Service Rate	Arrival Rate	Service Rate
9:00-10:00am	13	8	17	11	18	13
10:00-11:00am	20	16	17	16	28	25
11:00-12:00	23	24	29	23	28	24
12:00-1:00pm	20	21	26	22	23	29
1:00-2:00pm	11	9	20	17	22	21
2:00-3:00pm	9	9	11	7	13	11

Table 6: Daily Queuing System Analysis of the Servers

		Server1		Server2		Server3	
		Arrival Rate	Service Rate	Arrival Rate	Service Rate	Arrival Rate	Service Rate
Day 1 (Monday)	Total Arrival or Service Rate	92	68	126	102	166	139
	Average Arrival or Service Rate	15.3333333	11.33333	21	17	27.66667	23.16667
Day 2 (Tuesday)	Total Arrival or Service Rate	158	136	155	130	151	125
	Average Arrival or Service Rate	26.3333333	22.66667	25.83333	21.66667	25.16667	20.83333
Day 3 (Wednesday)	Total Arrival or Service Rate	110	93	125	112	150	136
	Average Arrival or Service Rate	18.3333333	15.5	20.83333	18.66667	25	22.66667
Day 4 (Thursday)	Total Arrival or Service Rate	89	76	133	107	158	139
	Average Arrival or Service Rate	14.8333333	12.66667	22.16667	17.83333	26.33333	23.16667
Day 5 (Friday)	Total Arrival or Service Rate	96	87	120	96	132	123
	Average Arrival or Service Rate	16	14.5	20	16	22	20.5
Total for the Week	Average Total Arrival or Service Rate	545	460	659	547	757	662
	Average System utilization	1.18478261		1.2047532		1.14350453	

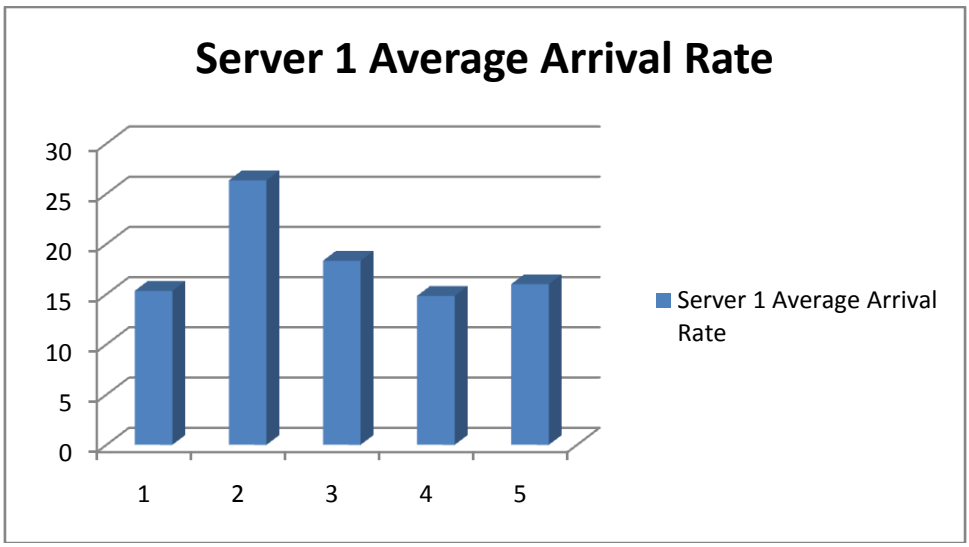

Figure 1: Server 1 Average Arrival Rate

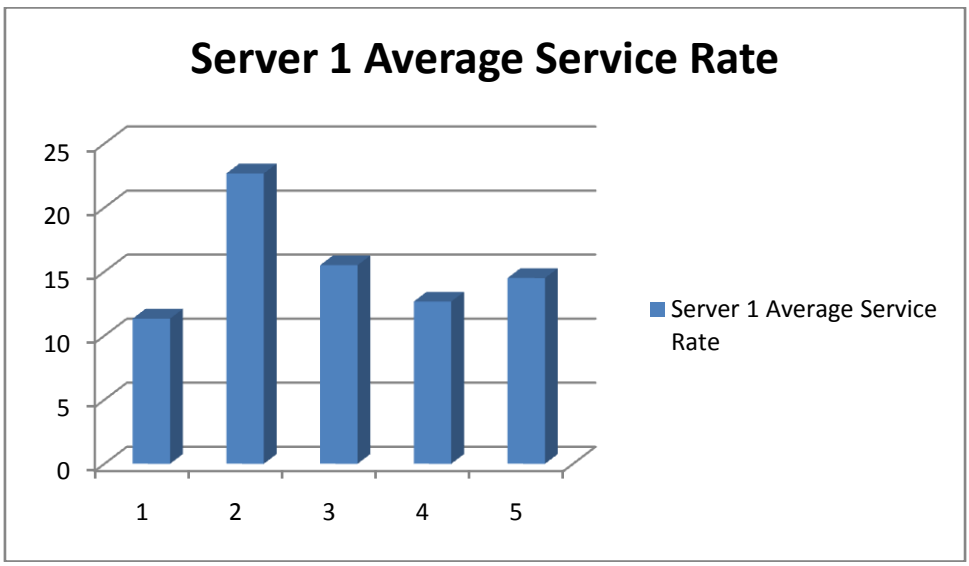

Figure 2: Server 1 Average Service Rate

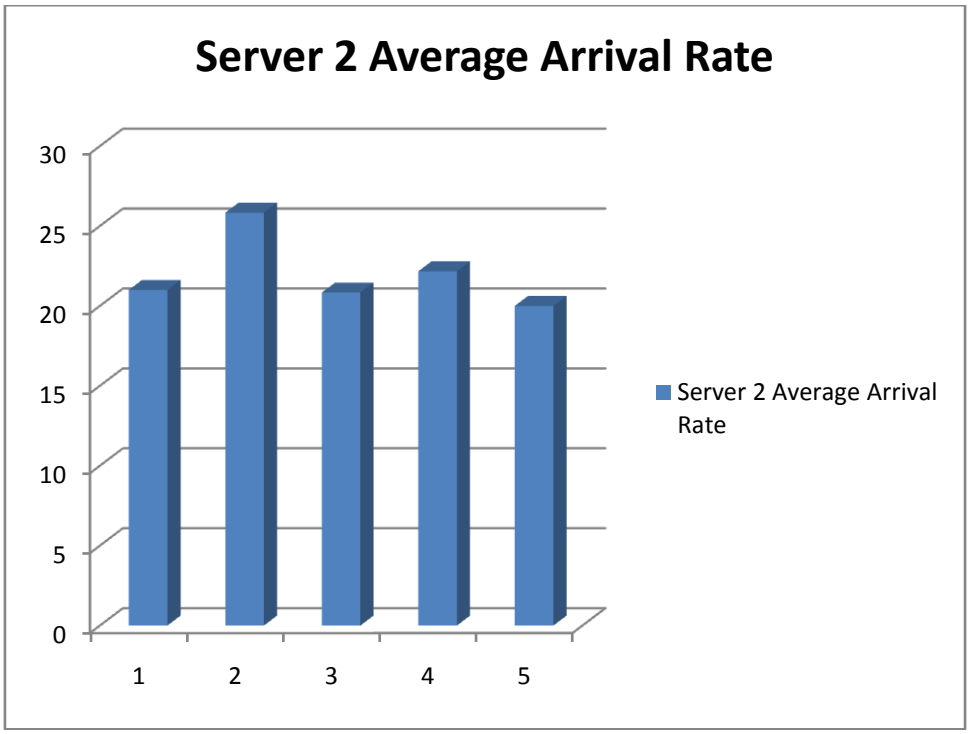

Figure 3: Server 2 Average Arrival Rate

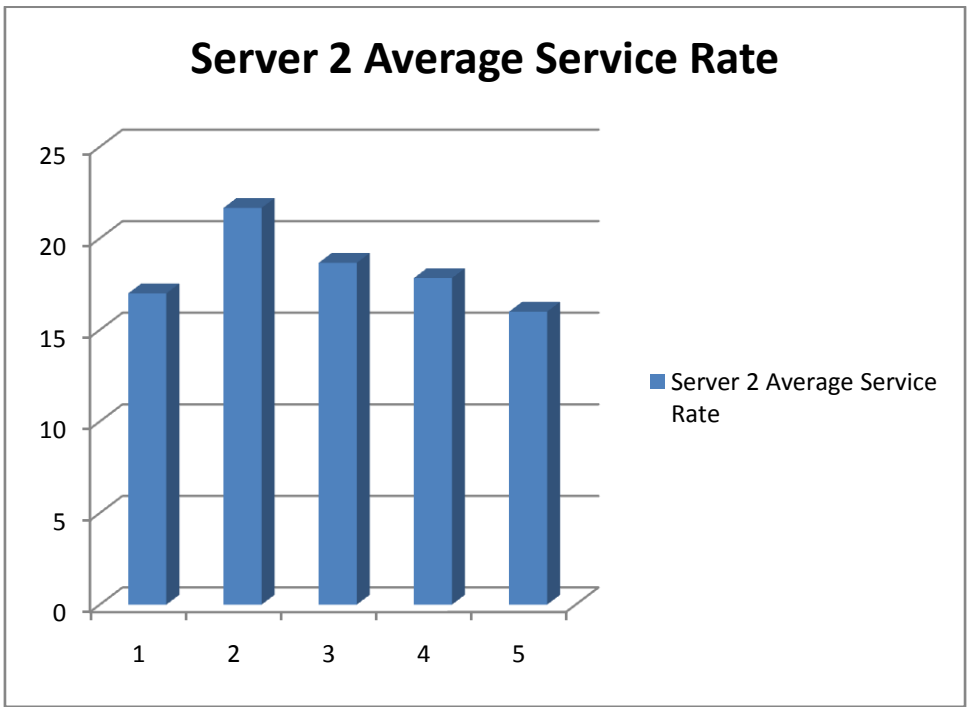

Figure 4: Server 2 Average Service Rate

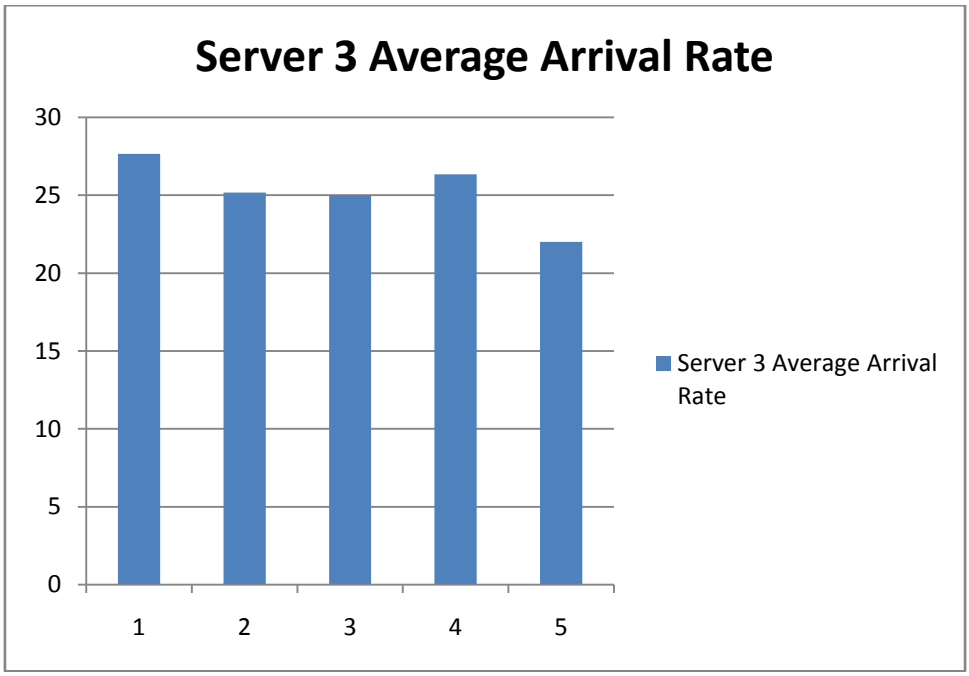

Figure 5: Server 3 Average Arrival Rate

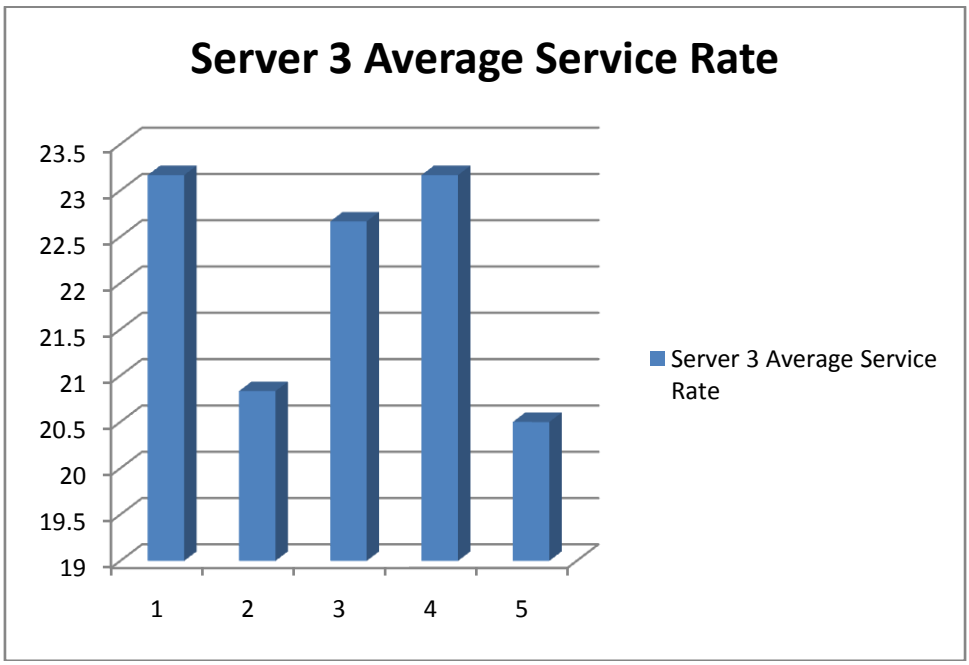

Figure 6: Server 3 Average Service Rate

Table 7: Daily System Utilization for each Server

Daily Record	Server 1	Server 2	Server 3
Day 1	1.352941	1.235294	1.194245
Day 2	1.161765	1.192308	1.208
Day 3	1.182796	1.116071	1.102941
Day 4	1.171053	1.242991	1.136691
Day 5	1.103448	1.25	1.073171

Customers arrival rate for server 1(λ_1) = 18.16667
Customers arrival rate for server 2 (λ_2) = 21.96667
Customers arrival rate for server 3 (λ_3) = 25.23333

Average Customers arrival rate for the servers (λ) = 21.7888889
Service Rate for Server 1(μ_1) = 15.33333
Service Rate for Server 2(μ_2) = 18.23333
Service Rate for Server 3(μ_3) = 22.06667
Average Service Rate for the Servers (μ) = 18.54444
The average number of customers being served(r)

$$R = \frac{\lambda}{\mu} \quad (1)$$

The average number of customers being served in server 1(r_1)

$$R_1 = \frac{\lambda_1}{\mu_1} = \frac{18.16667}{15.33333} = 1.184783 \quad (2)$$

$$R_2 = \frac{\lambda_2}{\mu_2} = \frac{21.96667}{18.23333} = 1.204753 \quad (3)$$

$$R_3 = \frac{\lambda_3}{\mu_3} = \frac{25.23333}{22.06667} = 1.184783 \quad (4)$$

$$R = \frac{\lambda}{\mu} = \frac{21.7888889}{18.54444} = 1.174955 \quad (5)$$

System Utilization for each Channel

$$\rho = \frac{\lambda}{M(\mu)} \quad (6)$$

$$\rho_1 = \frac{\lambda_1}{M_1(\mu_1)} = \frac{18.16667}{1(15.333337)} = 1.184783 \quad (7)$$

$$\rho_2 = \frac{\lambda_2}{M_2(\mu_2)} = \frac{21.96667}{1(18.23333)} = 1.204753 \quad (8)$$

$$\rho_3 = \frac{\lambda_3}{M_3(\mu_3)} = \frac{25.23333}{1(22.06667)} = 1.143505 \quad (9)$$

Average number in line

$$L_q = \frac{\lambda\mu\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M\mu-\lambda)^2} P_0 \quad (10)$$

Probability of zero units in the system(P_0)

$$(P_0) = \left[\sum_{n=0}^{M-1} \frac{\left(\frac{\lambda}{\mu}\right)^n}{n!} + \frac{\left(\frac{\lambda}{\mu}\right)^M}{M!\left(1-\frac{\lambda}{M\mu}\right)}\right]^{-1} \quad (11)$$

Average waiting time for an arrival not immediately served (W_a)

$$(W_a) = \frac{1}{M\mu-\lambda} \quad (12)$$

Probability that an arrival will have to wait for service (P_w)

$$(P_w) = \frac{W_q}{W_a} \quad (13)$$

Using equations (10) and (11) above, we have the results in the table below

Table 7: Results of the three Servers analyses

M	L_Q	P_O
1	0	-0.18048
2	0.836633	0.351096
3	0.13863	0.48456
4	0.050566	0.540665
5	0.025538	0.56806
6	0.015438	0.581313
7	0.015245	0.586285
8	0.007667	0.585774
9	0.00595	0.58128

Table 8: Formulas and Analysis of the Multiple Servers Queuing System

$\frac{\lambda}{\mu}$	M	L_q	P_0	$\frac{\lambda}{\mu}$	M	L_q	P_0
1	2	0.5	0.5	2.1	3	0.968927	0.08071
	3	0.083333	0.666667		4	0.305703	0.081065
	4	0.027778	0.75		5	0.157543	0.061793
	5	0.0125	0.8		6	0.098305	0.041509
	6	0.006667	0.833333		7	0.067568	0.025735
1.1	2	0.672222	0.409091	2.2	3	1.179965	0.064475
	3	0.112625	0.555393		4	0.348496	0.065728
	4	0.039775	0.623107		5	0.175457	0.04853
	5	0.019246	0.66096		6	0.107838	0.031214
	6	0.011106	0.684208		7	0.073286	0.018462
1.2	2	0.9	0.333333	2.3	3	1.45087	0.050809
	3	0.148148	0.462963		4	0.395693	0.053301
	4	0.054518	0.515312		5	0.194224	0.038258
	5	0.025871	0.569136		6	0.117566	0.023635
	6	0.017071	0.548823		7	0.079051	0.013379
	7	0.011719	0.550119	2.4	3	1.811321	0.039308
1.3	2	1.207143	0.269231		4	0.448133	0.043223
	3	0.190613	0.38575		5	0.213999	0.03028
	4	0.072004	0.424122		6	0.127566	0.018023
	5	0.038266	0.434123		7	0.084913	0.009794
	6	0.024414	0.429741	2.5	3	2.314815	0.02963
1.4	2	1.633333	0.214286	ANS	4	0.506894	0.035036
	3	0.240871	0.321027		5	0.234962	0.02406
	4	0.092162	0.347519		6	0.137914	0.01384
	5	0.050189	0.345548		7	0.090917	0.007239
	6	0.032809	0.329288	2.6	3	3.068436	0.021487
1.5	2	2.25	0.166667		4	0.573376	0.028376
	3	0.3	0.266667		5	0.257319	0.019192
	4	0.114894	0.283688		6	1.528019	0.0107
	5	0.063347	0.272506		7	0.075056	0.005401
	6	0.04186	0.248062	2.7	3	4.322134	0.014639
1.6	2	3.2	0.125		4	0.649416	0.022946
	3	0.369408	0.22096		5	0.281304	0.015364
	4	0.14012	0.230911		6	0.159958	0.008326
	5	0.077461	0.213491		7	0.103502	0.004066
	6	0.05123	0.18474	2.8	3	6.825871	0.008884
1.7	2	4.816667	0.088235		4	0.737464	0.018511
	3	0.450982	0.182507		5	0.307187	0.012341
	4	0.167815	0.18757		6	0.171806	0.006519
	5	0.092314	0.166595		7	0.110151	0.003086
	6	0.06069	0.136736	2.9	3	14.32961	0.004052
1.8	2	8.1	0.055556		4	0.840863	0.014881
	3	0.547297	0.15015		5	0.335283	0.009943
	4	0.198026	0.152169		6	0.184311	0.005134
	5	0.107773	0.129788		7	0.117079	0.002361
	6	0.070127	0.101029	3	4	0.964286	0.011905
1.9	2	18.05	0.026316		5	0.365964	0.008032
	3	0.661938	0.122919		6	0.197561	0.004065
	4	0.230895	0.123369		7	0.124318	0.001819
	5	0.123781	0.101139		8	0.051965	0.00076
	6	0.079516	0.074769	3.1	4	0.111448	0.00946
2	3	0.8	0.1		5	0.039967	0.006503
	4	0.266667	0.1		6	0.021165	0.003235
	5	0.140351	0.078947		7	0.01319	0.001411
	6	0.088889	0.055556		8	0.009022	0.000573
	7	0.061836	0.036232		9	0.006563	0.000223

Expected inter arrival time per hour $\frac{1}{\lambda} = \frac{1}{21.7888889} \times 60 = 2.753697$ minutes (14)

Service Time per hour $= \mu = \frac{1}{3.24 \div 60} = 18.54444$ (15)

From the table above: M=5, L_q = 0.025871=0.026 and P_0= 0.569136= 0.569

The average number of customers waiting for service (L_q) = 0.025871=0.026

Average waiting time for an arrival not immediately served (W_a)

$(W_a) = \frac{1}{M\mu - \lambda}$ (16)

$(W_a) = \frac{1}{5(18.54) - 21.79} = 0.014$ Hour or 0.847 minutes

The average time customers wait in line (W_q)

$(W_q) = \frac{L_q}{\lambda} = \frac{0.026}{21.79} = 0.00119 hour\ or\ 0.072\ minutes$

Probability that an arrival will have to wait for service (P_w)

$(P_w) = \frac{W_q}{W_a} = \frac{0.00119}{0.0.014} = 0.085$ (17)

The Average Number of Customers in the System (waiting and /or being served)

$L_S = L_q + R$ (18)

Or $L_S = W_s \times \lambda$ (19)

Using Equation (32) above;

$L_S = 0.026 + 1.2 = 1.226$

The average time spend in the system (waiting in line and service time) (W_s)

$W_s = W_q + \frac{1}{\mu} = \frac{L_s}{\lambda}$ (20)

$W_s = \frac{L_s}{\lambda} = \frac{1.226}{21.79} = 0.056$

System Utilization $\rho = \frac{\lambda}{M(\mu)} = \frac{21.79}{5(18.54)} = 0.235$ (21)

The system capacity = $M\mu = 5 \times 18.54 = 92.7$ (22)

II. DISCUSSION OF RESULTS

From the analysis, it was observed that number of servers necessary to serve the customers in the case study establishment was five (5) servers (or channels). This was proved in table 7 and 8 above. This is the appropriate number of servers that can serve the customers as and at when due without waiting for long before customers are been served at the actual time necessary for the service. This increase in servers reduces the waiting time, and the probability that an arrival will have to wait for service is 0.056. However, the system utilization was observed to be 0.235 for an hour. Furthermore, the system capacity of the five servers was observed to be 92.7 for an hour.

III. CONCLUSION

The evaluation of queuing system in an establishment is necessary for the betterment of the establishment. As it concerns the case study company, the evaluation or analysis of their queuing system shows that the case study company needs to increase the number of their channels or servers up to five(5) as show in the result analysis. The increase in the number of servers will reduce the time customers have to wait in line before been served. This will also increase the efficiency of the establishment due to the appreciation in their serve to the customers as and at when due.

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Effect of Corporate Governance on the Survival and Sustainability of Banks In Nigeria

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Abstract: **-** The rapid development and transformation of any organization in today's hypercompetitive environment to a large extent is dependent the quantumof strategic relationships which would further enhance service excellence. An important strategic planning step for an organization going through transformation is to understand and institute the concept and principles of corporate governance. Corporate Governance has assumed the central stage for enhanced corporate performance. The relevance of corporate governance cannot be overemphasized since it constitutes the organizational climate for the internal activities of a company. Corporate governance brings new outlook and enhances a firm's corporate competitiveness and stakeholder's value. This study tries to examine the effect of corporate governance on the survival and sustainability of companies. This paper is of the opinion that the adoption of section 404 of Sarbanes-Coxley Act, which requires that management certify that internal controls contain no material weaknesses, so as to further enhance integrity of financial statement and ensure effective corporate governance and ethics in the banking industry in Nigeria.

Keywords: **-** *Corporate Governance, Reforms, Regulation, Supervision, Banking Sector.*

I. INTRODUCTION

The global economy appears to be back on the road to recovery after suffering its worst recession in the post-war era. Emerging markets in Asia and Latin America continue to experience growth whilst the United States of America, where the crisis originated is also recording some recovery, largely due to an aggressive fiscal and monetary stimulus package implemented by the US government. It is expected that commodity rich economies will benefit from the recovery as demand for commodities increases and prices continue to trend upward.

The year 2010 saw continued concern over the impact of the global crisis on the domestic challenging economy, leading to capital flight by foreign investors. Weak oil prices caused a contraction of government revenue and a reduction in external reserves.

The poor operating precinct hampered the performance of many companies. Rising unemployment, weakened purchasing power and weakened investor confidence exerted downward pressure on asset prices. The challenge of management in a rapidly changing world and challenging economies is therefore to prepare the leaders in governance, captains of industries, entrepreneurs, managers and the citizens to cope with unforeseen change and to manage planned change in such a way that it enhances performances and sharpens the countries and organizations growth and development.

Economically, politically and socially, the world around us has been changing so fast that corporate landscapes of industrialized economies have equally changed drastically.

Increase in global competition and liberalization of markets combined with shift in consumer demand and preferences (changes in peoples values and priorities) have prompted the drive for lower cost margins and greater efficiency.

As a result of this, countries and corporates have been more or less forced to cut out wasteful and unproductive activities and concentrate resources in their areas of core-competence in order to achieve sustainable competitive advantages. On the other hand, worldwide, recession has affected company structure

and practices while global management has brought companies face to face with complex cross-cultural issues and competitions.

To survive these unprecedented turmoil, most organizations embarked on corporate governance. The aim is to solve today's business and high-end corporate's problems by improving business processes so as to engender companies sustainability and enhanced strategic performance.

Corporate governance, as a concept, can be viewed from at least two perspectives: a narrow one in which it is viewed merely as being concerned with the structures within which a corporate entity or enterprise receives its basic orientation and direction (Rwegasira, 2000) and a broad perspective in which it is regarded as being the heart of both a market economy and a democratic society (Sullivan, 2000). The narrow view perceives corporate governance in terms of issues relating to shareholder protection, management control and the popular principal-agency problems of economic theory. In contrast, Sullivan (2000), a proponent of the broader perspective uses the examples of the resultant problems of the privatization crusade that has been sweeping through developing countries since the 1980s, and the transition economies of the former communist countries in the 1990s, that issues of institutional, legal and capacity building as well as the rule of law, are at the very heart of corporate governance. Besides, the bitter experience of Asian financial crisis of the 1990s underscores the importance of effective corporate governance procedures to the survival of the macro economy. This crisis demonstrated in no unmistakable terms that ''even strong economies, lacking transparent control, responsible corporate boards, and shareholder rights can collapse quite quickly as investor's confidence collapse '' and emphasizing the need for mutual cooperation between the public and the privates sector in developing the capacity to ensure effective corporate governance with a view to ensuring the development of market-based economies and democratic societies based on the rule of law.

M.R. Chatu Mongol Sonakul, Governor, Bank of Thailand, ''Corporate Governance and Globalization, ''Opening Address at the ''Asian Economic Crisis and Corporate Governance Reform'' Conference held on September 12-14, 1999, Bangkok, Thailand. Quoted in Sullivan (2000).

The adaptation of various economic reform programmes in Africa in the 1980s, in which privatization of government-owned enterprises form a major plank, has heightened the corporate governance debate in the continent. The bitter experience of massive governance in some countries of Eastern Europe like Czech Republic and Russia that rushed into large-scale privatization without the necessary corporate governance ''infrastructure'', suggests that Africa needs to take stock of its corporate governance capacity. This paper is an attempt to do just that, using Nigeria as a case study. In the next section, we provide some perspective of the current structure of owner ship in the business sector in the country as well as assess the implementation of the privatization programme so far. In section III, following Ricardo(2000), we identify and review the different provisions of legislation governing corporate governance in Nigeria from three perspectives: disclosure and transparency; minority and shareholder rights; and oversight management. We evaluate the standard of corporate governance in Nigeria using the OECD scoring instrument in section IV and concluded in section V.

Corporate governance is now established as an important component of international architecture, but barely half a decade ago it was little known beyond specialists in a few countries such as US, Australia, Canada, UK and South Africa. In 1999, There were an estimated 274 conference in 39 countries on corporate governance, but most were in developing countries and almost none in Africa.

That is change. In addition to the king report, which was authored in South Africa, which in the view of many is the global benchmark, there has been a rapid growth in the development of African thinking on corporate governance. In many African countries this interest in corporate governance has its origins less in the context of private sector financial systems, and more in the need to improve the performance of, and then to privatise state enterprise.

In general, it is easy to see why corporate governance has grown in status. The asian financial crisis, which cause so much damage to the global economy, was triggered by poor corporate governance practices.

The fundamental purpose of corporate governance is healthy national development. In a period in which the private sector is accepted as the motor for growth, good corporate governance is a essential lever for development and social justice.

In addition to the South African King Report, there has been a rapid growth in the development of African thinking on corporate governance. In a period in which the private sector is accepted as the motor for growth, good corporate governance is an essential lever for development and social justice. As the New Partnership for Africa's Development (NEPAD) recognises, the link with economic and political governance criteria is critical. New thinking is to attack on the supply side of corruption (company bribes) by complementary anti-corruption measures by the state. The recent initiative of the African Union (AU) to develop an AU Convention on Combating Corruption addresses the importance of declaring public officials' assets, and also breaks ground by targeting unfair and unethical practices in the private sector.Governance, which is the manner in which power is exercised in the management of economic and social resources for sustainable human development is an extremely important component in the maintenance of a dynamic balance

between the need for order and quality in society; setting in motion the efficient production and delivery of goods and services; ensuring accountability in the use of power and the guarantee or protection of human rights and freedoms ;and the maintenance of an organized corporate framework within which each citizen can contribute fully towards finding innovative solutions to common problems.

Corporate Governance refers to the manner in which the power of a corporation is exercised in the management of the corporation's total portfolio of assets and resources, with the objective of maintaining and increasing shareholders' value and the satisfaction of other stakeholders in the context of its corporate mission.

Corporate Governance is concerned with creating a balance between economic and social goals and efficient use of resources, accountability in the use of power and as far as possible, to align the interests of individual corporations and society.

Corporate Governance means the establishment of an appropriate legal, economic and institution environment that allows companies to thrive as institutions for advancing long-term shareholders value and maximum human-centered development while remaining conscious of their other responsibilities to other stakeholders, the environment and the society in general.In the past business ownership was solely the prerogatives of the owners getting directly involved in the day to day running of the activities of the business. However with modernization, growth and expansion of business both in size and technical knowhow, it has become difficult and almost impossible for business owners to personally manage these trends alone. Appointment of managers has become imperative as business owners will like their enterprise to continue and such appointment is that the continuity and management will be done in their behalf. These are to give account of their stewardship periodically by reporting to the business owners the results of their works. Sanusi, 2003 asserts that there is no one single factor that contributes to institutional problems than the lack of effective governance. Widespread corporate scandals and failures had their root in dishonest management decisions and, in some cases, outright cover-ups of illicit activities, that is why in the words of Owolabi and Dada, 2011 as a result of fraudulent practices by the management of corporate organizations as well as in the preparation of financial statements prepared by the management and report thereon to the business owners has brought to the fore the role, which the pursuit of narrow group interest played in wrecking these corporations and, consequently, the lives of millions of innocent citizens who had a stake in them, therefore the concept of corporate governance emerges and we need to know.

The improvement of corporate governance practices in widely recognized as one of the essential elements in strengthening the foundation for the long-term corporate performance of countries and corporations. Although the result revealed no evidence to support the impact of boar composition on performance, there was significant evidence to support the fact that CEO duality adversely impacted firm performance. The result also suggested firm size and leverage also impacted the firm performance. A new variable, identified as more than one family member on the board, was found to have an adverse effect on firm performance. Abdullah, 2004 suggested neither board independence nor leadership structure nor the joint effects of these two had any relation with the firm performance. The structures of boards were largely found to be independent of management and absence of any dominant person.

Effective corporate governance has been identified to be critical to all economic transactions especially in emerging and transition economies (Dharwardkar et al., 2000). However, at varying levels of agency interactions, market institutional conditions that reduce informational imperfections and facilitate effective monitoring of agents impinge on the efficiency of investment. Likewise, corporate governance has assumed the centre stage for enhanced corporate performance.

II. THEORETICAL AND LEGAL FRAMEWORK OF CORPORATE GOVERNANCE

The concept of corporate governance attracts so much attention from scholars, corporate watchers and stakeholders because it is concerned with the economic health of an organisation, in particular, and the society In general. Therefore, the concept has been viewed from various perspectives and different authors have come up with different definitions that reflect their various perspectives. Cadbury (2000), for example, says that ‘’corporate governance is concerned with holding the balance between economic and social goals and between individual and communal goals. The corporate governance framework is there to encourage the efficient use of resources and equally to require accountability for stewardship of those resources. The aim is to align, as nearly as possible, the interest of individuals, corporations and society. The organization for Economic Cooperation and Development (OECD) (1999) opines that:

Corporate governance is the system by which business corporations are directed and controlled. The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporation, such as the board, managers, shareholders and other stakeholders, and spells out the rules and procedures for making decisions on corporate affairs. By doing this, it also provides the structures through

which the company's objectives are set and the means of attaining those objectives and monitoring performance.

Corporate governance is crucial in an attempt to enhance efficiency in the banking system, sustain the confidence of depositors, ensure better risk management strategies, increase shareholders' value, and meet the expectations of the various stakeholders. Corporate governance in the context of banking refers to the situation where operations are controlled directly to enhance transparency and accountability, thus protecting stakeholder's interests. The OECD, according to the Basle Committee on Banking, defines corporate governance ''as involving a set of relationships between a company's management, its shareholders, and other stakeholders. ''on the other hand, Armstrong (2003) contends that corporate governance seeks to create corporations that are governed transparently an with integrity and which are accountable and responsible.

The development of corporate governance is a reaction to unethical business practices in corporate organisations such as tempering with financial statements to give false impression of the financial health of these organizations to the recipients of these reports. Many organizations, which were once icons of success, productivity and financial discipline, became bankrupt and collapsed. For example, ENRON made bogus sales of three bogus power generating barges to the Lagos State Government Independent Power Project to boost its profit (Olesin, 2004).

Similarly, Worldcom, Xerox, Quest communications, Arthur Anderson and Halliburton were involved in some unethical business practices which included the manipulations of financial statements. In Nigeria, African Petroleum (AP) was involved in the concealment of debts to give misleading information on its financial statement (Onyenankeya, 2003). These examples, together with other reported cases of corporate failure arising from massive frauds and material misstatements such as the Asian financial crisis of 1997-98, led to the development and growth of corporate governance.

There are two schools of thought: agency and stewardship. Agency theory presents governance as a contract between directors and the shareholders. The directors and management, seeking to maximise their personal utility, take actions that are advantageous to themselves but are the expense of the shareholders. Consequently, the transactions costs of appropriate checks and balances- such as ensuring adequate disclosures to shareholders, using independent directors and auditors- are high. Stewardship theory, the alternative perspective, takes a broader frame of reference based on the original and legal definition of companies in which directors have a fiduciary duty to the shareholders to act in the best interest of the company at all times not in their own sectional interest (Companies and Allied Matters Act (CAMA), Section 282 (FGN, 2004). Corporate governance, therefore, is about promoting corporate fairness, transparency and accountability. The systemic corporate governance failures highlighted above led to some legislative efforts in so many countries such as the USA where the Sarbanes-Oxley Act was passed in 2002. The Sarbanes-Oxley Act dramatically changed the regulatory landscape for organisations that

participate in the US capital market. It imposed major corporate governance and disclosure reforms and created an entirely new regulatory requirement for published financial statements. The basic principles of corporate governance are also fully articulated in the Organization for Economic Co-operation and Development (OECD) principle of corporate governance.

Corporate governance framework entails the establishment of necessary structures to ensure that the principles and concept of corporate governance are instituted and practised. The structures required to adequately implement corporate governance are board of directors, audit, compensation, corporate governance and nomination, the code of personal and business conduct and ethics committees. (FGN, 2004) provides that every company shall have directors. Though the size of the board for effective corporate governance varies depending on the need, the common size is between seven (7) and fifteen (15). Majority of these are expected to be independent. Independence means that the directors are not employees of the company and do not depend on the company for their livelihood. These non-employee directors are expected to bring independent perspectives in their discussions at board meetings and provide a wide range of experience to the CEO in particular, the management, and the entire organization in general. The Central Bank of Nigeria (CBN) (2006) expects that the number of non-executive directors should exceed that of executive directors. To ensure that one person does not dominate at board meetings, corporate governance principles expect that the positions of the chairman of the board and the CEO are occupied by two different persons. It also expects the separation of the position of the chairman of the board from that of the CEO. Section 279 to 283 of CAMA (2004) specify the duties of directors which include the duty of care and skill in the best interest of the company. To carry out their duties with care and skill and to ensure good an effective corporate governance, the board creates four committees: adult, compensation, corporate governance and nomination, and code of personal and business conduct and ethics.

The purpose of the audit committee, which CAMA 2004 section 359 (3) requires all publicly quoted companies to establish, is to assist the board in its function of oversight of the integrity of the organisation's financial statements, external auditors' qualification and independence, the performance of internal audit function and external auditors and compliance with legal and regulatory requirements. The audit committee plays a vital role

in financial and operational controls in the whole system of corporate governance. Section 359(6) of CAMA 2004 specifies the duty of audit committee. The committee has authority to conduct any investigation appropriate to fulfilling its responsibility. One of the most important jobs of the audit committee is to ensure the integrity of financial statements in the light of recent financial misstatements and corporate failure (Agbugba and Egbunike, 2003: Onyenankeya, 2003: Olesin, 2004).

To stem the trend of falsifying financial statements and ensure the independence of external auditors, Okafor and Eiya (2006) are of the opinion that regulatory authorities should appoint auditors for banks and other financial institutions and specify what is in the best interest of the economy as the requirements of audit.

Furthermore, they suggest that auditors should be paid by the regulatory authorities and the expense from banks by the Nigeria Deposit Insurance Corporation (NDIC). To ensure the independence of auditors Section 201 of Sarbanes-Oxley Act (2002) prohibits auditors from performing certain activities for the companies they audit. Furthermore, Section 203 of the Act provides for the rotation of audit partners responsible for the audit of a company so as to ensure programming, investigative, and reporting independence (Mautz and Sharaf, 1980). The Central Bank of Nigeria CBN (2006) restricts the activities of external auditors and limits their tenure to a maximum of ten years. Section 404 of Sarbanes-Oxley Act requires that financial statements include management certified statement that internal controls contains no material weakness. Material weakness exists in situations where the internal control system may not reasonably detect or prevent material misstatement in financial results.

The purpose of compensation committee is to ensure adequate compensation policy that encourages high performance, promote accountability, and align employees' interest with that of the shareholders. This committee will review and approve the competitiveness of the company's cash and non-cash executive compensation to attract and retain top flyers, motivate employees to achieve organizational goals and align the interest of employees to the long-term interest of the shareholders. To buttress this point, CBN (2006) provides that a committee of non-executive directors should determine the remuneration of the executive directors.

As for corporate governance and nomination committee its purpose is to advise and make recommendations to the board on matters concerning corporate governance and to identify and evaluate potential candidates for directorship instead of leaving these issues to the chief executive officer.

The code of personal and business conduct and ethics is to ensure that an organisation conducts its business in accordance with the highest ethical standards and maintain complete confidence and trust of customers and the general public. To this end, the committee would ensure that employees and directors disclose conflicting interest in any transactions with the organizations. This certainly will forestall the abuse of official position and insider dealings.

As we indicated, it is expedient for the majority of the members of the board to be independent to give the board an outside perspective. The membership of the committees mentioned above should be dominated by these independent members. It is the view of Dunn (1996) that independent directors should constitute the audit committee. This would perhaps increase the integrity of financial statements. It would be especially beneficial if the chairpersons of these committees are independent to ensure non-interference of the executive. To effectively institute corporate governance, the structures mentioned above must be established and allowed to function as anticipated not only by law but also for the benefit of all the stakeholders of an organization. The term corporate governance has been used in many different ways and he boundaries of the subject vary widely. In the economics debate concerning the impact of corporate governance on performance, there are basically two different models of the corporation, the shareholder model and the stakeholder model. In its narrowest sense (shareholder model), corporate governance often describes the formally system of accountability of senior management to shareholders. In its widest sense (stakeholder model), corporate governance can be used to describe that network of formal and informal relations involving the corporation. More recently, the stakeholder approach emphasizes contributions by stakeholders that can contribute to the long term performance of the firm and shareholder value, and the shareholder approach also recognizes that business ethic and stakeholder relations can also have an impact on the reputation and long term success of the corporate. Therefore, the difference between these two models is not as stark as it firm seems, and it is instead a question of emphasis.

The lack of any consensus regarding the definition of corporate governance is also reflected in the debate on governance reform. This lack of consensus leads to entirely different analyses of the problem and to the strikingly different solutions offered by participants in the reform process. . An understanding of the issues involved can also provide the basis from which to identify good corporate governance practices and to provide policy recommendations.

III. LITERATURE REVIEW

Corporate governance is an evolving field which have gained popularity in the last decades after the demise of Enron, WorldCom, Arthur Anderson, etc in the United States of America which have forced Academics, legal practitioners, accountants and other related professionals, regulatory agencies government

institutions, NGOs and international financial institutions to pay attention to corporate governance reforms, (Key and Siberston 1995, Vinten, 1998; 2002; Chanbers 2006; Marlin 2008; Judge, Douglas and Kutan, 2008; De Cleyn, 2008). Other countries have had similar corporate scandals, for example HIH insurance in Australia; Marconi in UK, Parmalat in Italy; Regal bank, Leisure Net and Kron in South Africa and Cadbury in Nigeria. Consequent upon these publicized corporate a scandals and he preceding financial crises experienced in Asia in the late 1990s, there was a global impetus to promote good corporate governance, accountability and ethical business in many countries (Alo, 2001; samusi, 2003; Wilson, 2006; Inyang, 2008).

Corporate governance is a system by which organizations and companies are directed, managed, and controlled in order to enhance corporate performance and cater for shareholders concerns and stakeholders interest (Sanusi, 2003; Inyang, 2004). Corporate governance has leadership dimension, because it provide dimensional leadership to organizations by creating an enabling environment which integrates and systemize various collaborative efforts for settling objectives and achieving corporate goals (Ugoji and Isele, 2009). Good corporate governance helps to priorities organizational objectives and achieve good corporate performances, enhance ethical decisions making within organization where Shareholders concerns and stakeholders interest are addressed properly (sanda, mikailu, and garba, 2005 wieland, 2005, roe, 2008, de cleyn, 2008).

In its simplest conceptualization, corporate governance refers to the range of policy and practices that stockholders, executive managers, and board of directors use to manage the operations of corporate organizations towards fulfilling their responsibilities to the investors and other stakeholders in the society. It is essentially ‘’a system by which the organization or company directs, managers and controls the business of the company to enhance performance and corporate responsiveness to shareholders and other stakeholders’’ (Inyang, 2004). Corporate governance is a term that is used extensively today. In the media, we hear of good governance. The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporate such as, the board, managers, shareholders and stakeholders, and spells out the rules and procedures for making decisions on corporate affairs Kajola (2008).

Hussy (1999) defines corporate governance more formally as ‘’ the manner in which organizations, particularly limited companies are managers to the owners. In other words, corporate governance is not just a set of rules but also a structure of relationship geared towards establishing good corporate practice and culture..

Corporate governance refers to the process by which company is controlled, or governed. Just as nation have governments that respond to the needs of the citizens and establish policies, so do banks have systems of internal governance that determines the overall strategic direction and balance sometimes divergent interests.

Shleifer and Vishny (1997) ‘’Corporate governance deals with the way in which suppliers of finance to corporations assure themselves of getting a return or their investment.

Ultimate Business Dictionary (2003) defines corporate governance functionally as ‘’the managerial or directional control of an incorporated organization, which when well practiced can reduce the risk of fraud, improve company’s performance and leadership and demonstrate social responsibility.

Wolfensohn (2001) ‘’corporate governance is about promoting corporate fairness, transparency and accountability’’ OECD (1999) ‘’ corporate governance is the system by which business corporations are directed and rights and responsibilities among different participants in the corporation such as the board, managers, shareholders and other stakeholders, and spells out the rules and procedure for making decision on corporate affairs. By doing this, it also provides the structure through which the company objectives are set, and means of attaining those objectives and monitoring performance. From the public asset Coyle (2002) says ‘’corporate governance is about nurturing enterprises while ensuring accountability in the exercise of power and patronage by firm. From the shareholder’s view Coyle (2002) is therefore concerned with achieving a balance between economic and social goals and between individuals’ and communal goals. The relationship between the owners (shareholder) and decision makers (board of directors) has generated into conflicts which is now the major source of many problems with corporate governance.

The Basel committee on banking supervision (1999) states and that from a banking industry perspective, corporate governance involves the manner in which the business and affairs of individual institution are governed by their boards of directors and senior management. It sets out the duties of the board of directors to include:

a. Set corporate objectives (including generating economic returns to owners).
b. Run the day to day operations of the business
c. Consider the interest of recognized stakeholders.
d. Align corporate activities and behavior with the expectation that banks will operate in safe and sound manner, and in compliance with applicable laws and regulations.
e. Protect the interests of depositors.

The committee further enumerates basic components of good corporate governance to include:

a. The corporate values, codes of conduct and other standards of appropriate behavior and the system used to ensure compliance with them.

b. A well defined strategy against which the success of the overall enterprises and the contribution of individuals can be measured.
c. The clear assignment of responsibilities and decision making authorities, incorporating hierarchy of required approvals from individuals to the board of directors.
d. Establishment of mechanisms for the interaction and cooperation among the board of directors, senior management and auditor.
e. Strong internal control system, including internal and external audit functions, risk management functions independent of business lines and other checks and balances.
f. Special monitoring of risk exposures where conflicts of interests is likely to be particularly great, including business relationship with borrowers affiliated with the bank.
g. The financial and managerial incentives to act in an appropriate manner, offered to senior management, business line management and employees in the form of compensation, promotion and otter recognition.
h. Appropriate information flows internally and to the public. On a theoretical discipline which examines how to achieve an increase in the effectiveness, contracts, organizational regulation and business legislation. It is not a disputed fact that banks are crucial elements to any economy; this therefore demands that they have strong and good corporate to any governance in practice if their positive effects are to be achieved.

Ultimate Business Dictionary (2003) defines corporate governance functionally as ‘’the managerial or directional control of an incorporated organization, which when well practiced can reduce the risk of fraud, improve company’s performance and leadership and demonstrate social responsibility

In its simplest conceptualization, corporate governance refers to the range of policy and practices that stockholders, executive managers, and board of directors use to manage the operations of corporate organizations towards fulfilling their responsibilities to the investors and other stakeholders in the society. It is essentially ‘’a system by which the organization or company directs, managers and controls the business of the company to enhance performance and corporate responsiveness to shareholders and other stakeholders’’ (Inyang, 2004). Corporate governance is an evolving field which has gained tremendous popularity and interest worldwide after the collapse of Enron,Worldcom, Arthur Andersen etc in the United States of America which had forced academics, legal practitioners, Accountants, regulatory agencies ,government institutions, NGO’s local and international financial institutions and other professionals in related fields to be attentive to corporate governance reforms (Kay and Siberston, 1995; Vinten, 1998; 2002; Chanbers, 2006; Marlin, 2008; Judge, Douglas and Kutan, 2008; De Cleyn, 2008). Consequent upon published corporate scandals and the preceding financial crises experienced in Asia in the late 1990’s, there was global impetus to promote good corporate governance, accountability and ethical business practice in many countries (Alo, 2001; Sanusi, 2003; Wilson, 2006; Inyang, 2009). Corporate governance is a system by which organisations and companies are directed, managed and controlled in order to enhance corporate performance and cater for shareholder’s interest (Sanusi, 2003; Inyang, 2004). Corporate governance has a leadership dimensionbecause it provides dimensional leadership to organisations by creating the enabling environment which integrates and systemize various collaborative efforts for setting objectives and achieving corporate goals (Ugoji and Isele, 2009). Good corporate governance helps to prioritiseorganisational objectives and achieve good corporate performances, enhances ethical decision making within organisation where shareholders concerns and stakeholders interests are addressed properly (Sanda, Mikailu and Garba, 2006; Wieland, 2005; Roc, 2008; De cleyn, 2008). The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporate such as, the board, managers, shareholders and stakeholders, and spells out the rules and procedures for making decisions on corporate affairs Kajola, (2008).

.. Akinsulire, (2008) define corporate governance as the system by which the affairs of companies are directed and controlled by those charged with the responsibility.

O’Donovan, (2007) defines corporate governance as ‘an internal system encompassing policies, processes and people, which serves the needs of shareholders and other stakeholders, by directing and controlling management activities with good business savvy, objectivity and integrity. Sound corporate governance is reliant on ‘external marketplace commitment and legislation, plus a healthy board policies and processes’. O’Donovan goes on to say that ‘the perceived quality of a company’s corporate governance can influence its share price as well as the cost of raising capital. Quality is determined by the financial markets, legislation and other external market forces plus the international organizational environment; how policies and processes are implemented and how people are led. External forces are, to a large extent, outside the circle of control of any board. The internal environment is quite a different matter, and offers companies the opportunity to differentiate from competitors through their board culture. To date, too much of corporate governance debate has centered on legislative policy, to deter fraudulent activities and transparency policy which misleads executives to treat the symptoms and not the cause.

It is a system of structuring, operating and controlling a company with a view to achieve long term strategic goals to satisfy shareholders, employees, customers and suppliers, and complying with the legal and regulatory requirements, apart from meeting environmental aid local community needs.

Report of SEBI committee (India) on Corporate Governance defines corporate governance as the acceptance by management of the inalienable rights of shareholders as the true owners of the corporation and of their own role as trustees on behalf of the shareholders. It is about commitment to values, about ethical business conduct and about making a distinction between personal & corporate funds in the management of a company." The definition is drawn from the Gandhian principle of trusteeship and the Directive Principles of the Indian Constitution. Corporate Governance is viewed as ethics and a moral duty.

The triple bottomline reporting introduced by Elkington (1997) and adopted by the kings report Iodsa, (2002, 2009) requires modern corporations to disclose their economic, social and environmental performances for better decision making. The social responsibility investment index adopted by South Africa to integrate social responsibility and environmental sustainability issues into their corporate strategic plans and to adapt sound business practice (Naidoo, 2002; Wixly and Everinghan, 2005; Tailor, 2000;Roc, 2003).

Brown et al, in 2004 argued that the firms which practice the corporate governance more profitable and prosperous. Not only they earned more profit but also these firms pay more to their shareholders.

For comparison between developed and developing nations, Rashid 2008, posited that corporate governance play equally and balanced role in enhancing the performance of the firms in both developed and developing nations.

It is widely acclaimed that good corporate governance enhances corporate performance Brickely et al, 1994; Brickley and James, 1987; Byrd and Hickman, 1992; Chung et al, 2003; Brickley et al, 2000; Lee at al, 1992; Rosenstein and Wyatt, 1990; Weisbach, 1988.

IV. CORPORATE GOVERNANCE MEASURES IN NIGERIA

Over the years, Nigeria as a nation has suffered a lot of decadence in various aspect of her national life, especially during the prolonged period of military dictatorship under various heads. The political and business climate had become so fouled that most developed countries and any serious foreign investors will not want to do business with us.

The new democratic government of president obasanjo in 1999 inherited a pariah state, majorly because of the high level of corruption in the environment.

Corporate governance institutions must put in place strong internal control mechanisms to provide checks and balance against the oversight responsibility of the boards. Almost all reported cases of corporate failures indicate some level failure on the part of directors to properly discharge their oversight functions and ensure that receive all relevant information and demonstrate good faith (Ahmed, 2007). The internalization of effective mechanisms in the running of corporate organizations would encourage accountability and transparency and also discourage concealment of financial statements. Such internal mechanisms would help establish the concept of insider whistles in form of honest staff of the companies to speak out on questionable practices without repercussions.

Most public corporations such as NITEL, NSL, NEPA and NRC were either dead or simply drain pipes of public resources, while the few factories that were merely available were working below 50% of their installed capacity. The banks with their super profits were failing in their numbers, leaving a tail of woes for investors, shareholders, suppliers, depositors, employees and other stakeholders, hence the need for the government's far reaching decisions in introducing various corporate governance reforms.

V. INTERNAL COMPLIANCE AND CONTROL ISSUES

Internal compliance and controls are the nuts and bolts which keep the organization firmly I check. it ensures that structures, policies and procedures are established and complied with. Internal controls also ensure that laws and rules are adhered to by the company. When an effective internal control system is not in place, a company is bound to run into crisis which could threaten its existence. In some cases, decisions and actions revolve solely around the chief executive which does not make for good governance.

Many times, board of directors of companies when invited to all parties meetings have appeared to be quite at "sea" with happening in the companies, their responsibilities and indeed their liabilities. For good internal controls, entities must have structures designed by the boards, implemented by management and understood be the staff. There must be an internal control unit staffed with qualified personal with full mandate to ensure that internal controls are adhered to. The controls should also aim at ensuring that financial statements are reliable through the maintenance of proper and accurate records. Audit committees are also set up to ensure that internal controls are working effectively. Unfortunately some audit committee have not lived up to their responsibilities. To play their role effectively, it is important that those elected as audit committee have knowledge of internal control and accounting.

VI. ENHANCING CORPORATE GOVERNANCE IN THE BANKING SECTOR

Given the important financial intermediation role of banks in an economy, their high degree of potential difficulties arising from ineffective corporate governance and the need to safeguard depositors fund; corporate governance for the banking organization is of great importance to the local and international financial system. The Basel Committee on banking supervision published guidance to banking supervision in promoting the adoption of sound corporate governance practices and banking organization in their countries in 1999. This guidance drew from the principles of corporate governance that were published that year by the Organization for Economic Co-operation and Development (OECD) with the purpose of assisting government in their efforts to evaluate and improve their framework market regulator and participants in financial markets.

VII. CORPORATE GOVERNANCE AND RISK MANAGEMENT ISSUES

An important governance issue which become quite glaring in recent times is risk management of companies. It is obvious that many entities placed little attention on risk identification and management. Regulators are beginning to give attention to these requiring regulated entities in particular to put mechanism in place to identify and mitigate risks and disclose same in periodic fillings to regulators and in annual report. Indeed the disclosure of risk in annual reports as an important corporate governance is becoming a best practice. Indeed in the recently exposed drafts rules of the SEC, all public quoted companies including Banks shall:

- Include risk management as part of its accounting policies, disclose by way of notes any materials effect of unmitigated risk on corporate profitability.
- Disclose by way of notes strategies for preventing risks the company is exposed to.

The justification is that managing risk is part of any organizational strategy and operational activities. It is therefore important to report to the investing public the types of risk companies are exposed to, the effort to minimize it and where it becomes inevitable, the
effect or likely effect should be promptly made known to the investing public.
The board also needs to understand the risk which their companies are exposed to and frankly should periodically request management for briefing on this. Developing expertise in risk management should be a priority for entities and the capital market as a whole.

VIII. CONCLUSIVE REMARKS AND RECOMMENDATION

There is no doubt that, although corporate governance and corporate sustainability are relatively new areas in management science, several studies have been conducted in this area (and is still on-going) most especially on listed companies and multinationals. I suggest that future studies should strive to increase the sample size by including the small and medium sized enterprises, or at least privately owned large enterprises, because of their large population and dominance of the economics of most developing nations.

IX. RECOMMENDATIONS

After a detailed study and analysis has been carried out in investigation of the impact of corporate governance on the survival and sustainability of banks in Nigeira, the following recommendations are made:

i. There should be compliance of members of staff with laid down internal controls and operation procedures.
ii. There should be upgraded internal control system in banks.
iii. Shareholders should be more active in the affairs of banks.
iv. Board of directors of banks should be very active.
v. Procedures should be put in place to prevent, detect and correct fraudulent and self serving practices among members of the board and staff.
vi. Non- compliance with rules, laws and regulations guiding banking business should not be ignored.
vii. An effective management information system should be employed.

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A review of qualitative inspection aspects of end fittings in an Indian pressurized heavy water reactor

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Abstract:-The paper provides a summarized description of the current state of knowledge and practices used in India, in the qualitative inspection of end fittings – a key component of the fuel channel assembly of a pressurized heavy water reactor (PHWR), generally of a Canadian Deuterium Uranium (CANDU) type. Further it discusses various quality inspection techniques; and the high standards and mechanical precision of the job required, to be accepted as viable nuclear reactor component. The techniques, instruments and specific data for such components mentioned here are synthesized results from primary research and knowledge available in this area, in order to produce coherent argument focused on quality control of end fittings.

Keywords:-*CANDU, end fitting, fuel channel assembly, nuclear reactor component safety, PHWR, quality control.*

I. INTRODUCTION

Pressurized heavy water reactor (PHWR), Canada Deuterium Uranium (CANDU) specifically, is one of the key types of nuclear reactors used in India. The basic working of it includes use of pressurized heavy water as coolant as well as moderator. Natural Uranium-235 is used as fuel pallets to produce electricity via steam turbines and heat exchangers. In India, currently there are 16 such CANDU reactors and 6 more are planned or under construction. The electrical power produced ranges from 100 MW to 700 MW depending upon the model of reactor.

Vast facets of interdisciplinary engineering areas are utilized in the design and construction process of such a PHWR reactor components – Quality inspection methods being one of the most important areas. Such methods play an important role to ensure that parts of nuclear reactor core are manufactured to the strictest and most precise standards. The following section gives an overview of main components of CANDU reactor core.

1.1 CANDU PHWR: Core components and importance of end fittings

The CANDU reactor core has a number of mechanical components, assembled together to form a complex fuel transport system. The key characteristic of this core are its pressure tubes, which contain fuel bundles located in a cylindrical, low pressure moderator tank or 'calandria'. The major components, as shown in Fig. 1, namely pressure tube, liner tube, end fitting, calandria, garter spring spacers, rolled joints, feeder pipe and fuel bundle, along with many other accessories, comprise the fuel channel assembly. Heavy water is used for moderation. In our case, natural Uranium is used as fissile fuel, so such reactors are heavy water cooled. The fuel channel assembly of CANDU nuclear reactor supports the fuel bundles of the reactor core. So they are essentially part of primary heat transport system. Heavy water coolant and moderator flows reversibly through these channels and over fuel bundle, to remove the heat generated by nuclear fission reactions. These activities call for mechanical components, precisely inspected and tested, to meet such pressure, temperature, wear and radiation containment characteristics.

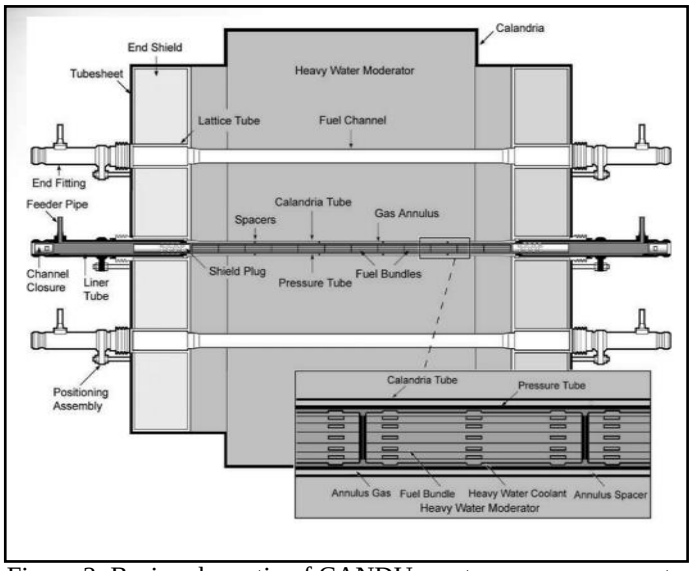

Figure 2: Basic schematic of CANDU reactor core components

The 'end fitting' is one of such critical mechanical components (Since it may have direct contact with fuel, it is classified as class-1 component). End fittings are located at each end of the fuel channel and is connected to the pressure tube by means of a highly precise zero clearance rolled joint. Its inner end is connected to the calandria tube. (Detailed schematic can be seen in Fig. 2). They also contain critical sealing surfaces to curb leakage. Generally there are about 380 fuel channels in a reactor core, hence the number of end fittings are 760. These are the parts visible on the outer wall of reactor core. Half of the fitting is inside the concrete shielded wall of the reactor and half of it is kept outside. End fittings are made of balanced material properties. Ideally they are made of Stainless Steel (SS403L) with 12% Chromium and 0.1% Carbon. The raw material (Drop forged cylindrical hollow billets) are then heat treated, quenched and bored to make them stress free. A number of precision manufacturing operations then lead to a finished job with intricate contours, ready for final quality inspection. Several qualitative test are also run intermediately during the manufacturing process.

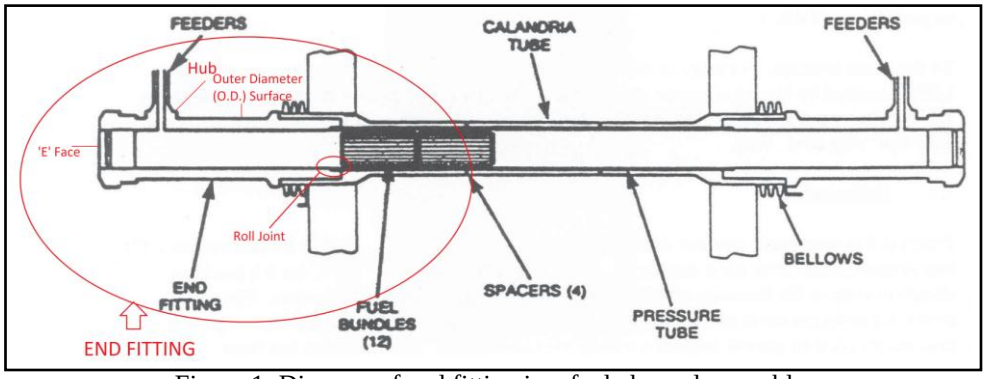

Figure 1: Diagram of end fitting in a fuel channel assembly

Primary coolant flows into and out of the channel though end fitting side ports which are joined to feeder pipes by bolted joints, at high pressure and temperature ranges (~100 kg/cm^2 and ~300°C). The coolant tubes are made of Zirconium alloy with 2.5% of Niobium as a standard material. Another importance of end fitting is that during fuelling operation, outer ends of each fitting act as a primary input/output port. This allows fuelling machine to make a sealed connection and allows removal and insertion of fuel bundles when their nuclear life cycle expire. When not connected to the fuelling machine, end fittings are sealed by channel closure plugs. To ensure that the end fitting is compatible with rest of the assembly with impervious seals; that it effectively shields radiation flux; and withstand high pressure and temperature, a number of properties need to be met with Atomic Energy of Canada Limited (AECL) specifications. Internal faults are checked all along the length by 100% ultrasonic inspection technique. To avoid degrading and ill-safety implications in the reactor, due to manufacturing defects and faults, it is very critical to conduct a proper qualitative inspection of end fittings.

II. QUALITATIVE INSPECTION TECHNIQUES FOR END FITTINGS

A variety of qualitative inspection techniques are available for mechanical components like end fittings and similar jobs. The principal techniques used in India, are explained below with description, procedure, equipment used, specific acceptance criteria, importance and implications on failure of tests.

2.1 Ultrasonic testing

Ultrasonic testing (UT) is a non-destructive material testing technique, which uses ultrasonic oscillations for detecting the presence of inhomogeneity of density, discontinuities, internal defects or elasticity in materials. For instance if the forged raw billet of end fitting has a hole or a crack within it, UT manipulator allows the presence of such flaws to be detected and their position located, even though the flaw lies entirely within the forging and no portion of it extends out to the exterior surface. Pulse-Echo technique is used by contact method with use of straight as well as angular beams. High frequency vibrations are sent into the part to be inspected and time intervals of arrival of the direct and reflected vibrations at outer surface are recorded (Fig. 3-a). By examining peaks produced on the time versus amplitude graph on device, flaws can be detected. Since highest safety requirements are demanded for end fittings, the operator scans the job after ensuring that the scanning surface is free from dust, paint, loose scale and has a moderate surface finish. Then couplant, petroleum jelly or spindle oil is applied and scanning is done of: (1) 'E' face of end fitting by normal beam technique before trepanning operation and (2) On outer diameter (O.D.) by angle beam technique both longitudinally and circumferentially, before trepanning operation and after rough machining (Fig. 3-b). An example of UT equipment used for this purpose is GE USM 35, with a 10-20 mm probe and 2-4 MHz frequency. The angle during angle beam technique is 28° to 45°. The acceptance criteria here is that readings should not exceed the amplitude of the reference standard. For example, if the reference standard is set to 250 mm (diameter of job) and if the waves are reflected at an earlier time; it indicates intermediate flaws, making the sample unacceptable. The results of this test are 'non-reporting', expressed as accepted, satisfactory, further process required or rejected. The importance of UT is, it is the only method by which internal discontinuities, distortions, material porosity and metal fiber discontinuity of micron scale can be detected. Failure of this test and thus a defective component implicates that failure/fracture will occur from the point of inhomogeneity due to high pressure, high temperature moderator flow. Additionally, associated components won't fit in assembly as these defects may cause major changes in the coaxiality and symmetricity of end fitting.

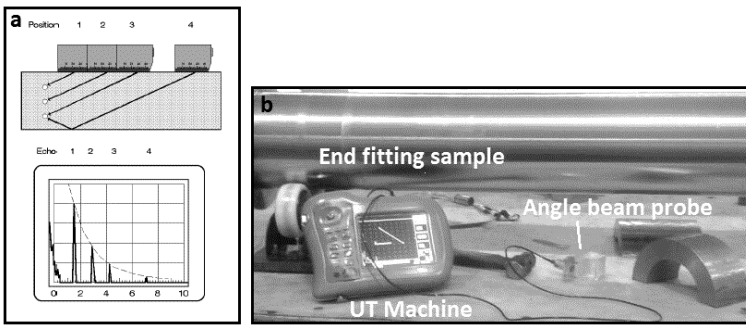

Figure 3: (a) UT Procedure and resultant echo response of flaws, (b) Angle beam UT technique setup for end fitting sample

2.2 Dimensional inspection (including inspection using profile projector)

After assuring UT testing, the end fittings pass through a series of strict dimensional quality control steps. During machining process, care has to be exercised so that numerous dimensions are maintained within close tolerances (ranging 10 µm to a maximum of 50 µm). It can be observed that the metrology instruments used for various dimensional inspections (Table I) are very precise and have lower least counts. Another inspection concerns the final material quality of end fittings (to check if they have good stress concentration balance), after they are heat treated. This test requires the hardness of steel to be between 255 to 350 BHN (Brinell harness), to be considered as acceptable. Some measurements, like the dimensions of rolled joint profile which are inaccessible, need to be measured using a special technique called mould inspection or profile projection. Here a mould replica of this profile is taken using silicon composite putty (with a very low deformation (5 µm) to maintain precision); and measured and compared with reference drawings on a horizontal profile projector (Fig. 4-a/4-b).

Table I: Dimensional inspection and instruments

Mechanical properties /parameters to be tested	Instruments	Comments
Symmetricity, Squareness, Parallelism	2D height gauge, Bearing V-blocks, Dial gauges	Instruments have least count of 0.001 mm (1 µm)
Absolute and relative concentricity		
Burnishing and surface roughness	Contact type surface roughness tester	Tester has a micro-sensitive probe/stylus with least count of 0.01 mm
Distance, Radius, Lengths	Vernier caliper, Ball type digital caliper, Radius gauge, Slip gauge	Least count varies from 1 µm to 10 µm
Chamfer, Angles	Bevel protector, Special gauges	Special templates are made from metal strips by precise laser cutting and calibrated by coordinate measuring machine (CMM)
Coating thickness, Wall thickness	Ultrasonic thickness machine	Special probe is used to measure coating thickness of hard chrome plating (HCP)
Outside diameter (O.D.), Inside diameter (I.D.), Ovality	3 point inside micrometer, Digital micrometer	Additionally snap gauges are used as special gauges to precisely measure ovality on O.D.
I.D. and O.D. grooves	Spline O.D. micrometer, Insider calipers	-

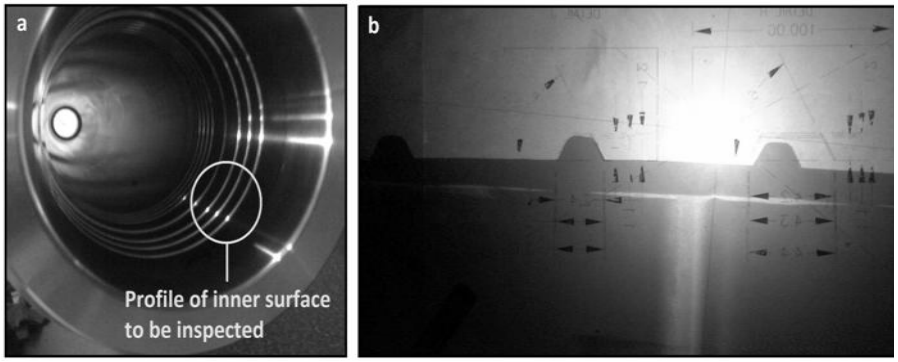

Figure 4: (a) Inner surface profile of rolled joint area to be inspected, (b) Profile projection / mould inspection of indicated groove profile

2.3 Hydrostatic testing

Hydrostatic tests are used for checking the strength and leakage of pressure vessels and pipelines. In our case, end fittings in a reactor are subjected to high pressure and high temperature moderator flow. Hence such a check is required. The finished machined end-fitting is put under a special facility for testing, filled with de-mineralized water (a nearly incompressible liquid) for 10 minutes. (Fig. 5). Initially uniform pressure of around 70 kg/cm^2 is applied and then gradually increased to high pressure (183 kg/cm^2) at controlled temperature between 80°C to 300°C. The test pressure is always kept considerably higher than the operating pressure to give a margin for safety, so as to simulate if a failure/leakage were to occur in reality. An examination for leaks is then done, usually indicated on calibrated pressure gauge connected to the hub or permanent changes in dimensions. Red or fluorescent dyes may be added to the water to make leaks easier to see. The acceptance criteria demands that there is absolutely no pressure drop and leakage from external surface. The importance of this method is that it allows us to simulate results similar to actual setup in a reactor. Implications of a quality failed component it would mean leakage of moderator induced with radioactivity.

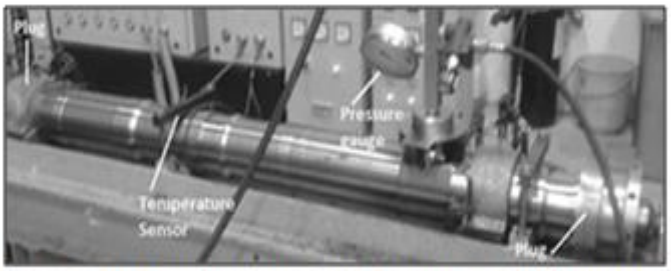

Figure 5: Hydrostatic testing setup for hollow cylindrical parts

2.4 Magnetic particle inspection

Magnetic particle Inspection (MPI) is a non-destructive testing process which detects surface and subsurface discontinuities, cracks in ferromagnetic materials (Stainless steel in our case). The technique involves use of magnetic fields and small magnetic particles (i.e. iron filings) to detect flaws in components. Here, wet magnetic particle inspection method is used, where suspension liquids like well refined light petroleum distillate or water containing additives (Wet fluorescent particles, typically 5 µm and smaller) are sprayed on the job. Petroleum-based liquids are highly recommended carriers because they provide good wetting of the metallic surfaces. Ultra violet (UV) light source is used to highlight these fluorescent particles. The initial procedure involves cleaning of the end fitting of oil and other contaminants; and mounting it on the MPI setup between two current coils by a copper rod (Fig. 6). Then a magnetizing pulse is applied for 0.5 seconds during which the operator washes the part with suspension fluid. Direct magnetization occurs when electric current ranging from 700 to 1500 A passes through the end fitting and a magnetic field is formed in it. When surface or subsurface discontinuity are present in the material, magnetic flux leaks and the particles build up a fluorescent indication at the area of leakage and acquire shape of the irregularity when UV light is applied. Demagnetization of job is crucial before unloading. End fitting is either accepted or rejected based on comparison with pre-defined classified reference standards. The importance of this method is that tight surface discontinuities, distortions, material pit marks and metal fiber discontinuities of micron scale can be detected. Advantages include high sensitivity and visual representation of flaws.

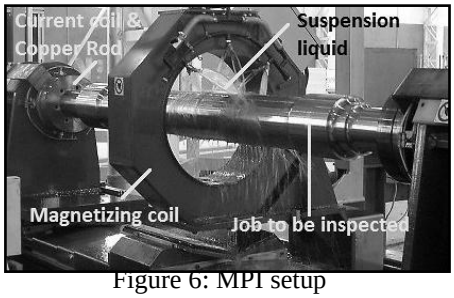

Figure 6: MPI setup

2.5 Borescopic and visual inspection

A borescope is an optical device which consists of a flexible tube with a display on one end, an objective lens and image or video capture device on the other, linked by optical fibers. Borescopes are used for visual inspection where the area to be inspected is inaccessible by other means (e.g. interior properties of end fittings). Such inspection is done with 1 out of every 15 jobs (sampling) and is one of the last qualitative inspections carried out on finished end fittings. Generally a video borescope with 3" LCD display (320x240 pixels or better) is used to inspect critical interior surfaces for imperfections, burrs, circumferential discontinuities, scratch marks, surface finish or through holes. Also, internal burrs at the edges of rolled joint and discontinuity in bore are particularly checked. Assurance of these details ensures smooth flow of coolant, as well as proper interlocking of pressure tube during assembly.

III. CONCLUSION

The paper introduces end fittings in a CANDU PHWR nuclear reactor core and signifies its importance. In conclusion, further it may be said that the design and manufacturing of end fitting of PHWR must meet high standards of qualitative inspection criteria for class-1 components; and thus having met so, can be used safely in the fuel channel assembly of the reactor core. Major qualitative inspection techniques are

reviewed with procedures, implications and acceptance or rejection criterions. Strict quality control protocols are implemented at intermediate as well as final stages of manufacturing of end fittings. When such a quality assured component is subjected to reactor conditions, a fail-proof working should be obtained as far as end fitting quality is concerned. Future directions may include automation of measuring, testing and gauging instruments and techniques, when used for quality control and engineering metrology of such customized reactor components in mass quantities.

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Implementation Of Least Mean Square Algorithm For Speech Enhancement Using Fpga

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Abstract: - The aim of this paper is to investigate the speech signal enhancement using Adaptive filters. Background noise elimination is very important in many applications like hearing aids, forensic applications, military, cellular environments etc. The adaptive filters has advantages like low processing delay and better tracking of the trajectory of non- stationary signals. If the evaluation of background noise is more slowly than the speech, i.e., noise signal is more stationary than the speech signal, we can easily estimate the noise during the pauses in speech. Any other way it is more difficult to estimate the noise which results in degradation of speech. In order to enhance the quality and intelligibility of speech, here we proposed a design based on LMS algorithm to remove noise from speech signal using VHDL based on commercially available FPGAs. In this design the LMS algorithm used as a noise canceller and the reference signal was adaptively filtered and subtracted from primary signal to obtain the estimated speech signal.

Keywords: - *LMS, Noise canceller, FPGA, VHDL and Speech Enhancement.*

I. INTRODUCTION

To model the relationship between two signals in real time in an iterative manner, An Adaptive filter is used which is a computational device. Adaptive filters are often realized either as a set of program instructions running on an arithmetical processing device such as a DSP chip or as set of logic operations implemented in a field programmable gate array (FPGA) or in a custom VLSI integrated circuits.

Adaptive filters, as a part of digital signal system, have been widely used in communication industry, as well as one of the applications such as adaptive noise cancellation.

However, implementation of adaptive filter takes a great deal and becomes a very important role in digital system design. Adaptive filters are usually implemented in DSP processor because they are capable of performing fast floating-point arithmetic operations. But now a day in signal processing, FPGA becomes an important competitor by providing a lot of facilities to designers in the market. In addition, FPGA is a form of programmable logic that can offer flexibility for repetitive reconfiguration. Because of slices organized as array of rows and columns in FPGA, a great deal of parallelism can be explored.

Although it is not efficient to use floating-point arithmetic in FPGA due to its need for an enormous area, it is sufficient to use fixed-point arithmetic for the adaptive filter to work well. The algorithm used to update the filter coefficient is the Least Mean Square (LMS) algorithm which is known for its simplification, low computational complication, and better performance in different running environments. In terms of the number of iterations required for convergence, LMS algorithm is seen to perform very well when compared to other algorithms used for implementing adaptive filters.

II. SPEECH ENHANCEMENT

Speech enhancement is concerned with improving some perceptual aspect of speech that has been degraded by additive noise. In most applications the aim of speech enhancement is to improve the quality and intelligibility of degraded speech. The improvement in quality is highly desirable as it can listener fatigue particularly in situations where the listener is exposed to high levels of noise for long period of time. The need to enhance speech signals arises in many situations in which the speech signal originates from a noise location or is affected by noise location or is affected by noise over a communication channel.

Speech enhancement algorithms can therefore be used to improve the quality of speech at the receiving end. The solution to the general problem of speech enhancement depends largely on the application at hand, the characteristics of noise source or interference, the relationship of the noise to the clean signal.

Critical to the design of speech enhancement algorithms is knowledge of the range of speech and noise intensity levels in real-world scenarios. From that we estimate the range of signal-to-noise ratio [SNR] levels encountered in realistic environment. This is important since speech enhancement algorithms need to be effective in suppressing the noise and improving speech quality within that range of SNR level.

III. ADAPTIVE FILTERS

Adaptive filters learn the statistics of their operating environment and continually adjust their parameters accordingly. This phase presents the theory of the algorithms needed to train the filters. In practice, signals of interest often become contaminated by noise or other signals occupying the same band of frequency. When the signal of interest and the noise reside in separate frequency bands, traditional linear filters are able to extract the desired signal . However, when there is spectral overlap between the signal and noise, or the signal or interfering signal's statistical data change with time, fixed coefficient filters are inappropriate.

The goal of any filter is to extract useful information from noisy data. Whereas a normal fixed filter is designed in advance with knowledge of the statistics of both the signal and the unwanted noise, the adaptive filter regularly adjusts to a changing environment through the use of recursive algorithms. This is useful when either the statistics of the signals are not known beforehand of change with time.

The adaptive filter has advantages like lower processing delay and better tracking of the trajectory of non-stationary signals [2]. These are essential characteristics in applications such as noise estimation, echo cancellation, adaptive delay estimation and channel equalization, where low delay and fast racking of time-varying environments and time-varying processes are important objectives. The existence of a reference signal which is hidden in the fixed-filter approximation step, defines the performance norm. The general adaptive-filter structure is shown in Fig1.

The LMS algorithm aims to minimize a cost function, $V(w(n))$, at each time step n, by a suitable choice of the weight vector $w(n)$. The strategy is to update the parameter estimate proportional to the instantaneous gradient value, $dV(w(n))/dw(n)$, so that:

$$w(n+1) = w(n) - \mu\, dV(w(n))/dw(n) \qquad (2)$$

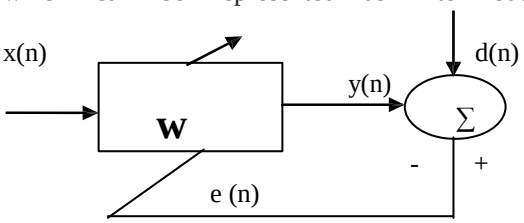
where μ is a small positive step size and the minus sign ensures that the parameter estimates descend the error surface. The cost function, $V(w(n))$, which minimizes the mean-square error, results in the following recursive parameter update equation

$w(n+1) = w(n) - \mu x(n)\,(y(n) - y_{est}(n))$ (3) The recursive relation for updating the tap weight Equation

(1) may be rewritten as

$$w(n+1) = w(n) - \mu x(n)(y(n) - xT(n)w(n)) \qquad (4)$$

which can be represented as filter output , estimation error and tap weight adaptation .



$$y_{est}(n) = wT(n)x(n) \qquad (5)$$

$$e(n) = y(n) - y_{est}(n) \qquad (6)$$

$$w(n+1) = w(n) + \mu x(n)e(n) \qquad (7)$$

Fig 1. Basic block diagram of Adaptive filter

The LMS algorithm requires only 2N + 1 multiplications and 2N additions per iteration for an N tap weight vector. Therefore it has a relatively simple structure and the

The basic configuration of an adaptive filter, operating in the discrete-time domain k, is illustrated in Figure 1. In such a scheme, the input signal is denoted by x(n), the reference signal d(n) represents the desired output signal (that usually includes some noise component), y(n) is the output of the adaptive filter, and the error signal is defined as

$e(n) = d(n) - y(n)$ (1) The error signal is used by the adaptation algorithm to update the adaptive filter coefficient vector w(n) according to some performance criterion. In general, the whole adaptation process aims at minimizing some metric of the error signal, forcing the adaptive filter output signal to approximate the reference signal in a statistical sense.

IV. LMS ALGORITHM

The LMS algorithm is a stochastic gradient algorithm, which uses a fixed step-size parameter to control the updates to the tap weights of a transversal filter, (Widrow and Hoff 1960). The algorithm aims to minimize the mean-square error, the error being the difference in $y(n)$ and $y_{est}(n)$. The dependence of the mean-square error on the unknown tap weights may be viewed as a multidimensional paraboloid referred to as the error surface .The surface has a uniquely defined minimum point defining the tap weights for the optimum Wiener solution. However, in the non-stationary environment this error surface is continuously changing, thus the LMS algorithm needs to be able to track the bottom of the surface. hardware is directly proportional to the number of weights.

The LMS algorithm is by far the most widely used algorithm in adaptive filtering for many reasons. The main features that attracted the use of the LMS algorithm are low computational complication, proof of convergence in static environment, unbiased convergence in the mean to the Wiener solution, and stable behaviour when implemented with finite-precision arithmetic. The convergence analysis of the LMS presented here utilizes the independence assumption.

V. FPGA IMPLEMENTATION

FPGA Implementation of an Adaptive Filter architecture using LMS algorithm. Adaptive filter is commonly used for a wide range of applications such as Echo cancellation, Prediction, Noise cancellation, Adaptive interference cancelling, system identification, Digital communication Receiver, Radar signal processing, Equalizations of communication channels, Biomedical signal enhancements, Navigational systems, Adaptive antenna systems beam forming etc..

In this paper, adaptive filter architecture implemented mainly application for noise cancellation. In the noise cancellation the architecture is taken in both sequential as well as parallel. For implementing Adaptive filter architecture, LMS algorithm is used because of low computational complexity, simplicity and gives its better performance in different running environments.

In all adaptive filter architecture try to minimize error i.e. minimization of different between the desired output and the real one for all the input vectors. Nowadays, the use of Field programmable gate arrays (FPGAs) is growing. Field programmable gate arrays (FPGAs) are widely used in many areas such as audio and video, Digital signal processing, Image signal Processing, Digital communication systems, mobile communication system and many other embedded applications, because of their high performance, parallel processing ability and flexibility.

There are usually two ways to implement the LMS algorithm, hardware implementation and software implementation [6], [7]. The hardware implementation of the algorithm in an FPGA has good real-time ability, but requires large resources.

VI. HARDWARE IMPLEMENTATION

In this work, the ANC is implemented in the Xilinx virtex-5 kit (Genesys) board. The Genesys circuit board is a complete, ready-to-use digital circuit development platform based on a Xilinx Virtex 5 LX50T. The large on-board collection of high-end peripherals, including Gbit Ethernet, HDMI Video, 64-bit DDR2 memory array, and audio and USB ports make the Genesys board an ideal host for complete digital systems, including embedded processor designs based on Xilinx's MicroBlaze. Genesys is compatible with all Xilinx CAD tools, including ChipScope, EDK, and the free WebPack[9].

The Virtex5-LX50T is optimized for high performance logic and offers: 7,200 slices, each containing four 6-input LUTs and eight flip-flops,1.7Mbits of fast block RAM, 12 digital clock managers, six phase-locked loops, 48 DSP slices and 500MHz+ clock speeds.

A. Simulation Results

A review of adaptive filters shows that the LMS algorithm is still a popular choice for its stable performance and high speed capability. The other advantage of the LMS over other adaptive algorithm is its high convergence rate. The high- speed capability and register rich architecture of the FPGA is ideal for implementing LMS. The proposed model is loaded
on XILINX FPGA board. It is implemented on virtex-5 LX50T. After synthesizing in Xilinx project navigator we got RTL schematic diagram of our proposed design which is shown in Figure4.

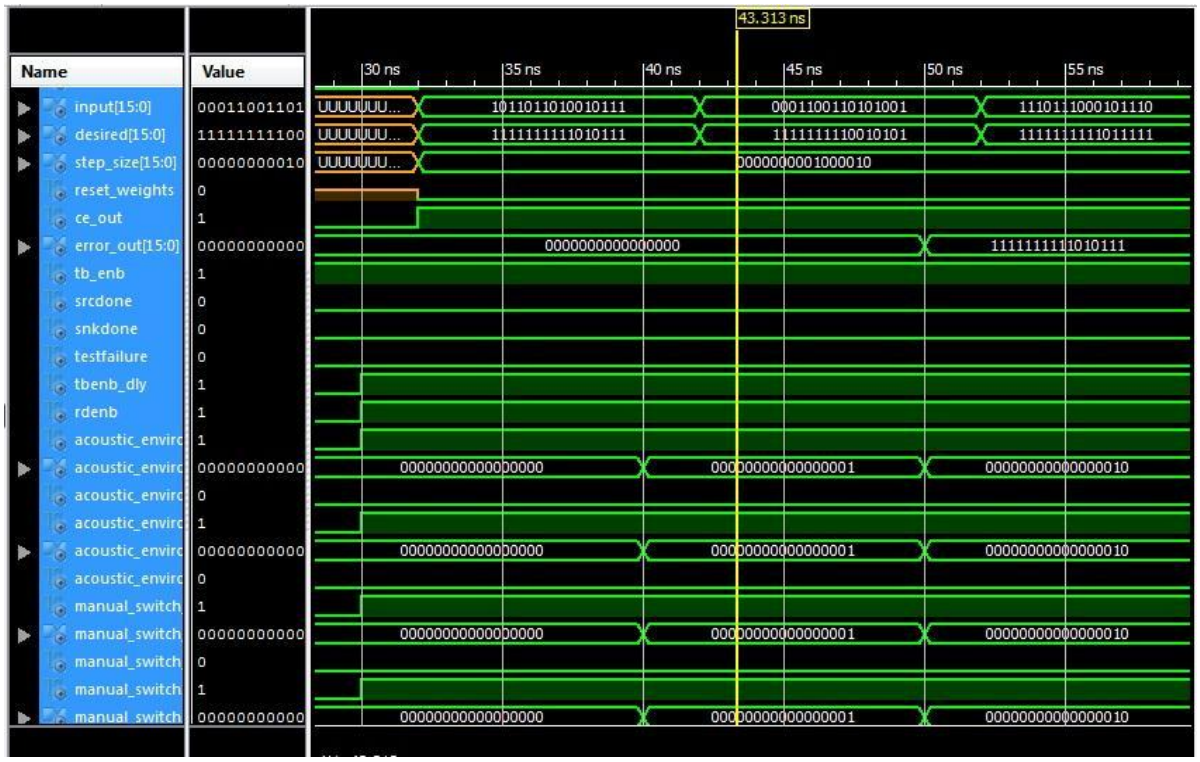


Fig 2. Xilinx ISE Simulation Results

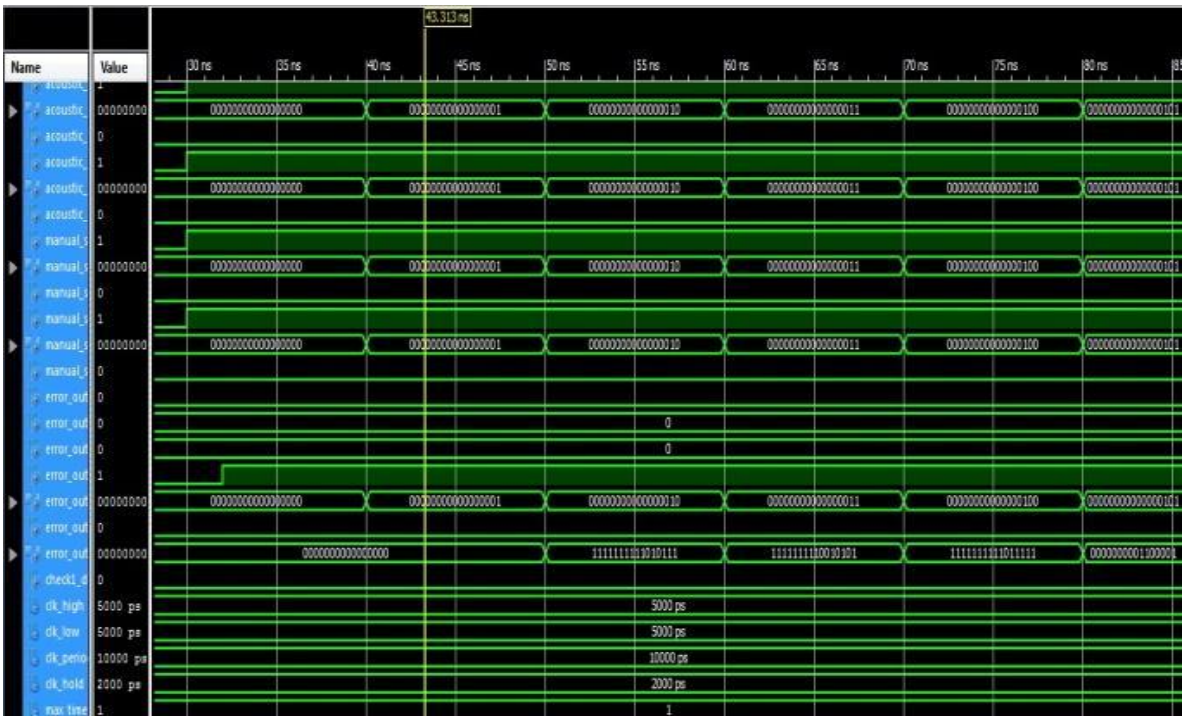


Fig 3. Simulation Wave Forms

The Xilinx ISE 13.4 software package is used in this project to implement the VHDL program. The system can be simulated to observe and verify its behaviour and the results were showed in fig. 2 and fig. 3. The design is used for the implementation on the FPGA chip.

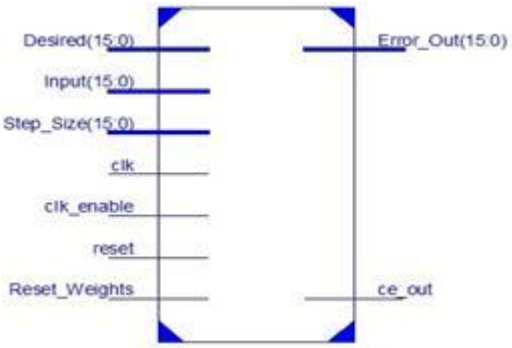


Fig 4. RTL schematic of LMS Filter

B. Chipscope Results

ChipScope provides you with a convenient software based interface for controlling the integrated logic analyzer, including setting in the triggering options and viewing the waveforms. Time required for simulating complex design for all possible test cases becomes prohibitively large and simulation approach fails. For rapid testing, such designs can be loaded on to the target FPGAs and tested by applying test inputs and directly observing their outputs[13].

The ChipScope Pro tools integrate key logic analyzer and other test and measurement hardware components with the target design inside the FPGA. Computer based software tool communicate with these hardware components and provide a designer robust logic analyzer solution. Waveforms are showed in Fig. 5.

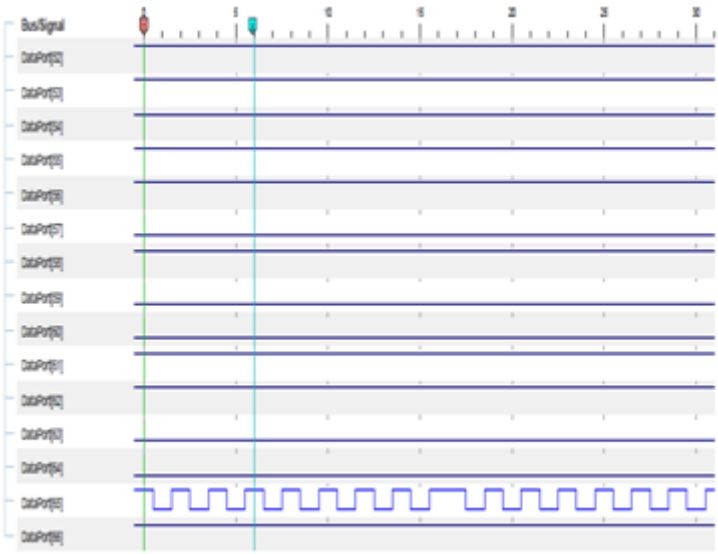


Fig 5.Chipscope waveform

C. Timing Summary

1. Speed Grade : -2
2. Minimum period : 23.452ns
(Maximum Frequency: 42.641MHz)
3. Minimum input arrival time before clock : 15.361ns
4. Maximum output required time after clock : 2.826ns
5. Maximum combinational path delay : 3.237ns

VII. CONCLUSION

Based on LMS algorithm an adaptive equalizer is designed and implemented using hardware description language VHDL. The design is simulated on Xilinx ISE 13.4 and a satisfactory result is obtained.

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Effects of Native Cassava Starch and Compatibilizer on Biodegradable and Tensile Properties of Polypropylene

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Abstract: **-** The effects of starch content and polypropylene-graft-maleic anhydride (PP-g-MA) as a compatibilizer on the properties of indigenous cassava starch filled polypropylene blends have been investigated. The blends were prepared by the addition of cassava starch of particle size 0.075 mm to polypropylene matrix using an injection machine with a screw speed of 50 rpm and at a temperature range of 160 - 190°C. Starch contents ranged between 0 and 50 wt. % and PP-g-MA was 10 wt. % based on starch content. Tensile, water absorption, weight loss and morphological properties were studied. Tensile strength and elongation at break decreased, while Young's modulus, water absorption and weight loss percent increased with increasing starch content. However, on addition of PP-g-MA, these properties were improved due to enhanced interfacial adhesion between the starch and the matrix though tensile strength and elongation at break were still lower than the neat PP. The morphological studies of fractured surfaces using SEM corroborated the deterioration in the properties.

Keywords: *- Cassava starch, polypropylene, PP-g-MA, tensile properties, water absorption, weight loss, SEM.*

I. INTRODUCTION

The advent of biodegradable polymers can be considered a best approach to solving the menace of municipal solid wastes in our environment. As a result, a great number of biodegradable polymers have been synthesized and microorganisms and enzymes capable of degrading them have also been identified [1]. In Nigeria and other developing countries, environmental degradation and pollution by synthetic polymers have assumed alarming proportions. Attempts therefore have been made to solve these problems through structural modifications of the synthetic polymers to enhance their biodegradability.

The combination of synthetic polymers such as polyethylene, polystyrene, polypropylene and natural additives like cellulose, starch, and chitin is an important way to improve biodegradability of polymers [2-5]. The bioplastics obtained offer great benefits over conventional materials - socially, economically and much more environmentally friendly. The fast pace of these bioplastics have endeared the chemical and plastics industries to invest heavily in this sector, and have high expectations of the new generations of bioplastics which are now competing favourably with the traditional petroleum-based plastics.

These bioplastics can be degraded into natural ecosystems such as active sludge, natural soil, lake and marine [6]. Accordingly, the biodegradability of polymers corresponds to the ability to be chemically transferred by the action o biological enzymes or microorganisms [7, 8]. Biodegradation for limited periods is a reasonable approach for the complete assimilation and disappearance of an article leaving no toxic or environmental harmful residue [1]. Biodegradable polymers have been found very useful in medical, agriculture, drug release and packaging applications.

Polypropylene is one of the most widely used plastics for packaging and production of bags and other consumer products. It has high melting point (160°C) with combination of properties such as strength, lightness, stability, flexibility, moisture and chemical resistance and ease of processability [9]. Polypropylene is also employed in the production of automotive interiors, fibres and non-absorbable sutures and in composites with other materials [10]. Starch is a natural polymer obtained from crops which include corn, rice, potatoes, cassava and wheat. Starch has been extensively used as a raw material in bioplastics production due to increasing prices and declining availability of conventional polymer resins.

Starch itself is difficult to process with poor dimension stability and inferior mechanical properties for its end products hence native starch is not used directly.

Starch therefore can either physically be mixed in with its native granules, kept intact or melted and blended on a molecular level with suitable polymer [1]. Bioplastic materials that are formed from starch-based blends may be injection molded, extruded, blown or compression molded.

The blend material composed of a mixture of synthetic polymer with natural biopolymer like starch is believed to obtain a plastic material with different properties [11]. The quantity of starch in the blend affects its properties. It has been observed that increasing the starch content is shown to worsen the mechanical and rheological properties and the processability of the blend [12-14]. As a way of improving the properties of the blend material, a compatibilizer, polypropylene-graft-maleic anhydride (PP-g-MA) containing groups capable of hydrogen bonding with starch hydroxyls is used. It forms suitable complexes with starch due to hydrogen bond formation between anhydride groups of the compatibilizer and hydroxyl groups of starch.

In this study, indigenous raw cassava starch was incorporated into polypropylene matrix in the presence of a compatibilizer as a means of enhancing the tensile and biodegradable properties of the blends formed. Tensile, water absorption and biodegradable properties were investigated as a function of starch content. Fractured surfaces of the blends were investigated by scanning electron microscope (SEM) providing the information for the evaluation of interfacial fibre/matrix adhesion.

II. EXPERIMENTAL

Materials

Polypropylene (PP) granules (Melt flow index: 70 g/10 min; melting temperature: 165°C) were obtained from CeePlast Industries Ltd, Aba, Abia State, Nigeria. Compatibilizer polypropylene-graft-maleic anhydride (PP-g-MA) was supplied by Sigma-Aldrich Chemicals Germany (melting point: 156°C; density: 0.934gcm^{-3}). Cassava tubers were purchased from local market in Ehime Mbano, Imo State, Nigeria. Cassava starch (CS) was extracted from the tubers according to the method used by integrated cassava project (ICP) of the Federal Ministry of Agriculture and Rural Development, Nigeria. It was sieved to a particle size of 0.075 mm.

Preparation of CS/PP Blends

Cassava Starch (CS) was dried to 1 – 2 % moisture content using an oven at 80°C for 24 h and then stored in sealed polyethylene bags to avoid moisture infiltration. Compounds of cassava starch (CS) or compatibilized cassava starch (CCS) and polypropylene (PP) were melt blending similar to polymer blending in an injection machine with a screw speed of 50rpm and at a temperature of 160 - 190°C to obtain CS/PP of CCS/PP blends. These blends with five different starch contents (10, 20, 30, 40 and 50 wt. %) were prepared for tensile properties and biodegradability whereas polypropylene-graft-maleic anhydride (PP-g-MA) at 10 wt. % based on the starch content was used as a compatibilizer. After injection molding, the sheets were conditioned for 24 h at 70°C and stored in desiccator prior to testing.

Water Absorption Test

Water uptake by the various blend samples were determined using cut samples of dimensions, 2 cm x 2 cm. Before the absorption test, cut samples were thoroughly washed, over-dried at 50°C for 12 h, cooled in desiccators, and immediately weighed to the nearest 0.001 g to obtain the sample initial weight (W_0). The conditioned samples were then immersed in distilled water at room temperature range 32 - 36°C. At predetermined intervals (10 days), samples were taken out from the water and weighed using determined balance to obtain the weight of the sample after immersion in water (W_1). Excess water on the surface of the samples was removed before weighing. The percentage (%) of water absorption by the samples was calculated as follows,

$$\% \text{ Water absorbed} = [(W_1-W_0)/W_0] \times 100 \quad \ldots\ldots (1)$$

Biodegradability Test

The biodegradability of the samples was carried out at ambient temperature under moisture-controlled conditions. Samples of known dimensions, 2 cm x 2 cm were placed in a perforated plastics boxes containing moisturized alluvial soil. The samples were buried 10 cm below the surface of soil which was regularly moistened with water. The samples were removed at predetermined time intervals (10 days), washed with distilled water, dried at room temperature to a constant weight and stirred in a desiccator until testing. The percent weight loss of the samples was determined as follows,

$$\text{Weight loss} = [(W_b - W_a)/W_b] \times 100 \quad \ldots\ldots (2)$$

Where W_b is the initial mass before degradation and W_a is the mass after degradation to the soil.

Tensile Properties

The tensile tests for the blends were conducted using universal tensile testing machine Instron 3366, according to ASTM D 638. The test on dumbbell shaped specimen of 3 mm thickness was performed at a cross-head shaped of 5mm/min at 23 ± 5°C. Five specimens were used to obtain the average values of the tensile properties.

Morphological test

The scanning electron microscopy (SEM) was used to evaluate the samples microstructure. The samples were first dried in an oven to remove air moisture and then sputter coated with a thin layer of gold to avoid electrical charging.

III. RESULTS AND DISCUSSION

Water Absorption Behavior

The waste absorption behavior is crucial for understanding the performance of natural filler based composites, since the moisture uptake under immersion in water or exposure to humidity intimately relates to such material properties like mechanical strength, dimensional stability, and appearance [15]. The water absorption of PP/cassava starch blends at different starch contents are presented in Figures 1 and 2. From the figures, it is evident that water uptake increased gradually with increase in starch content for both unmodified and modified starch/PP blends. The hydrophilic characteristic of Cassava starch was due to the presence of hydroxyl groups.

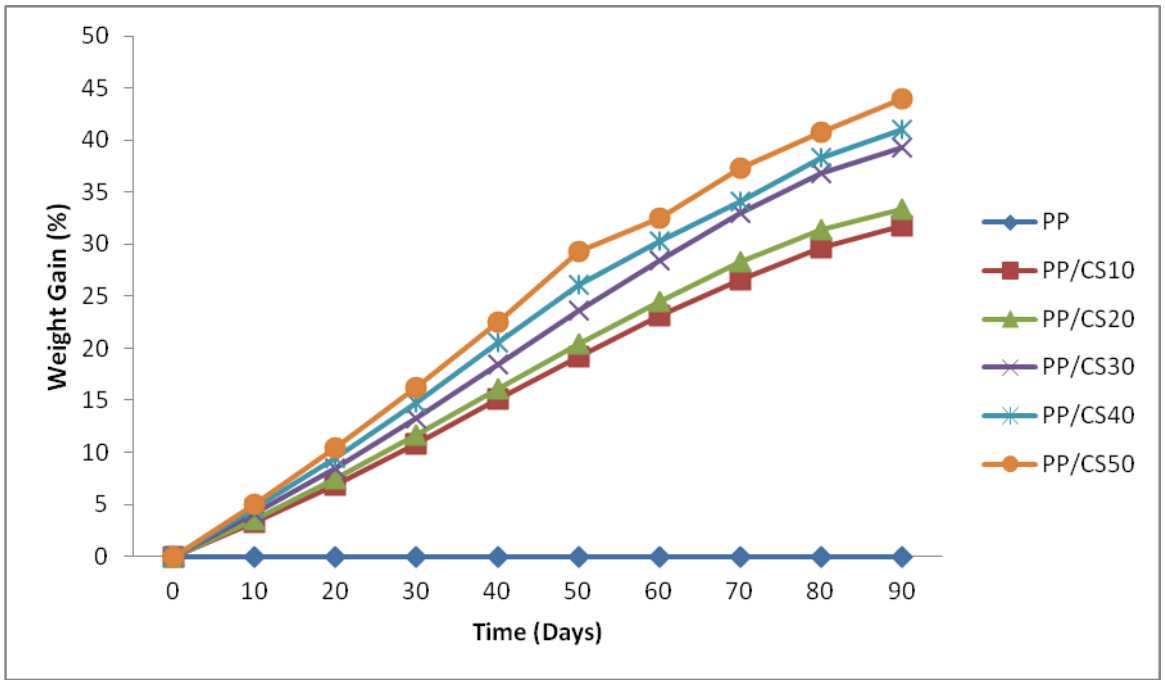


Fig. 1: Water absorption for PP/CS Blends

These hydroxyl groups increased with increasing starch content with the corresponding increase in water uptake. Again, the poor adhesion associated with high filler content may induce cracks and voids between the starch and matrix which increased penetration and high capillary action of water through the created interstice in the blend. Similar trends were observed by other researchers [16, 17]. The extent of water uptake however, decreased considerably on addition of compatibilizer to blends (Fig. 2). Compatibilized PP/starch blends showed considerable decrease in water uptake which corroborates a better adhesion between PP matrix and cassava starch. It is observed on comparison that at 70 days of immersion, % weight gain of CS was 3% greater than % weight gain of CCS at the end of 90 days test period. As reported by Bessadok et al. [18], modification of blend's constituents had resulted to blends with hydrophilic surfaces.

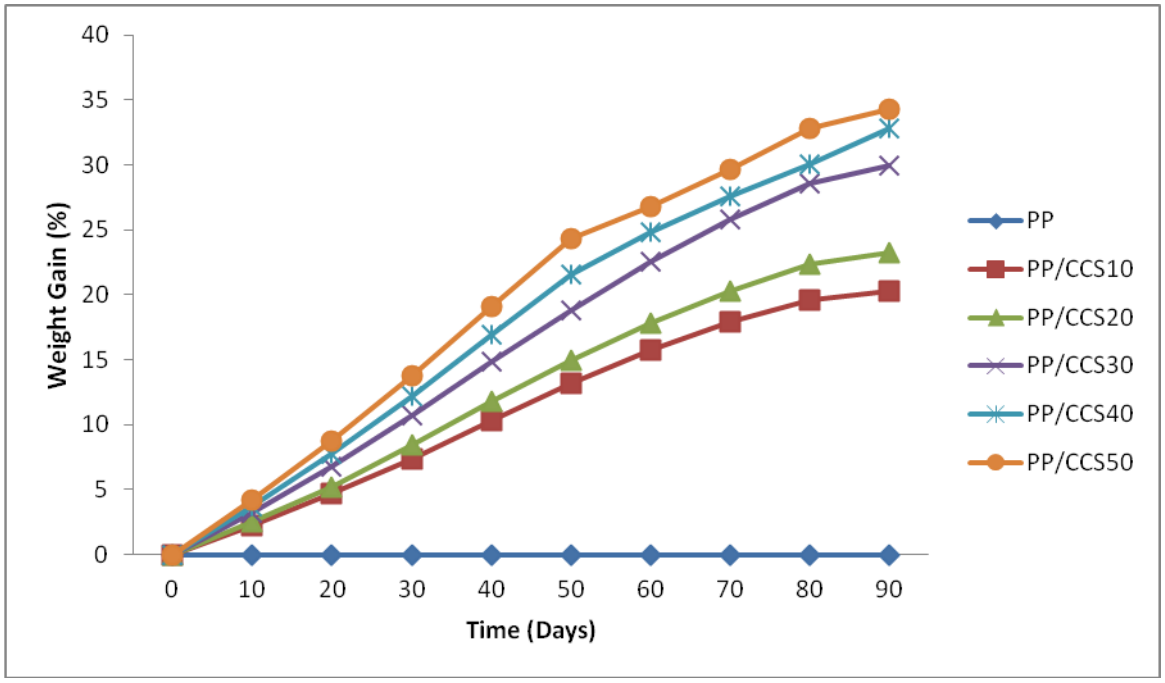


Fig. 2: Water absorption for PP/CCS Blends

Weight Loss

The biodegradation studies on composite behavior are of vital importance on the environmental application of biocomposites. Figures 3 and 4 represent weight loss of various blends as a function of starch content and biodegradation time for uncompatibilized and compatibilized blends.

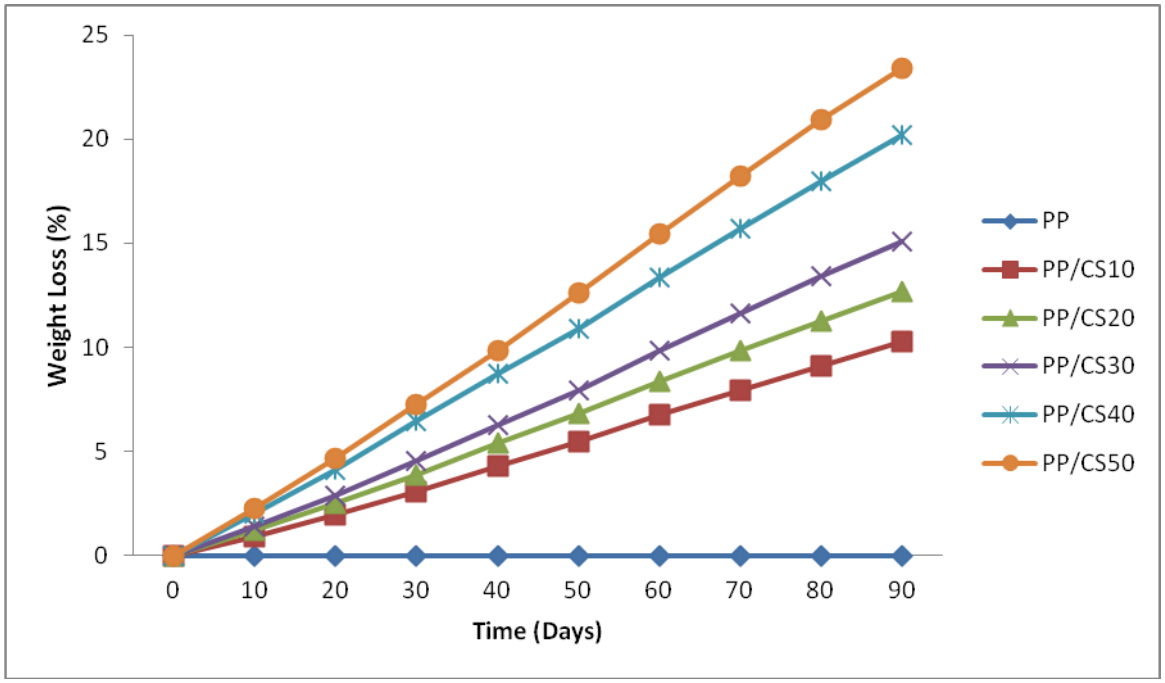


Fig. 3: Weight Loss for PP/CS Blends

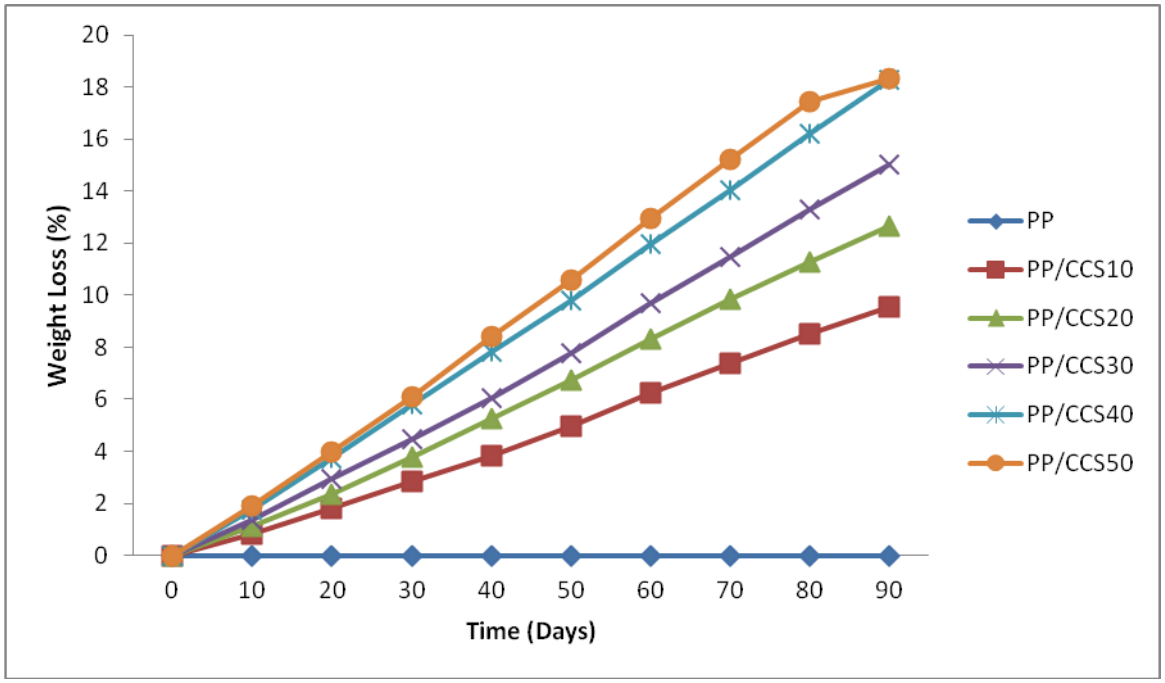


Fig. 4: Weight Loss for PP/CCS Blends

It can be seen that for both blends the weight loss percent increased with increase in starch content as well as burial time and continued as the burial time progressed. This may be attributed to the hydrolytic depolymerization of starch materials leading to monomeric units and possible blend deterioration caused by microorganisms [19, 20]. For both blends studied, weight reduction for 50 wt. % starch content after the first 10 days are 2.24 % and 1.92 % for PP/CS and PP/CCS respectively. The weight loss decreases gradually as the burial time progresses and after 90 days of study, the percent weight loss are 23 % and 18% accordingly. Again, it is noticed that after 70 days of study, the PP/CS blends had weight decrease of over 18 % which corresponds to the overall weight reduction percent for PP/CCS. The lower weight loss of PP/CCS may be linked to the improved interfacial bonding between PP matrix and starch and other similar factors leading to lower uptake.

Tensile Properties

Natural filler such as starch plays a vital function in defining mechanical properties of biofilled thermoplastic blends. A biodegradable polymer is expected to withstand normal stress encountered during its application [10]. The filler/matrix interfacial bonding is an essential factor that affects the mechanical properties of biopolymer blends.

Tensile tests were carried out to evaluate the tensile properties of both compatibilized and uncompatibilized PP/CS and PP/CS blends respectively. Figures 5 - 7 represent the effect of starch content on the tensile strength, elongation at break and Young's modulus of the blends. In the case of uncompatibilized PP/starch blends, adhesion between the two materials was expected to be lower than compatibilized PP/starch blends due to hydrophobic nature of PP and hydrophilic character of the starch to PP matrix showed a common phenomenal decrease in tensile strength (Fig.5) as shown by conventional biodegradable blends [10, 21, 22]. The decrease in tensile strength of the blends with increase in starch content was due to poor interfacial adhesion and low compatibility between the starch and PP [23]. The tensile strength of PP/CCS blends increased significantly than the PP/CS blends but however, lower than the neat PP. This is probably because of a better interfacial bonding that took place between the starch filler and the PP matrix after the addition of compatibilizer, PP-g-MA. This occurrence is further explained in the morphological sturdy. It was also noticed that on addition of 10 wt. % starch content to the PP matrix, the tensile strength dropped by 38 % and 28 % for uncompatibilized and compatibilized blends and was greater at 50 wt. % content given rise to 67 % and 59 % compared to the neat PP respectively. The polar nature of starch hindered its ability to develop strong bonding with non-polar PP. at high filler content, filler-filler interaction predominates over filler-matrix interaction leading to the agglomeration of starch filler within the PP matrix. This behavior indicated poor stress transfer due to inadequate wettability of starch filler by the matrix material [16, 24].

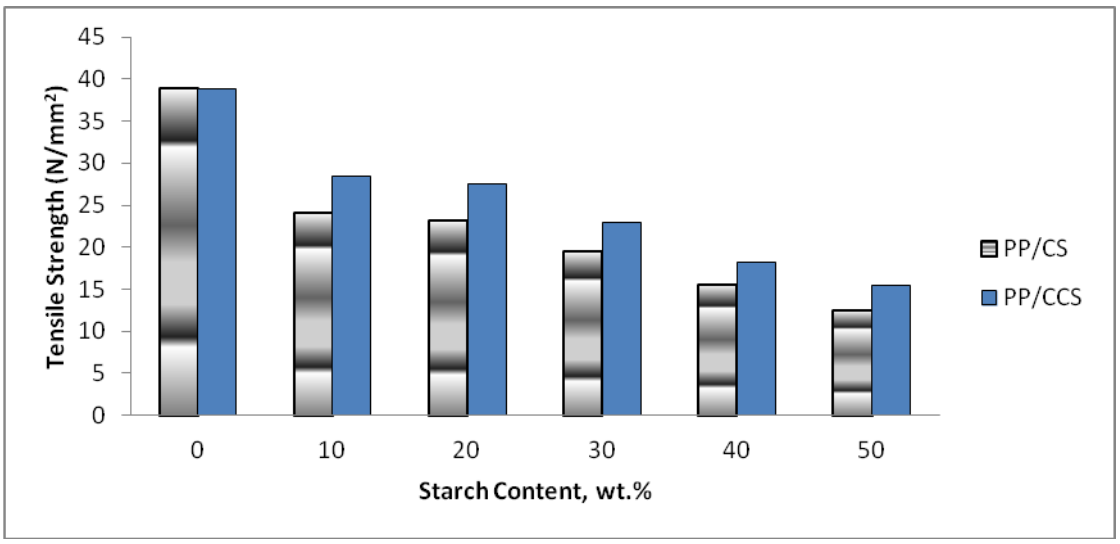


Fig. 5: Tensile Strength of PP/CS Blends

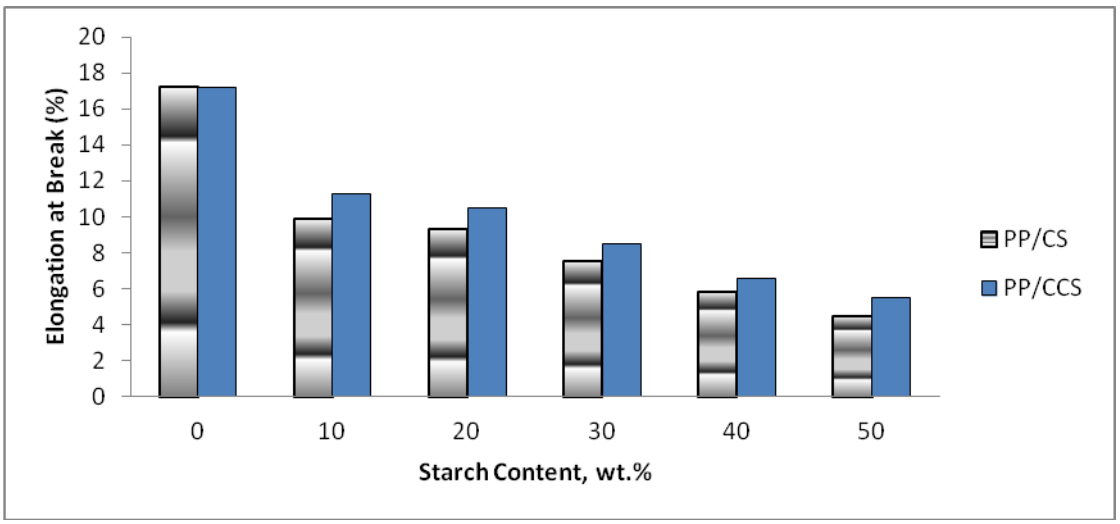


Fig. 6: Elongation at Break of PP/CS Blends

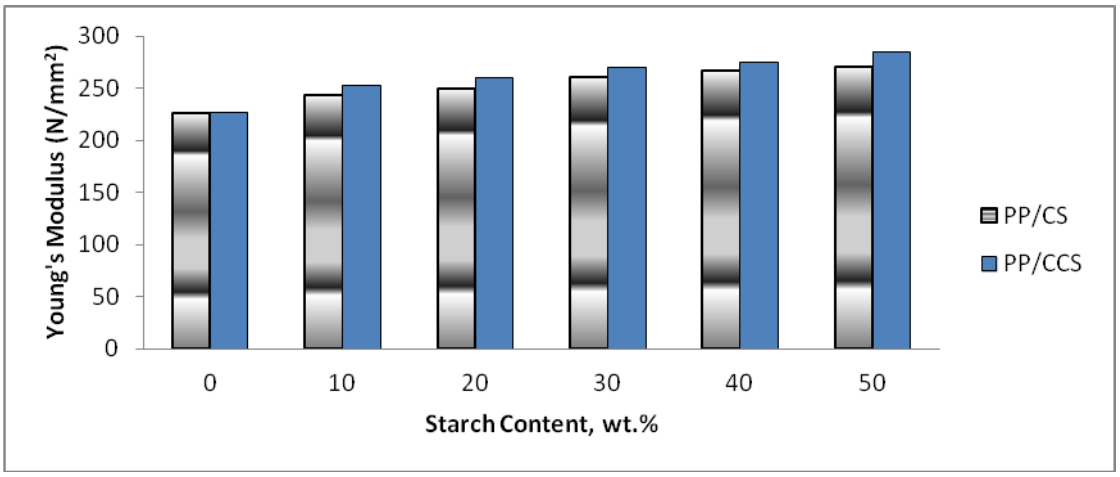


Fig. 7: Young's Modulus of PP/CS Blends

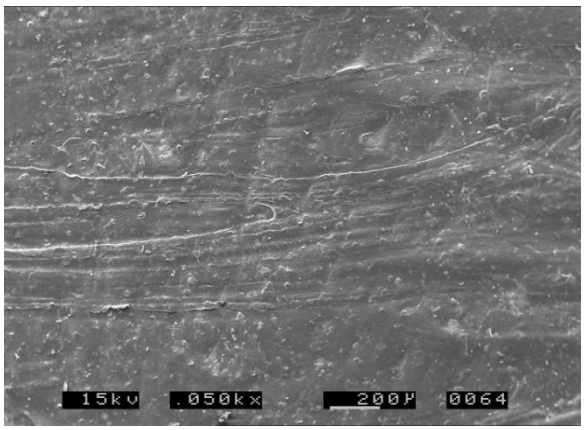
The effect of starch content on the elongation at break of PP/starch blends is presented in Fig.6. Elongation at break was observed to decrease on addition of 10 wt. % starch content and continued to decrease with increasing starch content. This may be attributed to the hydrophilic nature of the starch filler that may have

absorbed moisture and interfered with the adsorption effect by lowering the effect of physical bonding between the interfaces of PP/cassava starch [25]. As earlier mentioned, at high filler content, agglomeration may occur leading to high points of stress concentration which will readily initiate crack propagation in the blends. This induced the elongation at break of the blends to decrease with increasing starch content. Balakrishna et al., [16] and Karima et al., [26] observed similar trends with natural filler filled PP blends.

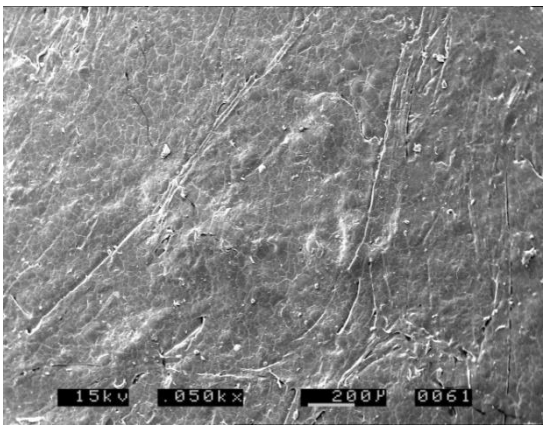
However, the addition of 10 wt. % cassava starch to the PP matrix increased the Young's modulus by 8 % and 11 % whereas 20 % and 26 % increment were observed at 50 wt. % starch content for uncompatibilized and compatibilized PP blends respectively (Fig.7). The incorporation of the starch into the blends hindered the mobility of the polymer chain of the PP matrix thus contributing to the rigidity of the blends [22, 27]. Supri et al [28] attributed the increment in Young's modulus to the intrinsic properties of the filler, where the filler may show its high stiffness. The high Young's modulus recorded by the PP/CCS blends may be linked to the presence of PP-g-MA which improved the bond characteristics of the starch and PP matrix. Moreover, the high percent decrease in tensile strength and moderate increase in Young's modulus of the PP/starch blends on addition of starch filler to the PP matrix suggest that the filler is not reinforcing filler. This is in concordance with the assertion of Billmeryer [29], who stated that non-reinforcing fillers produce reducing effect on the properties of polymers by weakening their rigidity. The effect of poor starch wetting by the matrix was demonstrated by the easy detachment starch from matrix as shown in the SEM micrographs in Figs. 8 and 9.

Morphology

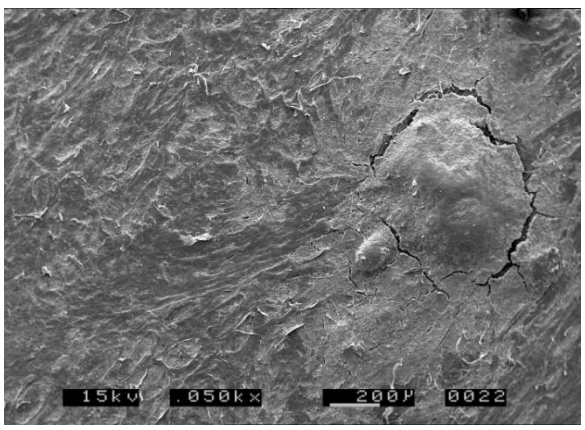
Figures 8 and 9 show the SEM images of PP/starch blends for both uncompatibilized and compatibilized blends before and after soil burial respectively. From the micrographs, the blends show specific morphology, rough surface with many air voids, though particles of starch seemed to be well embedded in the PP matrix. The rough surface nature of the blends may be associated with starch content, the higher the starch content, the more the surface roughness of the blends. The images here illustrate the increase in porosity of the blends due to fungal growth leading to formation of holes and voids. This is associated with uncompatibilized blends at higher starch content due to poor wettability compared to compatibilized ones with better interfacial adhesion.



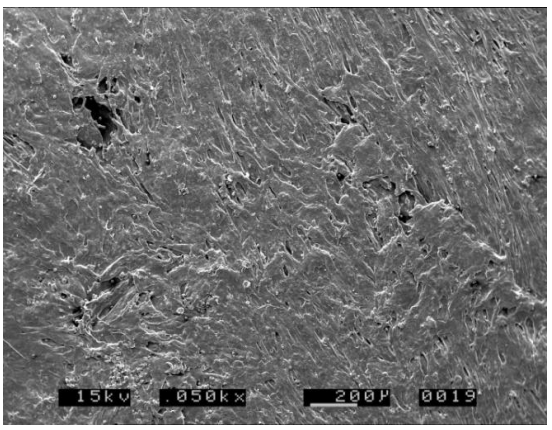
8(a)



8(c)

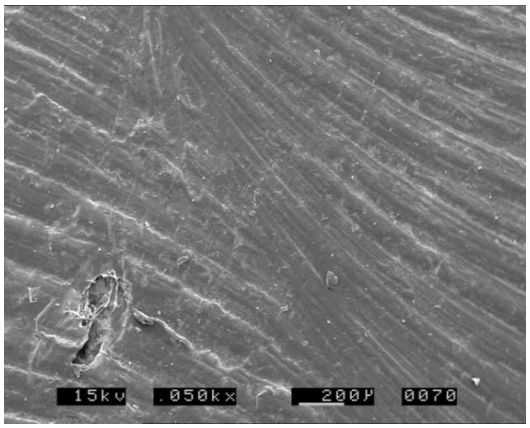


8(b)

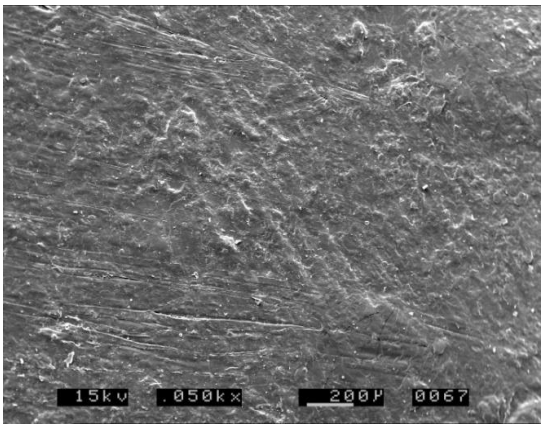


8(d)

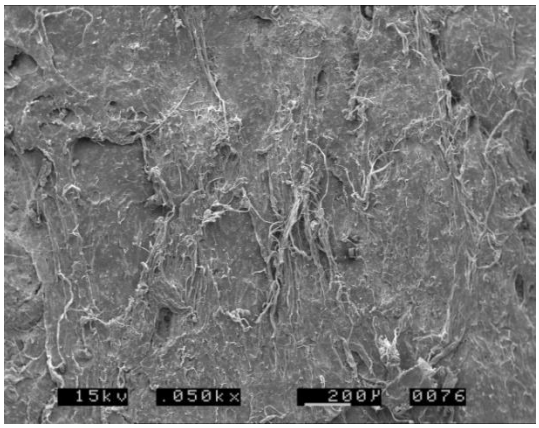
Fig. 8: SEM images of PP/CS blends, (a) 10 % CS and (b) 50 % CS before soil burial; (c) 10 % CS and (d) 50 % CS after soil burial.



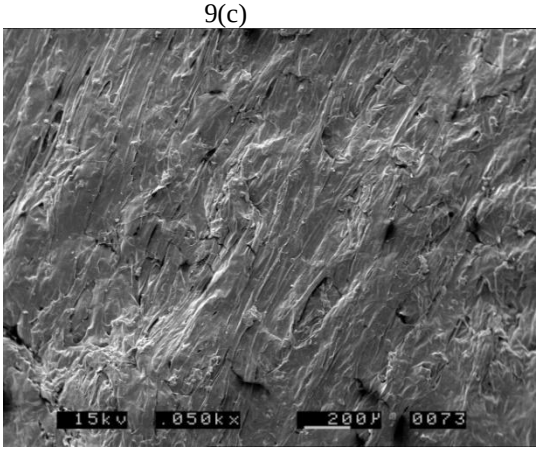
9(a)



9(c)



9(b)



9(d)

Fig. 9: SEM images of PP/CCS blends, (a) 10 % CCS and (b) 50 % CCS before soil burial; (c) 10 % CCS and (d) 50 % CCS after soil burial.

IV. CONCLUSION

The main conclusion drawn from this study can be summarized as follows:

1. Biodegradable blends have successfully been prepared using indigenous cassava starch blended with polypropylene.
2. Water absorption by the blends increased with increasing starch content as a result of increasing presence of hydroxyl groups in the blends.
3. Biodegradation rate of the blends increased with increasing starch content due to increased microbial invasion on the blends.
4. Higher starch content in polypropylene reduced the tensile strength and elongation at break due to poor interfacial adhesion between the starch and matrix.
5. The Young's modulus increased with increasing starch content due to reduction in mobility of the chains of PP matrix giving rise to the stiffness of the blends.
6. Determination of the tensile and biodegradable properties was confirmed by the SEM images.
7. The addition of PP-g-MA improved the properties under study due to enhanced interfacial adhesion between the starch and PP matrix.

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Android Blood Donor Life Saving Application in Cloud Computing

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Abstract: - Emergency situations, such as accidents, create an immediate, critical need for specific blood type. In addition to emergency requirements, advances in medicine have increased the need for blood in many on-going treatments and elective surgeries. Despite increasing requirements for blood, only about 5% of the Indian population donates blood. In this paper we propose a new and efficient way to overcome such scenarios with our project. We have to create a new idea, just touch the button. Donor will be prompted to enter an individual's details, like name, phone number, and blood type. After that your contact details will appear in alphabetical order on the screen; the urgent time of a blood requirement, you can quickly check for contacts matching a particular or related blood group and reach out to them via Phone Call/SMS through the Blood donor App. Blood Donor App provides list of donors in your city/area. Use this app in case of emergency. A large number of blood donors are attracted using an Android application. Cloud- based services can prove important in emergency blood delivery since they can enable central and immediate access to donors' data and location from anywhere. Since almost everyone carries a mobile phone with him, it ensures instant location tracking and communication. The location-based app, operational on android platform, will help users easily find donors of matching blood groups in their location and access their mobile numbers for instant help. Only a registered person, with willingness to donate blood, will be able to access the service.

Keywords: - *Supply Chain Network, Web Service, Blood Donor App.*

I. INTRODUCTION

IN today's world, supply chains are more complex than ever before. Consumers' demand for new products as well as the still critical economic situation requires that companies, as well as organizations, be more innovative while also becoming more cost-effective in the procurement and Production of their products and services as well as in their delivery, However despite numerous significant achievements, the discipline of Supply Chain Management (SCM) is still incapable of satisfactorily addressing many practical, real-world challenges. The user's location will be detected using GPS. If there is need of blood, the donor with the required blood group is identified and notified of the requirement. The project includes algorithm which detects accurate location of the donors, identifies the donors who are available nearby to the location of requester and notifies them. If the identified donors are not available or not willing to donate blood at present then the scope of detection is increased. (This is done by increasing the scope of search).Notifying the donor about the need of the blood is the most important task of the system.

Examples of perishable goods include food and food products, medicines and vaccines, cut flowers, etc. The MIS of Blood Bank India keeps the name of the donor who is donating blood, a unique id through which the donor can view his account , password for accessing the account , date of birth of the donor because his age must be in the range of 18-60 years, gender status of the donor, blood group of the donor, weight of the donor, mobile no, email id, address, city, state, date of last blood donation when a new blood donor registered himself as a Blood Donor.

This project consists of an application which is present on the donors' android-phone, a website which acts as an interface for the users of the system and it also uses cloud for storing the donor's data.

II. BLOOD DONORSHIP

Major headings are to be column centered in a bold font without underline. A donor was donating a blood for storage at a blood bank or any other center for transfusion to an unknown recipient. These can occur at a number of locations including blood donation centers, mobile camps, mobile vans, etc. There a number of types of blood donations such as voluntary blood donation programmer. This is the safe and quality blood donation service as the blood collection from voluntary non remunerated blood donors is well-thought-out to be the safest. In order to enhance voluntary blood donation in developing countries like India [1] is based on well-defined frameworks and operational guide for organizations for this important activity. International healthcare research bodies have extensive frameworks that address context of blood management[2]. In developed countries there are dedicated organizations that have effective blood donor management processes. One such example is the U.S. department of defense (DOD), which uses an enterprise blood Management software that will manage the blood supply chain including donor management, blood collections, testing, distribution and transfusion. Additionally this also provides a proactive delivery of information and service through a web portal[3].

A. RelevantPeerResearch

Santhanam et al [4][5] extended the nominal definition based on a standard dataset to derive a CART[6] based decision tree model based on standard donor ship. This analysis helped identify the attributes that classify a regular voluntary donor (RVD) in the context of a standard dataset. This provided an extended RVD definition based on the donor definition (along with the application of CART) provides a standard model to determine the donor behavior and provides the capability to build a classification model. This additional nominal class can be easily computed based on the statistical definitions and help assist in decision making.

Chau et al[7] have extensively analyzed the linkages related to the blood donation to the location of the blood donation centers.This research was carried out using donor's past donation profiles to help setup a new blood donation center for the Hong Kong Red Cross.Their findings provide correlations between spatial distance and the incentive for the blood donors which is the uniqueness of this research. This specifically helps in the effective setup of centers with maximal donorship potential.

Bing et al[9] have extensively analyzed the working and implementation of blood bank information systems. Their research provides an extensive background of blood bank information systems. The research also talks about the importance of the decision making capability that is required for effectively running the operations in blood banks. The research also identifies various critical areas that are required for the systems to also have in order to enable decision making.

III. PROBLEM DEFINITION

In spite of the availability of the potential blood donors not more than 5% of the total Indian population donates blood.

Advancement in medical science has increased the blood demand. Also blood-donors usually don't come to know about the need for blood.

These reasons motivate us to develop a more efficient system that will assist the present blood donation system.

IV. FEASIBILITY STUDY

A. About the Dataset

The blood transfusion dataset is based on donor database of Blood Transfusion Service Center in Hsin-Chu City in Taiwan. The center passes their blood transfusion service bus to one university in Hsin-Chu City to gather blood donated about every three months. This dataset is derived from I- Cheng Yeh[6].

The data set consists of 847 donors from the cloud donor database. These 847 donor data, each one included R (Recency - months since last donation), F (Frequency - total number of donation), M (Monetary - total blood donated in c.c.), T (Time - months since first donation), and a binary variable representing whether he/she donated blood in December 2013 (1 stand for donating blood; 0 stands for not donating blood). There is an imbalance in that the people who have donated blood in 2013 accounts for only 54% in the dataset.

Table 1 Revised RVD confusion matrix

	TP Rate	FP Rate	Precision	Recall	F- Measure	ROC Area
Class0 (not RVD)	0.92	0	1	0.92	0.96	0.96
Class1 (RVD)	1	0.08	1	1	1	0.96
WeightedAvg.	1	0.08	1	1	1	0.96

This dataset has been extended to accommodate the following attributes. RVD a Boolean attribute that is computed based on the original attributes along with definitions [1]. Additionally geo-location information was added in the syntax of latitude:longitude. This was randomly assigned to locations in India for analysis. Please note the data used is to be considered only for demonstrative purposes.

V. PROPOSED SYSTEM

IF ((Frequency > 18.5 (times) AND Recency < 8.5 (months))
RVD = TRUE ELSE
RVD = FALSE
This is further analyzed by a perspective at the overall dashboard across the indicators and ranking the locations by scores. The algorithm for the dashboard is indicated as follows. Figure 2 provides the implementation of this algorithm.
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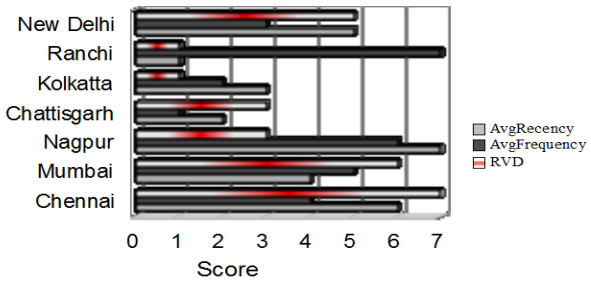

A. RVD SCORING ALGORITHM

Geo-location RVD Scoring Algorithm
Step 1: Loop through each unique location L (latitude, longitude) based on geographic division (such as state, District and city).
Step 2: For each location L compute the average frequency, average regency and total RVD count.
Step 3: Calculation of Location level summary scores for the regency, frequency and RVD across the locations.
The Recency Score (location) is computed as the Rank in descending.
The Frequency Score (location) is as the Rank in ascending.
The RVD Score (location) is computed as the Rank in ascending.
Step 4: Plot this score in the chart with scores on the X – Axis locations on the Y.
The results in comparison with the earlier model [5] reveal an improvement in the true positive rate for RVD class along with a delta increase in the false positive rate.

VI. FRAMEWORK

Registration

This registration maintains the details about donors. Then provide the user name and password. This login information provides the accessible permission to the user and restricts the unauthorized users. The system records:-

- Donor details and particulars;
- Donation history;
- Blood group details;
- Donor inquiries; and
- Donor Statistics Report.

Donor information

- Donor particulars information;
- Past history of blood donation results;
- Donor Donation counting;
- Blood constituents to be prepared; and
- Blood collection details.

Website management

We maintain the website to gather the blood donor's details such as registration details, donor's details and blood details. This website maintains the database up to date. This website appears in attractive and user friendly. The responsibility of this module is to capture donation details for Twine Blood Transfusion,

Mobile management

This module helps to manage and control mobile Blood Bank Movement or Programs and serves as marketing information collector. Its web-based feature works on anytime and anywhere concept and helps to capture data from the various locations. In this phase we list out the donor based on mobile GPRS services so easy to get the more information about donors in particular region.

VII. CONCLUSION

This project aims to create a web application known as cloud application for android mobiles. The sole purpose of this project is to develop a computer system that will link all donors. The system will help control a blood transfusion service and create a database to hold data on stocks of blood in each area as data on donors in each city. Furthermore, people will be able to see which patients need blood supplies via the website. They will be able to register as donors and thus receive an SMS from their local clients who needs blood to donate blood in cases of need. The website will help develop public awareness amongst its visitors of the hospitals' need for blood in order to supply the appropriate donors.

Future work will be focused on further enhancing these models to allow integration with blood donor management systems including innovative ways of visualization. The current implementation of the RVD model can also be implemented with other relevant attributes. Similar strategies can also be adopted for other healthcare domains.

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Evaluation of Concrete Compressive Strength by incorporating Used Foundry Sand

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Abstract: - The main objective of this study was to evaluate the compressive strength of concrete by utilizing three types of used foundry sand; with bentonite clay, with sodium silicate & with phenolic resin as partial replacement of fine aggregates. To accomplish the research an experimental program was conducted in which ten concrete mixtures were casted, by keeping all other parameters for concrete proportioning as constant and only change made was in the amount of fine aggregates. Ten, Twenty and Thirty percent replacement level of river sand by used foundry sands was maintained in this study. All fine aggregates were selected after achieving desired physical and chemical tests. Workability, compressive strength and modulus of elasticity were measured and compared with the conventional concrete termed as control mixture. It was observed that workability increased with replacement levels. The cubes were crushed at 7, 28 and 63 days of standard moist curing. The compressive strength of all concrete specimens increased with increase in curing age. With exception to foundry sand with phenolic resin, compressive strength of concrete mixtures was decreased with increase in replacement level at all ages. Similar trends were observed in modulus of elasticity of concrete.

Keywords: - *Fine aggregate, Used Foundry sand, Compressive strength, Modulus of Elasticity*

I. INTRODUCTION

Metal foundries (ferrous & non ferrous) utilize high quality sands in production of metal castings. The sand is mixed with variety of additives and binders according to type of metal casting. It is recycled and reused multiple times in the process until it loses its characteristics and thus discarded. Foundry sand discarded by foundries is called used foundry sand (UFS). According to researcher [1] UFS was a mixture of sand, residues from metal casting process & variety of binders. UFS classified as non-hazardous waste when produced by iron, steel and aluminium foundries. [2-3]

The physical and chemical properties of UFS depend upon: type of metal being poured, casting process, type of binder system, type of furnaces and type of finishing process like grinding, blast cleaning and coating [4]. Depending on type of binder systems used in metal casting process, used foundry sands are classified as; Clay bonded sand (Green sand) and chemically bonded sands. Green sand is black in colour due to high carbon content. Being a combination of sand, clay and water, spent green sands are effective in geotechnical applications like base courses, structural fills, embankments etc. Chemically bonded sand is

utilized in mould making as well as in core making where high strengths are essential to bear the high temperature of molten metal. Colour of chemically bonded sand is lighter than clay bonded sands. Their texture is coarser than clay bonded sands. Chemically bonded sands lack the hydraulic characteristics of green sands and are effective in agricultural and construction use [5].

The phenomenon of reusing UFS in applications other than landfills is quite well established in places like Europe, England and North America, where UFS is utilized in manufacturing of cement, concrete, asphalt, bricks & controlled low strength material (CLSM). Some of these reuse options are beginning to be adopted in some developing countries like India [6]. UFS is utilized in Turkey, where it was mostly used as land fill cover only a small amount was reused for engineering applications like in Portland cement, concrete parking/paving, garden seating etc. [7]

In past, limited work has been carried out on the utilization of UFS in mortar and concrete which is being reported here. One researcher investigated the compressive strength of concrete with UFS as a partial replacement accounting to 0%, 25%, 50% and 100% of ordinary sand [8]. It was concluded that, strength of concrete was decreased by increasing the replacement of UFS. Another author assessed the effects of UFS (green sand) as partial replacement of fine aggregates in cement mortars and concrete by replacing regular sand by 10%, 20% and 30% of UFS in mortar mixtures and 7% and 10% in concrete mixtures [9]. Its results revealed that mortar and concrete mixtures with UFS exhibited lower compressive strength by 20%-30% as compared to control mixtures. Modulus of elasticity tested at 28 days, did not show significant variations. One reported the utilization of UFS in high strength concrete by replacing natural sand by 0%, 5%, 10%, and 15% of UFS [10]. They concluded that increase in the replacement level of UFS, decreased the compressive strength, tensile strength and modulus of elasticity of concrete. According to one author reported that UFS could be utilized in the production of good quality Ready Mixed Concrete (RMC), with no major mechanical, micro-structural and environmental impacts [7]. It was reported that fly ash stabilized phenolics better than ordinary cement concrete, Strength analyzed and leachability of stabilized mixes of UFS to assess the feasibility in construction and geotechnical applications as CLSM [11]. In one study, effect of UFS on mechanical properties of concrete analyzed and reported that UFS could be used as partial replacement of fine aggregates for producing good quality concrete [12]. Marginal increase in strength & durability of concrete incorporating UFS investigated and concluded that UFS could be effectively used in producing structural grade concrete [4]. In one case abrasion resistance of concrete was investigated by utilizing UFS and it was found that abrasion resistance of concrete increased due to inclusion of UFS at all ages [13]. Depth of wear decreased with increase in UFS levels. Concrete with utilization of up to 15% UFS can effectively be used in production of structural concrete and in applications where abrasion is of major concern. Industrial by-products like UFS could be utilized to manufacture durable concrete with sufficient strength [6]. The characteristics of concrete assessed by utilization of metallurgical industry by-products as partial replacement of aggregates. Chemically bonded foundry sand (CFS) and green foundry sand (GFS) were utilized as partial replacement of fine aggregates. Higher workability was obtained in case of concrete added with CFS. [14]

II. EXPERIMENTAL PROGRAM

The experimental setup was established to assess the influence of UFS as fine aggregate on the fresh and hardened concrete properties. The workability, compressive strength and modulus of elasticity were obtained and compared with those of control mixture.

2.1. Materials

An Ordinary Portland Cement used as binder in proportioning of concrete mixture. Locally available crush was used as coarse aggregate and four types of sands were used as fine aggregate to complete this experimental work. Locally available river sand (NS) was used in proportion of control mixtures while UFS were used in rest of the mixtures. Three types of sands, classified according to the binder used, Foundry sand with Bentonite Clay as binder termed as “FBC”, Foundry Sand in which Phenolic Resin used as binder termed as “FPR”. Sodium Silicate used as binder in last Foundry sand (FSS) utilized in this study. Three types of foundry sands namely foundry sand with bentonite clay (FBC), Foundry Sand with Phenolic Resin (FPR) and Foundry sand with sodium silicate (FSS) were used.

Figure 1 gives schematic of materials used for preparation of concrete samples in this research work and Table 1 gives properties of materials used in the experimental work. Grain distribution curve of fine aggregates is shown in Figure 2. It is obvious from Figure 2 that NS is coarser than UFSs.

Oxide composition of fine aggregates are shown in table 2, which indicates that silica **(**SiO_2) is the most abundant oxide present in all the sands. Different types of binders present in used foundry sands result in variation in oxide contents present in these sands.

2.2. Concrete Mixture Proportioning

A constant concrete proportion of 1:2:4 was used with a single water cement ratio of 0.6 for all the mixtures. Total ten concrete mixtures were prepared according to standards, one of those was a controlled mixture; CC (without addition of used foundry sand) and in the remaining nine mixtures NS was replaced by 10%, 20% and 30% of three types of UFS. These nine mixtures were named after the binder used in foundry sand (FBC, FSS & FPR) and replacement level, e.g. FBC_{10} denoted 10 % replacement level of NS with FBC.

Total 90 cubes of 100 mm size were casted and cured in curing tank for 7, 28 and 63 days for determination of their compressive strength. Thirty cylindrical moulds (height 300mm and diameter 150mm) were also casted; three for each concrete mixture to get modulus of elasticity at 28 days of age.

III. EXPERIMENTAL RESULTS DISCUSSION

Slump was measured to check the influence of UFS on workability of concrete. The Compressive Strength and Modulus of elasticity were measured at different ages and the obtained results revealed the influence of the UFS on the behavior of hardened concrete. Finally, results were compared with those of control mixture and with data obtained from investigations by various researchers. The discussion is given in following section;

3.1. Workability Test

The slump values of all concrete mixtures used in this research has been shown in Figure 3. Concrete specimen with UFS exhibited higher workability than conventional concrete. The increase in workability may be attributed to the presence of finer UFS. In all cases rapid increase in workability has been observed when replacement level varied from 20% to 30%. The workability results corroborate to the previous research conducted by [14].

3.2. Compressive Strength

Compressive strength results of all concrete mixtures; determined at 7, 28 and 63 days of curing are listed in Table 3 along with standard deviation values given in circular parenthesis ( ). In all cases, Compressive strength increased with the age of concrete and compressive strength of UFS concrete decreased as compared with the control mixture. Figure 4 shows the comparison of UFS with control mixture at all ages and replacement level of 10, 20 and 30%. At age of 7 days, about 15 to 20 % reduction in strength was noticed when NS replaced by 10% UFS and further decrease in strength occurred when replacement level was increased. Similar results have been observed at 28 days but reduction in strength reduced to 8% when NS was replaced by 10% FBC and 25 to 33 % reduction in strength were observed at 30% replacement level. FPR showed better strength at age of 63 days, the compressive strength of control mixture and FBC up to 20% replacement level were almost same.

The compressive strength decreases by increase of UFS in concrete mixture,. All three UFS utilized in this research were finer than the ordinary sand. Thus, higher surface area of fine particles led to decrease in volume of cement paste with the aggregates in concrete mixture and caused decreases in strength. The results for compressive strength of the present work have been compared with previous investigations by evaluating the relative strength at different replacement ratios of UFS. It can be depicted from Figure 5 that the results of this study are consistent with the previous investigations. However, the relative strength varied in different patterns for different researchers. The increase or decrease in compressive strength of concrete with UFS might be due to different kinds of UFS used by different researchers. Properties and quality of UFS vary from foundry to foundry and it depends on type of casting process and binders used. Almost all the researchers have concluded that percentage replacement of fine aggregates by UFS should be in the range of 10% to 20%. At higher levels of UFS, strength decreased drastically due to higher proportion of fine particles in UFS.

5.3. Modulus of Elasticity

The modulus of elasticity of ordinary concrete mixture (CC) was 22.9 GPa. Consistent with the values of compressive strength, the Modulus of Elasticity (E) of UFS-concrete mixtures was smaller than that of control mixture. However, the variation among E values of the concrete specimen was very small. The decline of E showed in Figure 6, was similar in nature to previous investigations.

IV. CONCLUSIONS

Following conclusions are deduced from the experimental results:

1. Compressive strength increases with increase in curing age in all cases and at 28 days of curing, 80% of compressive strength was reached in all concrete specimens.
2. Strength decreased with increase in percentage replacement of UFS; compressive strength of control mixture (CC) was more than concrete mixtures with UFS at all curing ages

3. After 28 days the difference of strength between concrete mixtures with 10% UFS and control mixture was least distinct.
4. Strength loss in UFS concrete mixtures was due to presence of anti-binder in the form of very fine powder of carbon and clay in the UFS, which resulted in lack of contacts between the aggregates and cement paste**.**
5. FPR concrete mixtures showed somewhat favorable strength results as compared to FBC and FSS concrete mixtures. It achieved almost same strength as CC mixture at 63 days of curing. FSS concrete mixture showed lower strength values than FPR and FBC concrete mixture.
6. No significant variation was observed in modulus of elasticity values of different concrete specimen. Average value of modulus of elasticity of UFS-concrete mixtures was 20.5 Gpa, as compared to 22.9 GPa of control mixture.

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Table 1: Physical Properties of Materials

Cement Characteristics		**Values Obtained**			
1	Type	ASTM 1			
2	Specific gravity	3.15			
3	Blaine Fineness	3656 cm^2/g			
Coarse aggregates Characteristics					
1	Maximum size	20 mm			
2	Density	1550 kg/m^3			
3	Fineness modulus	7.8			
Fine aggregates Characteristics		**Type of Fine Sand**			
		NS	**FBC**	**FSS**	**FPR**
1	Specific gravity	2.76	2.48	2.65	2.60
2	Bulk relative density, kg/m^3	1590	1440	1325	1500
3	Moisture content, %	1.84	3.11	1.44	0.1
4	Fineness modulus	3.8	3.1	2.7	2.3

Table 2: Oxide Composition of Fine Aggregates

Constituents	Description	Oxide Content			
		NS	FBC	FSS	FPR
SiO_2	Silica	16.4	12.3	18	9.8
Al_2O_3	Aluminium oxide	4.03	4.38	3.82	5.27
Fe_2O_3	Ferrous oxide	2.32	3.79	4.17	2.11
SO_3	Sulphur trioxide	0.27	1.41	2.35	1.2
CaO	Calcium oxide	7.42	1.23	0.45	1.09
MgO	Magnesium oxide	6.01	0.23	0.52	0.3
L.O.I	Loss on ignition	6.51	7.25	5.45	6.23

Table 3: Compressive Strength with different replacement levels of UFS at all ages.

Mix #	Designation	UFS content	Compressive strength f_c, Mpa		
			7 days	28 days	63 days
M1	CC	0 %	**26** (0.97)	**31**(0.83)	**33**(0.49)
M2	**FBC-10**	10 %	**22**(1.92)	**28**(1.88)	**30**(0.67)
M3	**FBC-20**	20 %	**20**(1.17)	**24**(1.55)	**28**(1.50)
M4	**FBC-30**	30 %	**19**(0.97)	**23**(0.71)	**27**(0.85)
M5	**FPR-10**	10 %	**21**(0.82)	**27**(0.88)	**33**(1.31)
M6	**FPR-20**	20 %	**25**(1.68)	**29**(1.38)	**32**(1.33)
M7	**FPR-30**	30 %	**19**(0.81)	**23**(1.67)	**27**(0.96)
M8	**FSS-10**	10 %	**21**(0.07)	**25**(0.41)	**25**(0.97)
M9	**FSS-20**	20 %	**19**(1.23)	**25**(0.26)	**26**(0.78)
M10	**FSS-30**	30 %	**18**(0.21)	**21**(0.89)	**23**(1.03)

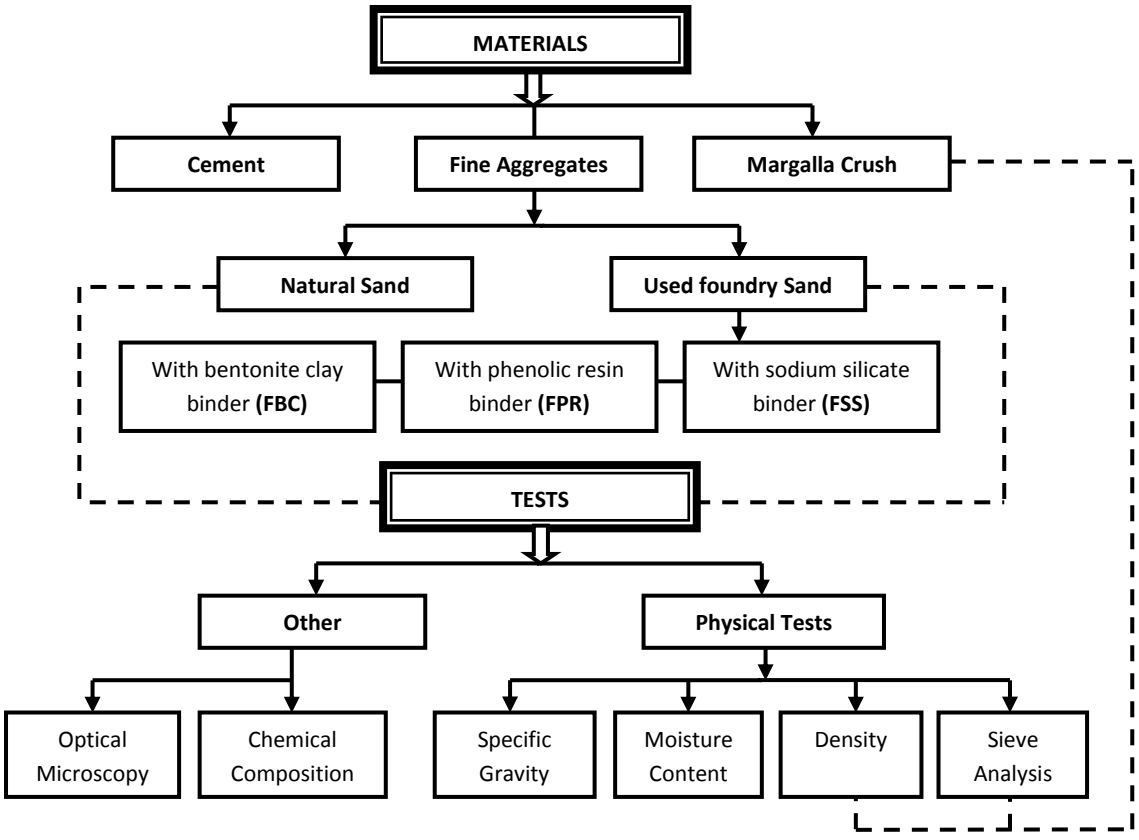

Figure 1 Schematic of Materials used in Concrete Proportioning

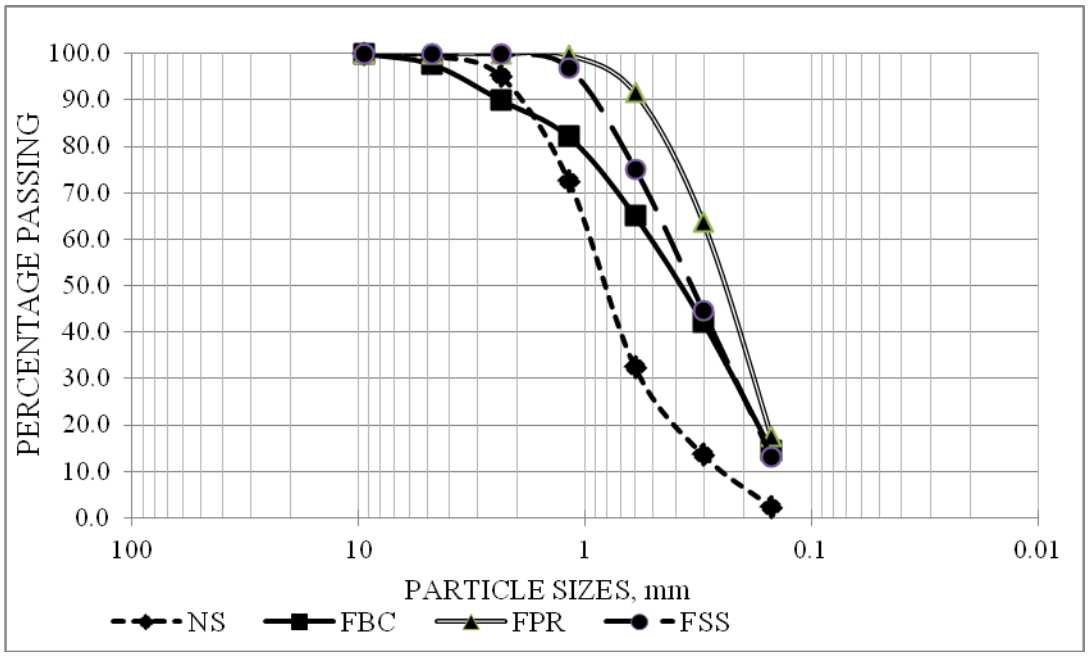

Figure 2 Grain size distribution curve of the fine aggregates

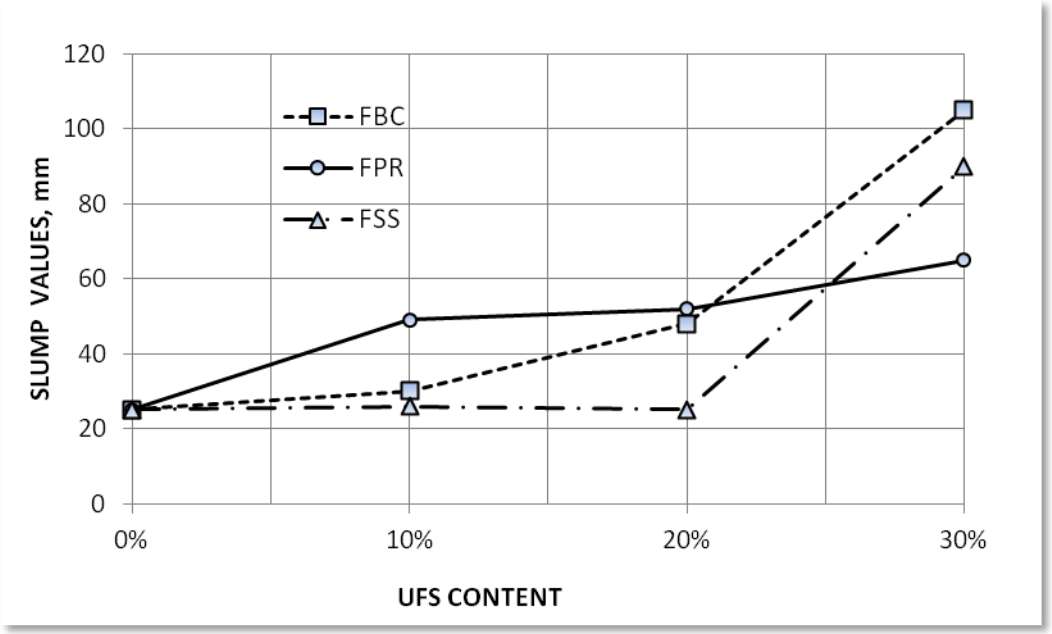

Figure 3 workability of all Concrete Mixtures in term of Slump

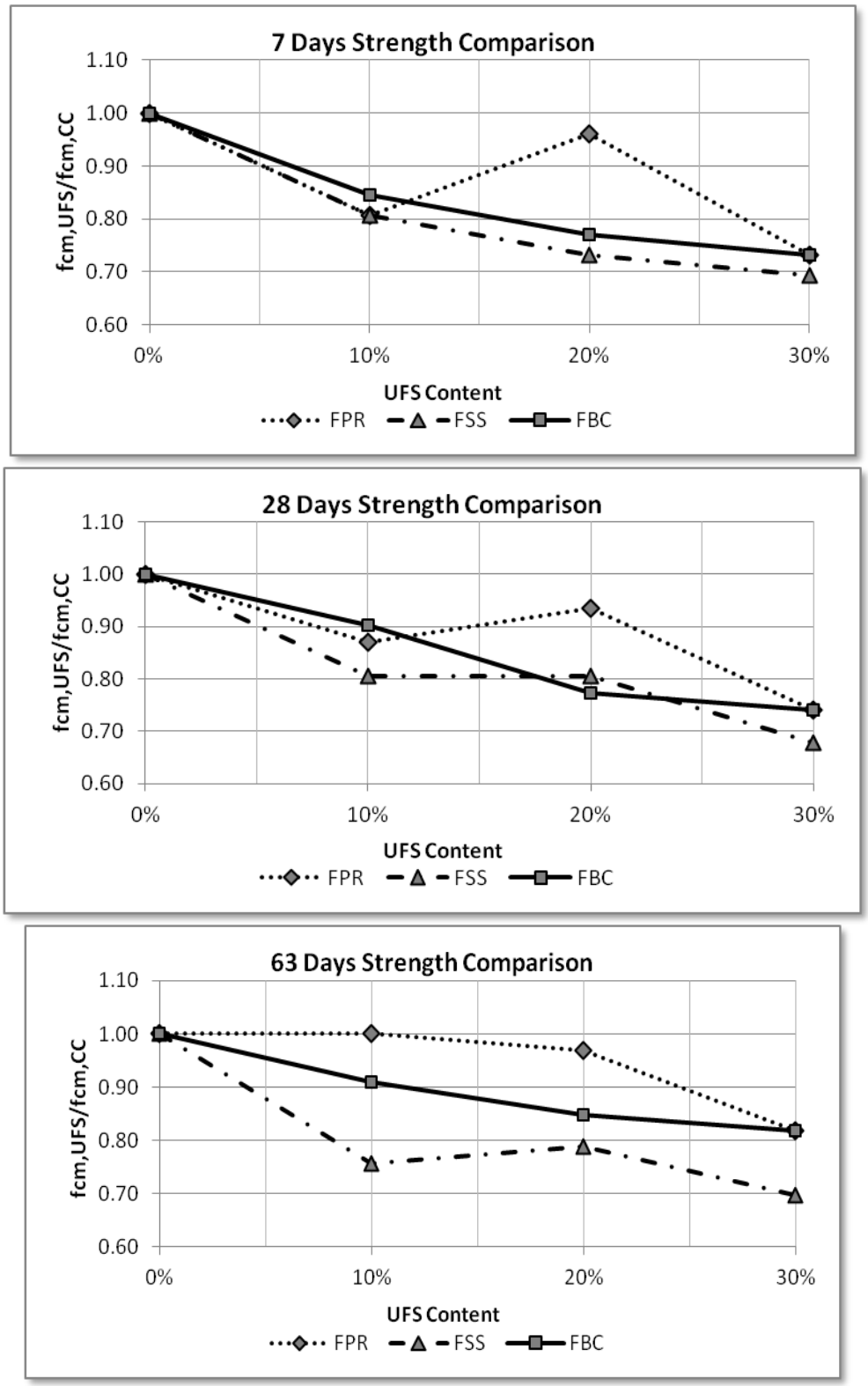

Figure 4 : Compressive strength of all concrete mixtures at different ages of curing

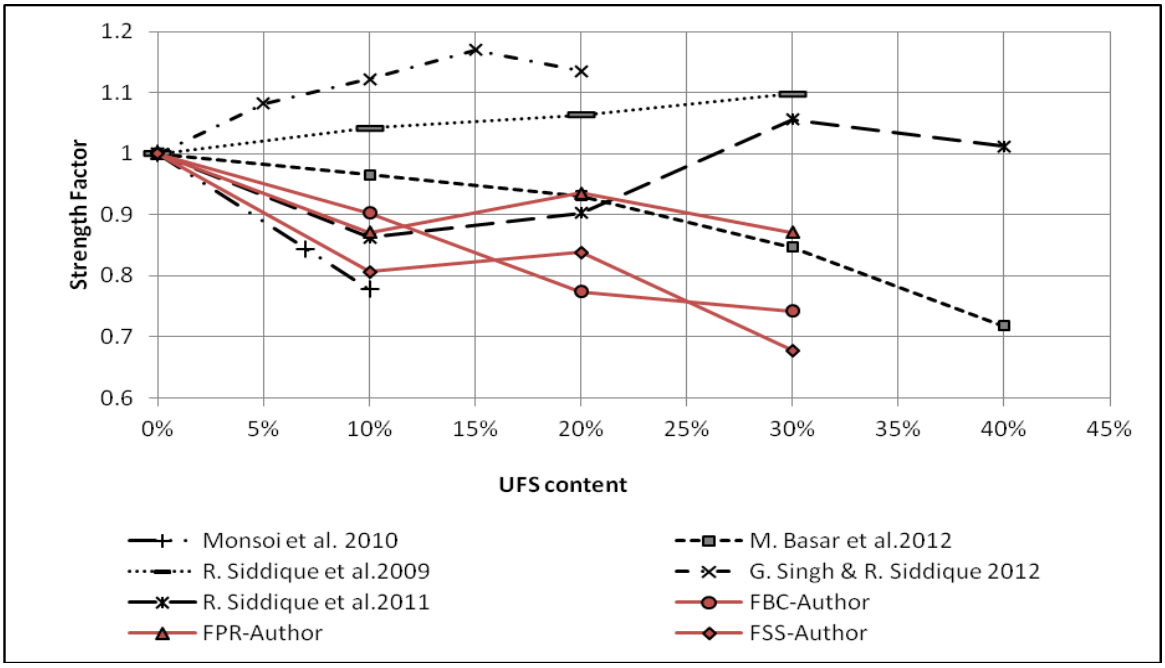

Figure 5: Compressive Strength variation at 28 days

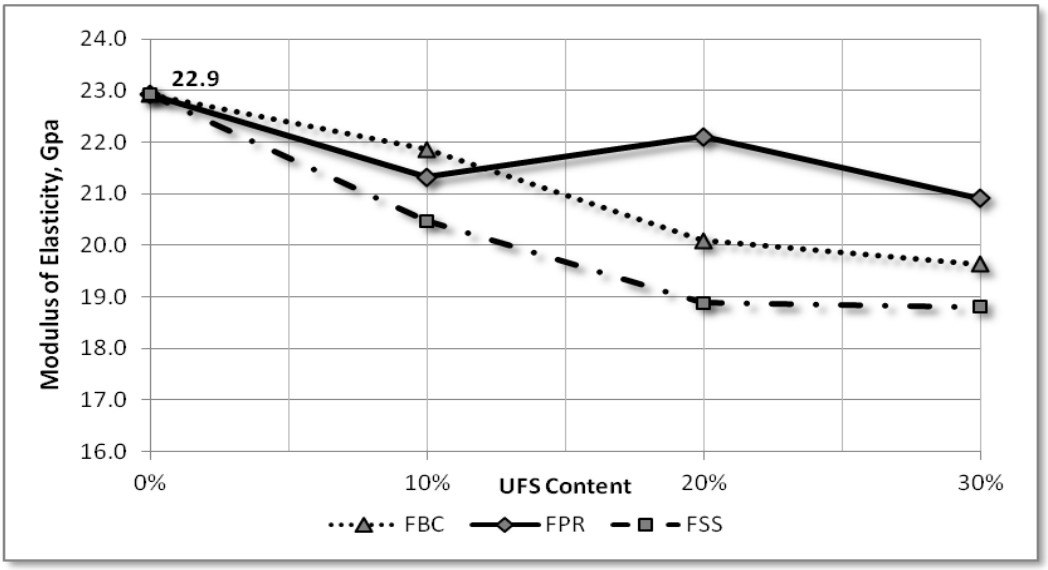

Figure 6 Modulus of elasticity of all concrete specimens

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Influence of Alkali Treatment and Fibre Content on the Properties of Oil Palm Press Fibre Reinforced Epoxy Biocomposites

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Abstract: - In the present work, oil palm press fibre reinforced epoxy composites were developed. The effect of fibre loading varying from 5 wt. % to 30 wt. % on the mechanical properties of oil palm press fibre/epoxy composite was studied. The effect of alkali treatment on mechanical properties of the composites was also investigated. The mechanical properties of treated OPPF/epoxy composites were found to be higher that the untreated oil palm press fibres. Optimum tensile, flexural and impact strengths of OPPF/epoxy composites were obtained at fibre content of 20 wt. % in this work. Hardness, tensile strength and modulus of the composites increased with increasing fibre loading. Alkali-treated OPPF/epoxy composites when compared with untreated OPP fibres at 20 wt.% fibre loading showed an increase of tensile strength by 18.79 %, flexural strength by 15.15 % and impact strength by 18.21 %. The removal of hemicelluloses and other impurities with alkali treatment resulting to higher crystallinity of the OPPF could be responsible for these observations.

Keywords: - *Oil palm press fibre, epoxy resin, alkali treatment, mechanical properties, composites.*

I. INTRODUCTION

Biocomposites are material composites in which one of its phases either matrix (polymer) or reinforcement/filler (fibres) comes from natural source (Hassan et al., 2010). A proper combination of a plastic matrix and reinforcing fibres gives rise to composites having the best properties of each component. Plastics are known to be soft, flexible and light weight when compared with fibres, however, their combination yields a high strength to weight ratio to the emerging composite. The properties of composites are dependent on those of the individual components and on their interfacial compatibility. Adequate matrix fusion to enhance thorough fibre impregnation, formation of strong fibre/matrix interfacial bonding, and matrix-to-fibre stress transfer efficiency are vital requirements for the manufacture of reliable, eco-friendly natural composites that can exhibit better mechanical properties and withstand environmental attacks (Malkapuram et al., 2009).

Natural fibres have specific advantages over conventional fibres and also have won the hearts of material scientists, researchers and industrialists for the past decades. Apart from being biodegradable unlike the conventional fibres, low density, low cost, specific properties comparable to those of conventional types, ease of separation, carbon dioxide seizure, non-corrosive, reduced tool wear, reduced dermal and respiratory irritation (Mohanty et al., 2002; Singha and Thakur, 2008), have aroused the interest in the utilization of natural fibres using varied synthetic and natural polymeric materials. However, natural fibres suffer some serious limitations. The polar nature of natural fibres creates incompatibility problems with many synthetic polymers. Bogoeva - Gaceva et al. (2007) has reported other demerits of natural fibres such as poor resistance to moisture, limited processing temperature, and low dimensional stability. Based on this, various chemical treatments have been done to improve adhesion or interfacial bonding between natural fibres and synthetic polymers (Li et al., 2007). These will inevitably enhance the basic properties of natural fibres reinforced polymer composites (Arif et al., 2010; Aranjo et al., 2008).

Alkaline treatment, bleaching, acetylation and steaming are such various processes applied to improve fibre-matrix interaction (Das et al., 2000; Shukla and Pai, 2005; Corrandini et al., 2006).

The alkaline method is an effective way to improve the properties of composites reinforced with natural fibres (Rosa et al., 2009). Sinha and Rout (2009) reported the improvement in mechanical properties of alkaline treated jute fibre composites. Bisanda and Ansell (1991) studied the effect of silanes on properties of sisal-epoxy composites and reported an increase in compressive strength. Rout et al., (2009) studied the effect of 2 % alkali treatment on coir fibre-polyester composites and reported considerable improvement in tensile properties. Huda et al., (2008) in their study, observed that surface treated fibre reinforced composites showed better mechanical properties than the treated fibre-reinforced composites. Similarly, fibre surface modification treatments are found to be effective in improving the properties of composites with natural fibres such as oil palm fibres (Sreekala and Thomas, 2003), Sugar palm fibre (Dandi et al., 2011) and pineapple leaf fibres (Thee popnatkul et al, 2009).

Oil palm press fibres (OPPF) are used as reinforcement materials in this present study. They are one of the waste products obtained from the oil mill during palm oil extraction processes. These fibrous residues are got after the oil is separated from the fruits and account for 10 – 15 % of the fresh fruit bunch. A good source of energy to run the oil mill plants when mixed with other waste products such as kernel shells and empty fruit bunches (Pickard, 2005). The ash obtained by burning OPPF does not contain adequate nutrients to be used as a fertilizer and dumping creates an environmental pollution. However, its incorporation in concrete as a cement replacement has been studied (Pickard, 2005). Epoxies are important class of thermosetting polymer which are greatly used as materials for fibre-reinforced composite materials and structural adhesives (Shangjin et al., 2001; Zhikai et al., 1997). The role of matrix is to keep the fibres in a desired location, orientation and to effectively transfer the stress to fibres (Goud and Rao, 2011). Epoxies are mostly used in natural fibre reinforced polymer composites due to high tensile strength, low shrink rate, low flow rate, low volatility during cure, etc. (Goud and Rao, 2011). The present study investigated the effect of fibre concentration and alkali treatment on some mechanical properties of OPPF/epoxy composites.

II. MATERIALS AND METHODS

Materials

Oil palm press fibre (OPPF) was obtained from Ada Palm Industry, Ohaji, Imo State, Nigeria. Commercially available epoxy resin CY-230, hardener HY-951 mould releasing agents and NaOH pellets used were purchased from a local supplier in Benin City, Edo State, Nigeria.

OPPF Preparation/Treatment

To leach out the remaining residual oil from the OPPF which was retained after processing, "wet extraction" method that used hot water as described by Vijaya et al., (2013) was used. The fibres were thoroughly washed with distilled water to further remove impurities followed by sun drying for five days. The dry fibre was then treated with 5 % solution of NaOH for about 2 h to avoid fibre damage. The fibre was later washed with distilled water to remove excess of NaOH and dried at 80°C for 12 h.

Composite Preparation

Epoxy and hardener were mixed in a container and the OPPF was added and stirred well for 8 - 10 mins. The thoroughly mixed mixture was poured into the mould cavity of known dimensions already coated with mould releasing agents and allowed to cure at room temperature. Composites with various OPPF contents (5, 10, 15, 20, 25 and 30 wt. %) were obtained.

Testing of the composites

The test samples were cut out from the composites and were tested according to ASTM standards. Tensile testing was done as per ASTM D638 using a universal Shimadzu tensile machine at a crosshead speed of 5 mm/min. flexural testing was carried out according to ASTM D790 using three points bending method with the same testing machine for tensile testing at the same crosshead speed. Impact strength testing was done according to ASTM D256 by Izod impact machine. Hardness test was conducted using a Rockwell Hardness testing machine according to ASTM D785. All specimens were conditioned at a temperature of 23± 5°C and relative humidity of 50 ± 5 % for 2 days before testing. For each test, five replicate specimens were tested and the average values recorded.

III. RESULTS AND DISCUSSION

Tensile properties

The tensile properties of OPPF/epoxy biocomposites were probed to reveal the effects of the OPPF contents and its alkali treatment on the OPPF/epoxy interface and eventually on the tensile behaviour of the materials. Tensile strength and modulus of untreated oil palm press fibre (UOPPF) and alkali treated oil palm press fibre (AOPPF) reinforced epoxy composites were presented in Figures 1 and 2 respectively. Figure 1

shows that the tensile strength of the composites decreased with addition of 5 wt. % filler content and thereafter started to increase with increasing filler loading. The decrease may be linked to inadequate filler to reinforce the matrix of the composites. As the filler content increases from 5 - 20 wt. %, the tensile strength of the composites also increases but a decline in tensile strength was noticed beyond this point. Other previous results (Husseinsyah and Mustapha, 2011; Goud and Rao, 2011) show similar trend. The good tensile strength at low filler content may be attributed to good dispersion of OPPF in the epoxy resin, good wettability and good interfacial adhesion.

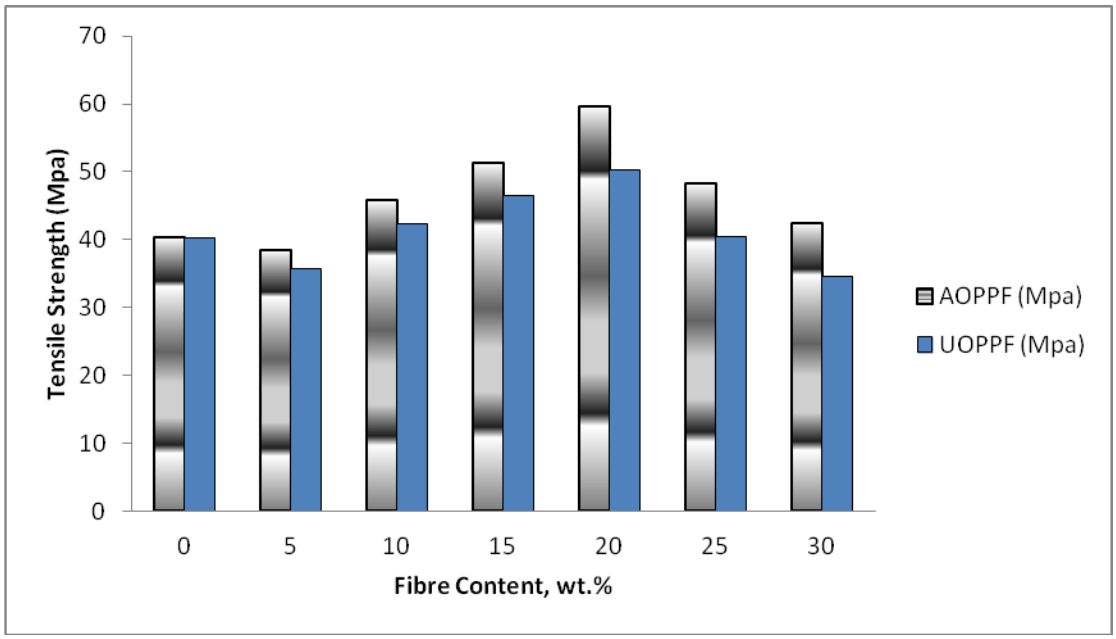

Fig. 1: Tensile Strength of untreated and treated OPPF/Epoxy composites

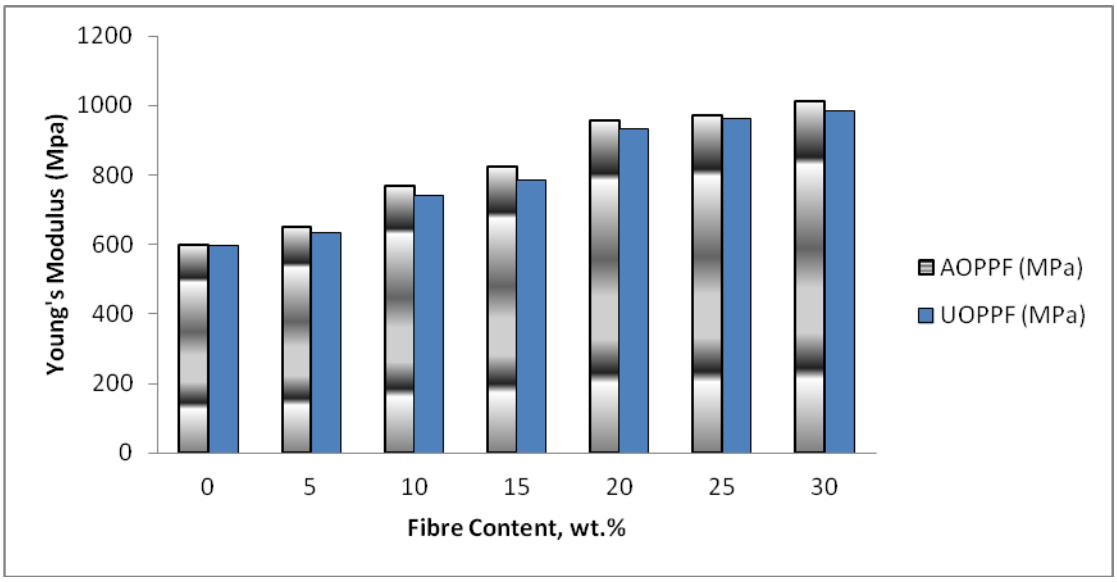

Fig. 2: Tensile Moduli of untreated and treated OPPF/Epoxy Composites

The decrease in strength after 20 wt. % content could be explained due to poor wettability, high porosity and voids resulting to a weak interface and inefficient stress transfer. It is worthy to note that all treated composites produced an improvement in tensile strength compared to untreated composites. An improvement of 7.97 % at 5wt. % of treated over untreated fibre whereas 18.79 % at 20 wt. % was also seen over untreated one.

This improvement may be linked to the enhancement in the adhesion between the fibre fibrillation, reduction in diameter, and increase in the number of reactive sites and changes in chemical compositions of the fibres when alkali treated. From fig. 2, it is evident that the incorporation of OPPF improved the tensile modulus of epoxy for both untreated and treated fibre composites and the values increase as the filler contents increase.

On comparison, alkali treated OPPF composites showed higher improvement when compared to untreated composites. Alkali treatment will remove some hemicelluloses, lignin, glue and other extractives in fibre bundles which yields higher percentage of α-(alpha), cellulose in natural fibres (Jayaramudu et al., 2009). This causes the fibre surface to be rough leading to improved interface between fibre and matrix. Alkalization causes fibre bundle breakages (fibrillation) into small fibres thereby increasing the effective surface area available for wetting by the matrix (Yan et al., 2000). This results to a better fibre/matrix interface due to the reduction in fibre diameter, increased fibre aspect ratio and rough surface topography hence improved mechanical properties. Similar to our findings were the works of (Goud and Rao, 2011; Mohanty et al., 2001; Prasad et al., 1983 and Corradini et al., 2006).

Flexural Properties

Flexural properties of untreated and treated composites at various fibre contents for flexural strength and flexural modulus are respectively presented in figures 3 and 4. As was observed in tensile strength, the flexural strength of OPPF/epoxy composite increased with increasing fibre content up to 20 wt. % but a gradual decrease in tensile strength was seen with higher fibre contents (Fig. 3).The reduction could be attributed to inadequate filling of epoxy resin into the OPPF during composite making which favoured fibre/fibre interaction than fibre/matrix interaction.

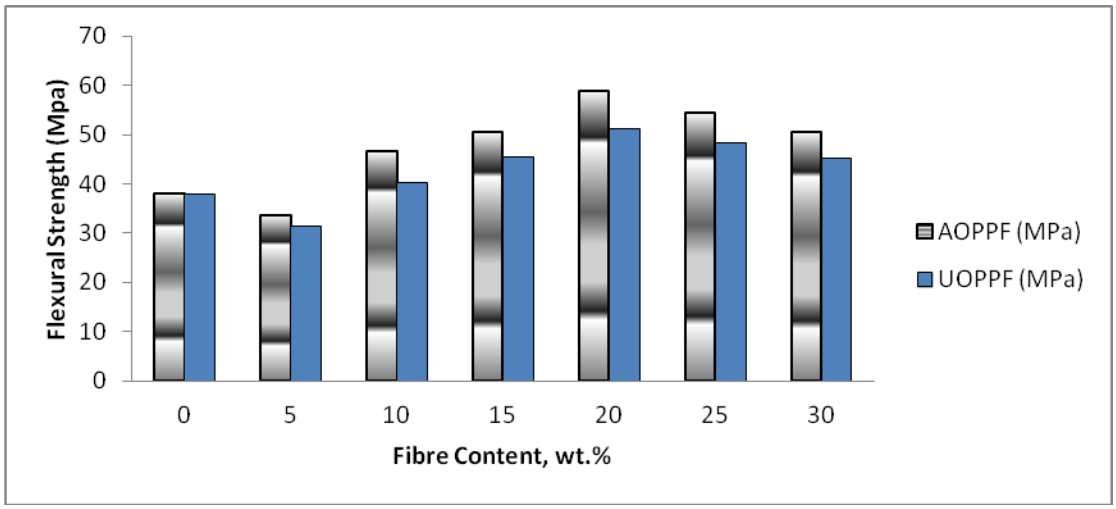

Fig. 3: Flexural Strengths of untreated and treated OPPF/Epoxy composites

Flexural modulus on the other hand increased linearly with increasing fibre content up to 30 wt. % investigated (Fig. 4). This behavior may be linked to the incorporation of rigid OPPF filler which offered a characteristic reduction in the ductility of epoxy resin matrix and hence resulted to the increase in flexural modulus. For alkali treated OPPF/epoxy composites, flexural properties are higher than those of untreated counterparts. This confirms the contributions of alkalization of fibres in terms of changes of fibre properties and fibre/matrix interface improvement. Alkali treated OPPF/epoxy composites at 20 wt. % showed 55.09 % improvement in flexural strength and 44.25 % in flexural modulus when compared with the neat resin. Alkali treatments of fibres cause fibrillation of fibres which increases the effective surface area available for contact with the matrix and hence improved interfacial adhesion. Therefore, modification of OPPF improved OPPF/epoxy biocomposite compatibility and bonding characteristics by producing compatible surface energies with developed interface bonds. Similar to our result were the works of CaO et al., (2005) and Bledzki and Gassan, (1999) on alkali pre-treatment of fibres.

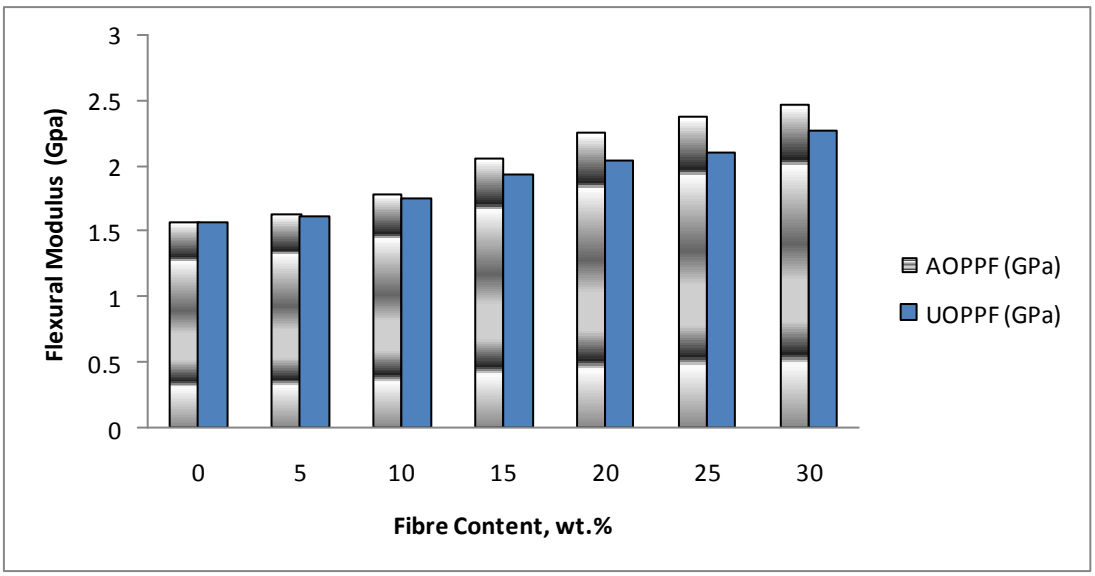

Fig. 4: Flexural Moduli of untreated and treated OPPF/Epoxy composites

Impact Strength

The impact properties of a composite material are directly related to its overall toughness. Composite fracture toughness is affected by inter laminar and interfacial strength parameter (Mishra et al., 2003). Figure 5 shows the effect of strength of untreated and treated OPPF/epoxy composite with variation in filler volume fractions. From the figure, it is clear that the impact strength increased steadily with increase in filler concentration for both untreated and treated composites showing 20.04 KJ/m^2 and 23.69KJ/m^2 with 20 wt. % filler content respectively. However, there is a decline in inpact strength on further increase in filler content which was found to be more prominent in untreated fibre than the untreated ones.

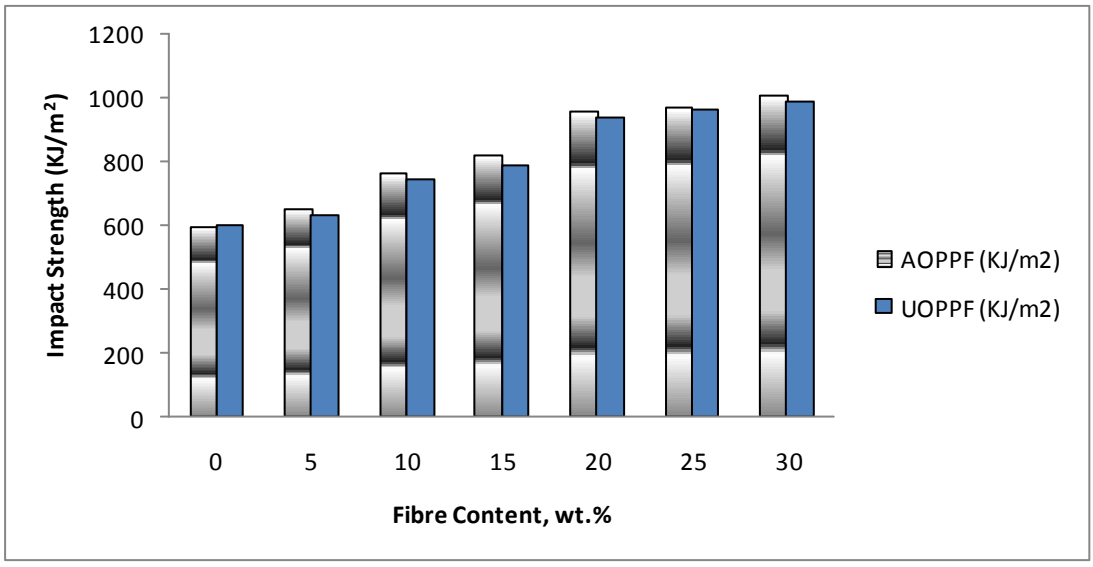

Fig. 5: Impact Strengths of untreated and treated OPPF/Epoxy composites

This may be assigned to the existence of weak interfacial interaction between the filler and matrix material for higher filler concentration beyond 20 wt. %. Bengtsson et al., (2007) reported that agro fibres act as stress concentrates in a polymer matrix thus reducing the crack initiation energy and consequently the impact strength of the composites. It has been reported that the impact strength of a composite is influenced by many factors including the matrix fracture, fibre/matrix debonding and fibre pull out (Zhong et al., (2007). Conversely, the treated OPPF/epoxy composites showed an improvement of the impact strength compared to the untreated OPPF/epoxy composites. The treatment of the OPPF improves the compatibility and promotes the ability to dissipate energy during fracture.

Hardness Properties

The variations of the hardness of composites as a function of fibre content are presented in Figure 6. In this study, hardness was a measure of resistance to indentation and the values got were used to estimate the mechanical strength of each composite. This shows that fibres that increase the modulus of composite are expected to increase the hardness of the composite because hardness is a function of the relative fibre volume and modulus.

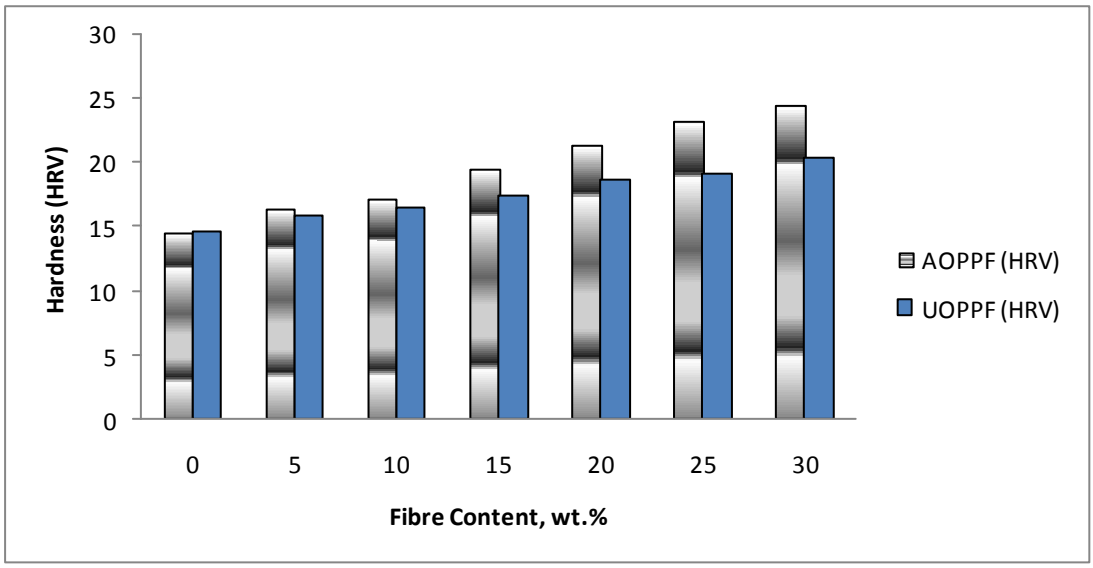

Fig. 6: Hardness properties of untreated and treated OPPF/Epoxy composites

The hardness of both untreated and treated OPPF/epoxy composites was found to increase progressively with increase in the fibre content. It is observed that the treated fibres showed better hardness properties than the untreated ones at all filler content investigated. The highest values of 20.306 HRV and 24.482 HRV at 30 wt. % filler content were obtained for untreated and treated composites respectively. This scenario could be linked to the better adhesion of the matrix to the fibre brought about by the fibre treatment with NaOH. Similar to our findings were the results of Idrus et al., (2011), Rahman et al., (2008) and Elvy et al., (1995). The addition of natural fibres to a polymer matrix has been seen to reduce flexibility of the resulting composite which in turn increases the stiffness. Rahman et al., (2010) reported that the hardness properties of a composite were enhanced as a result of the decrease of flexibility and increase of stiffness of a composite.

IV. CONCLUSION

Oil palm press fibre (OPPF) reinforced epoxy resin composites were prepared by varying fibre concentrations. The influence of alkali treatment of OPPF/epoxy composites on tensile, flexural, impact and hardness properties has been studied. Composites from treated OPP fibres had higher values of mechanical properties than those made from the untreated fibres. This is because the alkali treatment improves the interface adhesion characteristics of the fibre and matrix by removing hemicelluloses, lignin and other impurities from the fibres. In the present work, it is found that optimum values and significant improvements in tensile, flexural, and impact properties where at 20 wt. % filler content for treated composites. Generally, results indicated a better wettability of treated fibres with matrix, and corroborated the function of treated oil palm press fibre as not only filler but also as a reinforcing agent.

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Optimization of cassava root sieviate medium to an enriched animal feed by Aspergillus niger

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Abstract: - Optimization of the media components cassava root sieviate with Aspergellus Niger was carried out using Face-Centered Central Composite Design (FCCCD) of the Response Surface Methodology (RSM) and the responses were measured in terms of protein and crude fiber contents. Statistical Analysis (ANOVA) of the result showed that time and substrate concentration had effect on biodegraded cassava root sieviate (p-value was 0.00) ie. 0.00 < 0.05. The optimum value of enriched cassava root sieviate with Aspergellus Niger were found to be on 10 days (time) and 6g/10ml concentration resulting to 9.42% from 1.85% enrichment in protein content and degrading crude fiber to 8.38%, from 70.3%, thus indicating the potency of Aspergillus niger for the production of economical livestock feed from renewable source.

Keyword: - *Cassava root sieviate, Aspergillus niger, Optimization, animal feed, Biodegradation.*

I. INTRODUCTION

Cassava root sieviate is the by-product left after peeled cassava tubers have been processed to foo-foo. It contain high fiber and low protein content hence utilization in animal feeding is limited (lyayi and Tewe, 1994, Iyayi and Losel 2004). It also contains high amount of non-starch polysaccharides mostly of non-digestible carbohydrate such as cellulose, hemicelluloses, lignin which have a high water holding capacity. This was observed to be poorly depressed and bio-utilized by laying birds, which results in, digressed weight gain and reduced egg production (Aderemi et al, 2004). The digestibility of a feed for both ruminant and non-ruminant tend to decrease with crude fiber content. Typically, a 1% increase with crude fiber brings a 1% decrease in digestibility of ruminants and a 2% decrease for pigs (F.A.D, 1985, and Aderolu et al, 2002). Cassava root sieviate contains about 50% crude fiber, and 2.01% crude protein (Aderemi et al, 2004).

Nigeria is the world's largest producer of the crop, with an annual production capacity of 45million metric tones (www.foramfera.com/index.php/market). The processing of cassava into various uses generate large amount of wastes and environmental hazards of very serious concerns. These wastes generally cause air pollution and contamination of soil by release of cyanide because of fermentation, if not harnessed (FAO, 2001). In recent years, considerable emphasis has been placed on the improvement of fibrous crop by the growing of non-toxic fungi on straw. The ability of fungi to produce enzymes, which bring about catalytic transformations in the wide range of desirable reactions make them interesting to industrialists and agriculturists (Iyayi and Losel 1999). Microbial fermentation has been reported as an effective means of breaking down non-starch polysaccharides of agro-industrial wastes to increase their metabolizable energy and their nutritive value in general (Onilude, 1999).This research is very important because livestock feed were sourced from renewable and relatively inexpansive food materials such as agricultural by-product and waste, peel, seed, chaff and root sieviate.

Aspergillus niger is safe for industrial, medical and agricultural use. It is readily available and secretes enzymes such as lipases, cellulases, proteases, amylases and xylanases when grown on selected agro industrial wastes. (Schuster et al, 2002, Vande Vandervoort et al, 2004). This fungus is widely used industrially to produce various types of enzyme and citric acid pectinase, alpha galactasidase, and glucose oxidase, among others. It is used for waste management and bio transformation (Schuster et al, 2002 & Mbah, G. O. et al, 2013). Exploiting the above characteristics, the nutritional value of cassava root sieviate could be enhanced by optimizing the

media constituents through solid state fermentation (biodegradation) which is a better choice in the bio conversion of agro industrial wastes to animal feed considering the nature of feed.
Optimization of media composition is a vital tool to an efficient cell growth and improved secretion of various enzymes that help in degradation. Sugar syrup was added to provide more carbon which influence the secretion of enzymes by Aspergillus niger. Hence, optimization of media constituents will go a long way in improving yield and reducing cost of production. Central Composite Design (CCD) have been described as a statistical technique that is widely used for the optimization of medium composition for growth and metabolite.

In this study, Face-Centered Central Composite Design (FCCCD) was used to determine the influence of medium constituent and identify the optimum level of the constituent in enriching the nutritional value of cassava root sieviate to animal feed by Aspergillus niger.

II. MATERIALS AND METHODS

2.1 Aspergillus niger culture

The pure culture of Aspergillus niger was isolated from a bread sample spoilt by fungi using saboraud dextrose agar medium. Streak plate technique was employed for the isolation observing aseptic precautions. Incubation lasted for 72 hours at 30^oC

.

2.2 Preparation of cassava root sieviate sample

Cassava tubers were procured from a local farm at Agbogugu, Enugu, Nigeria. They were peeled and washed. The peeled cassava samples were fermented for 72hours and later sieved. After sieving the fermented cassava, the cassava root sieviate chips were sundried (Tewe 1992) and ground into fine powder using Disc Mill. The ground cassava root sieviate were stored in airtight container. The chemical composition of unfermented cassava root sieviate was analyzed and recorded, such as Dry Matter, crude fat, Crude fiber (AOAC 2000), crude protein, Hemicelluloses (AOAC, 1990) total CHO, cellulose (FAO 2000), Lignin, NDF, ADF, ADL (Vine Soest and Wine 1967, AOAC 1990).

2.3 Substrate preparation for solid state fermentation (Biodegradtion)

The Face-Centered Central Composite Design (FCCCD) under the response surface methodology was used to determine the influence of medium constituents in enriching the nutritional value of cassava root sieviate and to identify the optimum levels. Two independent variables namely time and substrate concentration were investigated at three levels (low, basal, high) coded as (-1,0,1). The detailed experimental designs were presented in Table 1.

Thirteen experiments with five replications at center points were studied. The fermentation media were varied at 2g, 4g and 6g in duplicates. Then each sample was mixed with 10ml of 25% sucrose solution containing the fungal biomass. The fermentation medium was prepared in Petridish and incubated at 30^0C for different fermentation periods of 6,8 and 10days. Two dependent variables: protein and crude fiber content serve as the responses, Y_i. A linear regression equation given below was used to determine the relationships that exist between dependent and independent variables.

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_{12} X_1 X_2 \ldots\ldots\ldots\ldots\ldots\ldots \quad 1$$

where Y is the dependent variable (protein and crude fibre content) X_1, and X_2 are independent variables (time and substrate concentration, β_o is the intercept term, β_1 and β_2 are the linear coefficients, β_{12} is the interaction coefficient.

III. RESULTS AND DISCUSSION

Table 1 summarizes the result obtained with the experimental design which was aimed at determining the conditions that favour maximum protein increase and maximum crude fiber degradation in cassava root seriate. Linear regression equation obtained from equation 1 and Table 1 for protein and fibre were fitted to the data model for predicting the responses as given below:

$$Y_{cp} = 6.86 + 1.285x_1 + 1.745x_2 + 0.2125x_1x_2 \ldots\ldots\ldots\ldots \quad 2$$

$$Y_{cf} = 20.27 - 5.91x_1 - 5.11x_2 - 0.0375x_1x_2 \ldots\ldots\ldots\ldots\ldots \quad 3$$

Table 1: FCCCD experimental design showing coded and actual valves with the experimental and predicted values for enrichment of cassava root sieviate

Run	Time (days) X_1	Conc. (g/mol) X_2	Crude Protein (%)		crude fibre (%)	
			Experimental	Predicted	Experimental	Predicted
1	8(0)	4(0)	7.21	6.86	20.50	20.27
2	6(-1)	2(-1)	3.62	4.04	30.50	31.24
3	10(+1)	2(-1)	5.77	6.19	18.85	19.52
4	8(0)	4(0)	7.21	6.86	20.50	20.27
5	8(0)	2(-1)	4.81	5.12	24.41	25.38
6	8(0)	6(+1)	8.83	8.61	14.70	15.16
7	6(-1)	4(0)	5.85	5.58	28.05	26.17
8	10(+1)	4(0)	8.41	8.15	16.10	14.37
9	8(0)	4(0)	7.21	6.86	20.50	20.27
10	6(-1)	6(-1)	6.42	7.11	20.10	21.10
11	10(+1)	6(+1)	9.42	10.10	8.30	9.22
12	8(0)	2(0)	7.21	6.86	20.50	20.27
13	8(0)	4(0)	7.21	6.86	20.50	20.27

Table 2:- Full design matrix and response result for the experiment variables

Standard	Run	X_1	X_2	X_1X_2	Y(CP)	Y(CF)
1	5	0	0	0	7.21	20.50
2	9	-1	-1	+1	3.62	30.50
3	1	+1	-1	-1	5.77	18.85
4	6	0	0	0	7.21	20.50
5	12	0	-1	0	4.81	24.41
6	10	0	+1	0	8.83	14.70
7	3	-1	0	0	5.85	28.05
8	4	+1	0	0	8.41	16.10
9	7	0	0	0	7.21	20.50
10	2	-1	+1	-1	6.42	20.10
11	13	+1	+1	1	9.42	8.30
12	8	0	0	0	7.21	20.50
13	11	0	0	0	7.21	20.50
Effect y (CF)		-11.8	-10.22	-0.075		20.27
Effect y (CP)		2.57	3.49	0.425	6.86	

From analysis of variance (ANOVA) significant difference was determined at $P \leq 0.05$.
Model of the analysis: $X_{ijk} = \mu + a_i + b_j + \boldsymbol{\lambda}_{ij} + e_{ijk}$
X_{ijk} = Content of biodegraded cassava peel and root sieviate taken from the substrate concentration of gm/10ml at different time interval.
μ = the grand mean
a_i = the ith effects of substrate concentration of gm/10ml on crude protein, crude fibre and total carbohydrate.
b_j = the jth effect of time.
$\boldsymbol{\lambda}_{ij}$ = the interaction between substrate concentration and time.
e_{ijk} = error associated in the observation.

TEST OF HYPOTHESIS
H_0 = Crude protein = crude fibre = Total CHO
H_1 = Crude protein ≠Crude fibre ≠ Total CHO
H_0 = Time has no effect on cassava peel.
H_1 = Time has effect on cassava peel.
H_0 = There is no interaction effect between time and substrate concentration
H_1 = There is interaction effect between time and substrate concentration.

TABLE 3: ANOVA Table for 2g/10ml conc. (CRS): Tests of Between-Subjects Effects

Dependent Variable: Content of biodegraded cassava root sieviate

Source	Type III sum of Square	df	Mean Square	F	Sig.
Corrected Model	2014.096[a]	8	251.762	17036.523	.000
Intercept	6190.877	1	6190.877	418931.550	.000
Concentration	1725.976	2	862.988	58397.686	A. 000
Ferment. time	156.288	2	78.144	5287.932	B. 000
Concentration x Ferment. time	131.832	4	32.958	2230.238	C. 000
Error	0.133	9	0.015		
Total	8205.106	18			
Corrected Total	2014.229	17			

a. R. Squared = 1.000 (Adjusted R Squared =1.000)

TABLE 4: ANOVA table for 4g/10ml conc. (CRS)

Source	Type II sum of Square	df	Mean Square	F	Sig.
Corrected Model	1255.201[a]	8	156.900	8286.978	.000
Intercept	5444.113	1	5444.113	287541.202	.000
Concentration	953.716	2	476.858	25186.149	A. 000
Ferment time	157.633	2	78.817	4162.853	B. 000
Concentration x Ferment time	143.852	4	35.963	1899.455	C. 000
Error	0.170	9	0.019		
Total	6699.485	18			
Corrected Total	1255.371	17			

a R. Squared = 1.000 (Adjusted R Squared =1.000)

TABLE 5: ANOVA table for 6g/10ml conc. (CRS) :Tests of Between-Subjects Effects

Dependent Variable: Content of biodegraded cassava root sieviate

Source	Type II sum of Square	df	Mean Square	F	Sig.
Corrected Model	503.382[a]	8	62.923	3816.067	.000
Intercept	2965.527	1	2965.527	179850.005	.000
Concentration	198.661	2	99.330	6024.082	A. 000
Ferment time	151.199	2	75.599	4584.867	B. 000
Concentration x Ferment time	153.522	4	38.381	2327.660	C. 000
Error	0.148	9	0.016		
Total	3469.057	18			
Corrected Total	503.530	17			

a. R Squared = 1.000 (Adjusted R. Squared = .999)

IV. DISCUSSION

4.1 Characterization Results

Presented in Table 1 are the FCCCD experimental design showing coded and actual values with the experimental and predicted values for enrichment of cassava root sieviate. The control values of crude protein and fiber for cassava root sieviate are 1.85% and 70.30%. The control value was gotten from preliminary analysis of unfermented cassava root sieviate. Table 2 showed the full design matrix and response result for the experimental variables. The highest crude protein and lowest fiber contents was observed at 6g/10ml at 10days for cassava root sieviate samples. These results were in line with Aderemi and Nworgu (2007) and Iyayi and Losel (2004) who observed the ability of Aspergillus niger to breakdown the fiber and increase protein content. The appearance of the mycelia of the fungi on the substrate after 48 hours was an indication that degradation has commenced. This was in line with Ofoya and Nwajiuba (1990) thus confirms suitable environmental conditions for the fungi.

The degradation of cassava root sieviate starts with the breakdown of polysaccharides into Oligosaccharides which can be hydrolyzed by glucosidase into their component monomer. The metabolism of these monomers can then give energy and carbon for the growth for the micro-organism as reported by Smith et al (1996). From this study, it was observed there was increase in protein content compared to undegraded CRS from 1.85 to 9.42%. This implied that Aspergillus niger has significance ($p<0.05$) effect on the protein content. This increase in the crude protein observed was probably due to the additional crude protein produced in the fungal mycelia (Onilude, 1994) and thus is influenced by carbon to nitrogen ratio, similar result had been reported by Abu (1997) using sweet potatoes in solid state fermentation. Also this result was in line with Iyayi and Losel (2001), who reported enriched protein of cassava peel and pulp with different fungi types.

The fiber component decreased over the period of biodegradation. The fungi secreted some enzymes (cellulose, fungal amylase, pectinase) on the substrate, resulting decreased fiber content. (Bolaski and Galantin 1976). Crude fiber decreased from 70.3% to 8.3% for CRS. This result here is in line with Chesson (1993) who reviewed the early claim that disruption of cell walls and their degradation by microorganism enzyme could be beneficial to host animal. He reported that the available cell wall carbohydrate was not attacked by digestive enzymes now seem wildly optimistic after biodegradation. He then stressed that total breakdown requires the action not only of the enzymes responsible for the primary attack on the cell wall polysaccharide and glucan hydrolases but also of a second set of glucosidases able to reduce oligasaccharides to their monomer components.

Table 6: Validation Of Developed Quadratic Model And Optimum Medium Constituents

Time (day)	Conc. (g/mol)	Crude protein			crude fiber		
		Predicted (%)	Experimental (%)	Error (%)	Predicted (%)	Experimental (%)	Error (%)
6	2g/mol	4.04	3.62	1.04%	31.24	30.50	9.98
10	2	6.19	5.77	6.78	20.27	18.85	3.03
8	4	006.86	7.21	4.85	19.52	20.50	3.43
8	6	8.61	8.83	2.49	9.22	14.70	0.00
10	6	10.10	9.42	6.73		8.30	2.37

$$\text{Error \%} = \frac{\text{predicted} - \text{experimental}}{\text{Predicted}} \times \frac{100}{1} \quad \ldots\ldots\ldots\ldots \quad 4$$

Five combinations of the two independent valuable were experimented and the observed results were compared with the predicted results. The error analysis was computed to determine the closeness between the predicted and the observed results.

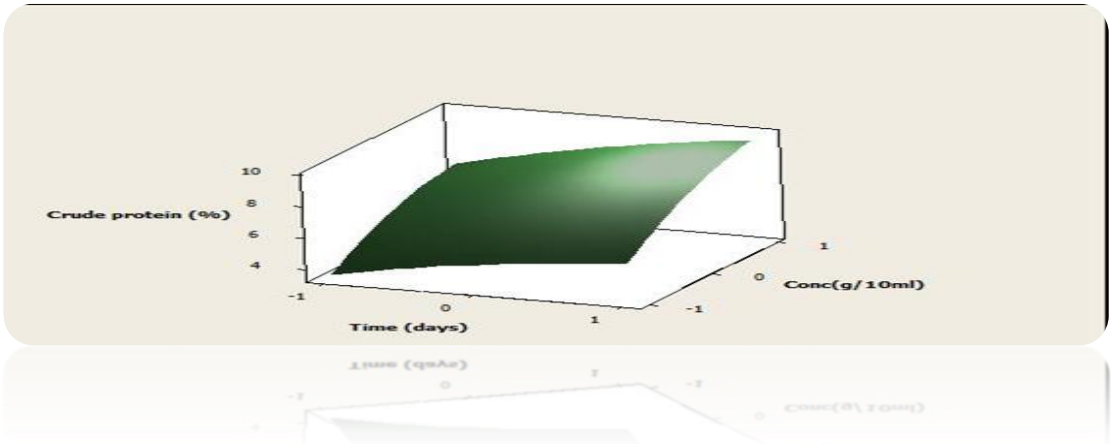

Fig. 1: RS plot of crude protein for cassava root sieviate

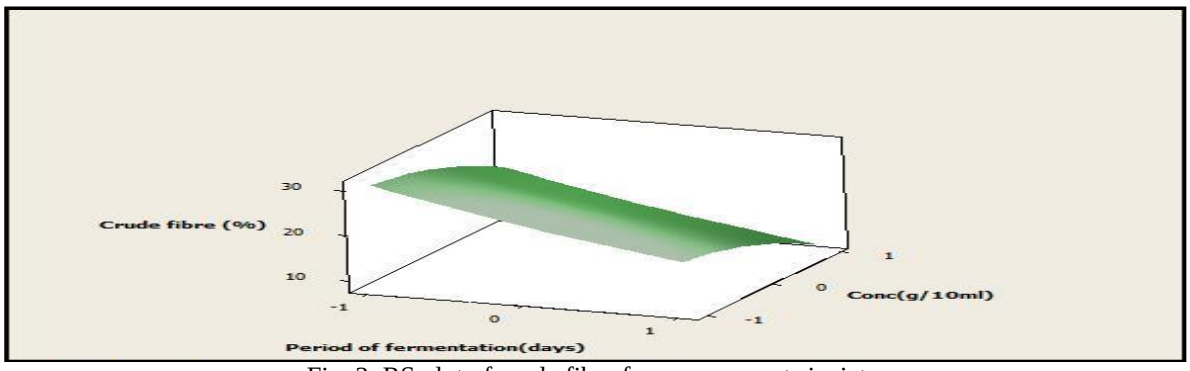

Fig. 2: RS plot of crude fiber for cassava root sieviate

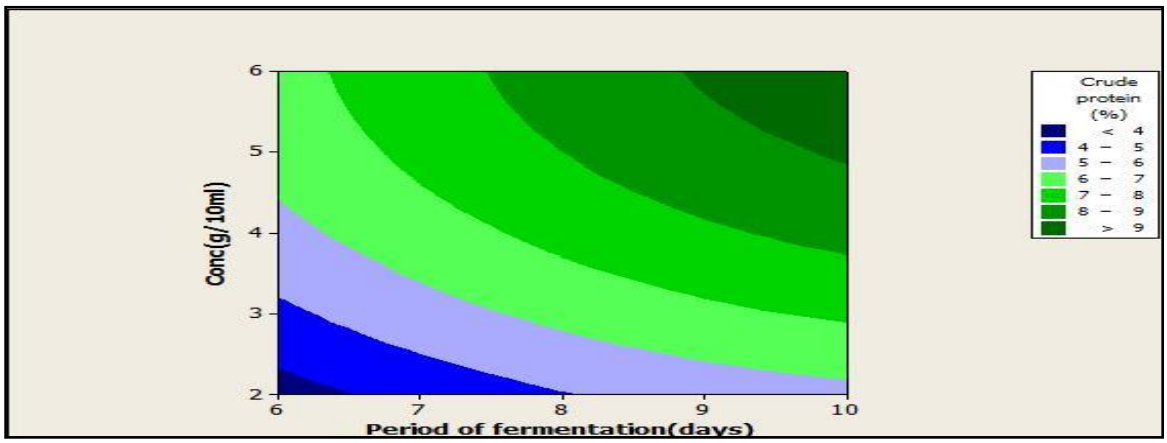

Fig. 3: Contour plot of crude protein for cassava root sieviate

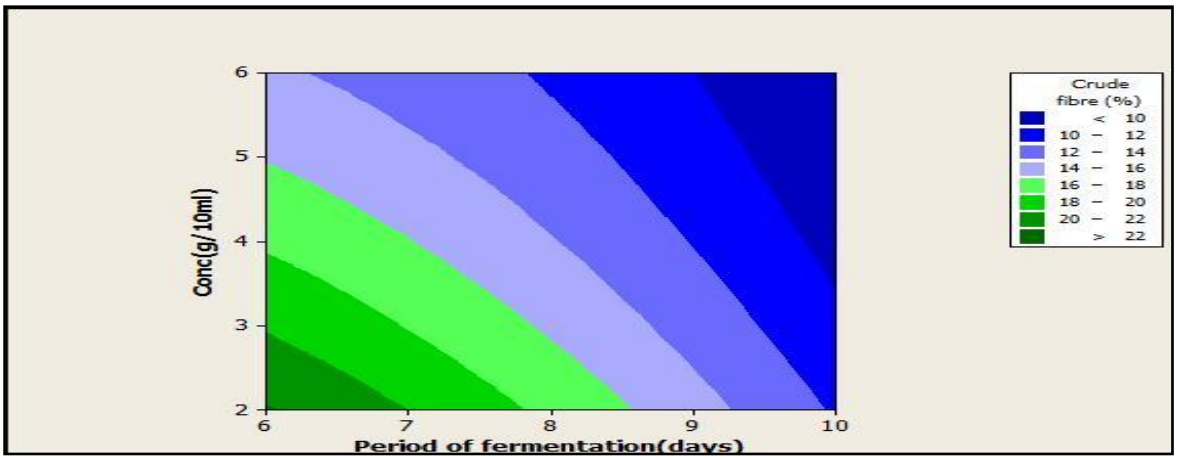

Fig. 4: Contour plot of crude fiber for cassava root sieviate

4.2 Response Surface Plot and Contour Plots

From response surface plot (Fig. 1 – 4), the crude protein content increases with increasing time and substrate concentration.

The corresponding contour plots show considerable curvatures for the figures, implying that the two interacting factors were interdependent. In other words, there were significant interactive effects on (CRS) between time and substrate concentration. It is pertinent to note that the values of output responses are tied to the intensity of the color of the plots. Hence, for the response surface plots and their corresponding contours, the best results are 6g/10ml concentration and 10 days.

4.3 Statistical Results

Biodegradation time and substrate concentration were validated by means of ANOVA to assess the goodness of fit. The test of hypothesis states that if P-value is less than 0.05, accept H_1, but if greater than 0.05, accept H_o(Myers and Montgomery,2002).

From the tables 3,4 and5 (CRS),,t P-value for substrate concentration, time and interaction effect was 0.00 which is less than 0.05 (0.00 < 0.05). It showed that time and substrate concentrate had effect on biodegraded CRS, and there was significant interaction. The fact that ANOVA report gave high R^2 value as 1.0, means that the correlation is perfect and model is adequate.

V. CONCLUSION

The optimum values of enriched cassava root sieviate with Aspergillus niger were found to be on 10 days and 6g/10ml conc., resulting in 9.42% enrichment in protein content and 8.30% crude fibre degradation in cassava root seriate. This suggest possible solution to utilization of cassava root seriate as animal feed and also solve environmental problem caused by their improper disposal.

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A Genetic Algorithm Based Approach for Segmentingand Identifying Defects in Glass Bottles

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Abstract: -This work mainly aims at designing and developing a suitable tool for identifying defects in glass bottles through visual inspection based on Segmentation algorithm. The defect identification is done in three stages. These are Image acquisition, Pre-processing and filtering and Segmentation. In the Image acquisition stage, samples of real time images are taken and are converted into 512x512 monochrome images. In the Pre-processing and filtering stage, the image acquired is passed through median filters. The Proposed filter is Modified Decision Based Unsymmetric Trimmed Median Filter (MDBUTMF) because it produces a high value of Peak to Signal Ratio (PSNR) of 60-75db.The de-noised images is further sent to the third stage which is Segmentation. In this work, Segmentation is done using Genetic Algorithm (GA). The defects in the images are segmented and highlighted. Thus the areas of defects are spotted out. The Genetic segmentation has produced high Sensitivity, high Specificity and high Accuracy of 92%, 93% and 93% respectively. Thus the Proposed work produced effective results and hence this tool shall be useful for food processing industries for the Quality Inspection of the glass bottles.

Keywords: - *Genetic algorithm, Segmentation, defects in glass, Modified decision based unsymmetric trimmed median filter, computer aided vision*

I. INTRODUCTION

The Term Digital Image Processing refers to the processing of a two dimensional picture by a digital Computer. A digital Image is an array of real or complex numbers represented by a finite number of bits. An image given in the form of a transparency, slide, photograph or an X-ray is first digitized and stored as a matrix of binary digits in computer memory. Importance and necessity of digital image processing stems from two principal application areas are 1. Improvement of pictorial information for human interpretation.2. Processing of scene data for autonomous machine perception. Digital Image processing has a broad spectrum of applications such as remote sensing, image storage and transmission for business applications, medical imaging,acousticimaging and automated inspection of industrial parts. Images required by satellites are useful in tracking of earth resources, geographical mapping, prediction of agricultural crops, urban growth, weather, flood and fire control.

Quality is a very important factor in Glass industries that has to be considered during the production of glass bottles. During different processing stages,there are possibilities of occurring cracks or breaks or bubbles or accodomation of any other external materials such as hair, dust etc. on the glass surface. Here the main defect under consideration is the accommodation of external materials on the surface of the glass bottle.

1.1 Components of Image Processing

1.1.1 Image Acquisition

Image acquisition is the process of capturing the images. Image capture devices or sensors are used to view and reproduce images of the sample. These devices include scanners, ultrasound, X-ray and near infrared spectroscopy. In camera vision most commonly used is CCD (charge coupled device) i.e. Camera. However recent developments in technologies have seen an adoption of digital camera which in turn reduces the additional component required to convert images taken by photographic and CCD cameras. Images captured by all of the above 2 devices maintain the features of the images with little noise due to its variable resolution. Its name specifies definition. To get any image from any source especially hardware based any source is called as image acquisition in the image processing because without image receiving/acquisition, the processing on the image is not possible. It is the first step in the work flow. It is created typically from a physical scene. The term assumed to imply or include processing, compression, storage, printing and display of such image.

1.1.2 Image Pre-Processing

This mainly refers to initial processing of raw image. The Image captured through sensors is transferred in to computer. These are then converted in to digital image. Digital Images are digits which are readable by computer and are converted in to tiny dots or picture elements representing the real objects. In some cases pre-processing are done to improve the image quality by removing the undesired distortions referred as noise. Each or a combination of the digits of the image in digital form represents a small partition of the image called picture element(Pixel).Objects are described as black and white picture which are represented by digits ranging from 0-255 where 0 is black and 255 is white. Each pixel in coloured Image is represented by 3 digits RGB (Red, Green, Blue) components with each being (0 to 255) darkest to lightest RGB. An arrangement of these digits in row-column format gives a representation of the image. With this arrangement image analysis can be done using matrix theory and other mathematical techniques

1.1.3 Segmentation

Image segmentation is a process of cutting adding and feature analysis of images aimed at dividing an image in to regions that have a strong co-relation with objects or area of interest using the principal of matrix analysis. Segmentation can be achieved through the following techniques such as Thresh holding, Edge based segmentation, Region based segmentation. Thresholding is a process where only the dark region of interest ,the other regions are converted in to background colours in the threshold image before further processing. This process is useful in colour 3 (Maturity) and feature based (Defect and Damage detection) sorting. Edge based segmentation relies on detection by edge to edge operators, which detects discontinuities in gray level, the pixel colour, texture etc. Edge detection is useful in shape and size sorting. Region based segmentation involves the grouping together and extraction of similar pixels to form region representing single objects with in the image. In this process, the other regions are deleted leaving only the feature of interest.

1.1.4 Components of Computer aided vision

Fig 1 shows the components of the computer vision system that can be used to find out the defective portion of the material coming under the test which highlights the defects.

The hardware configuration of computer vision systems is relatively standard. Typically a computer vision system consists of

- An illumination device, which illuminates the sample under test.
- A solid-state charged coupled device array camera, to acquire an image.A frame grabber, to perform the A/D (Analog to Digital) conversion of scan lines in to picture elements or pixels digitized in an N row by M column Image.
- A personal computer or microprocessor system, to provide disk storage of imagesandcomputational capability with software and specific applicationprograms

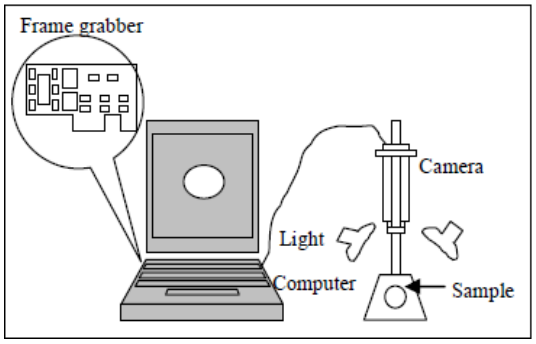

Figure 1 Components of computer aided vision system

II. INSPECTION OF GLASS BOTTLES THROUGHIMAGE PROCESSING

The Proposed block diagram for the inspection for the inspection of glass bottles can be shown below.

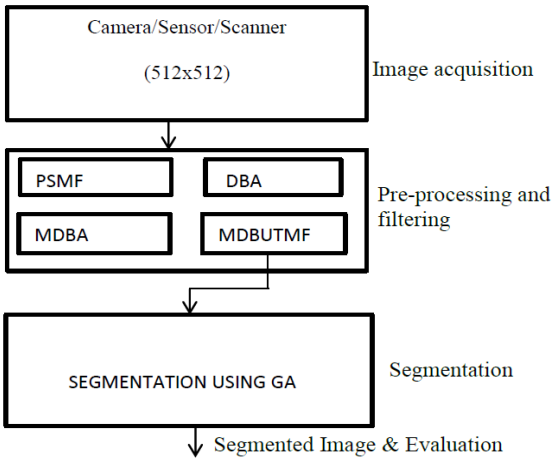

Fig 2 Inspection of glass bottles through Image processing

With reference to the figure 2, After the Image acquisition process through camera/scanners, it is then subjected to the following stages[9]

1.2Filtering Stage

Noise is any undesirable signal. Noise is everywhere and thus we have to learn to live with it. Noise gets introduced into the data via any electrical system used for storage, transmission, and/or processing. Filtering is perhaps the most fundamental operation of image processing and computer vision. In the broadest sense of the term filtering, the value of the filtered image at a given location is a function of the values of the input image in a small neighbourhood of the same location. In a wide variety of image processing applications, itis necessary to smooth an image while preserving itsedges. The different filters used are…

2.1.1 PSMF-Progressive switched median filter

A new median-based filter, Progressive Switching Median (PSM) filter, is proposed to restore images corrupted by salt-pepper impulse noise. The algorithm is developed by the following two main points: 1) switching scheme-an impulse detection algorithm is used before filtering, thus only a proportion of all the pixels will be filtered; and 2) progressive methods-both the impulse detection and the noise filtering procedures are progressively applied through several iterations. Simulation results demonstrate that the proposed algorithm is better than traditional median-based filters and is particularly effective for the cases where the images are very highly corrupted.[2]

2.1.2 DBA-Decision based Algorithm

It is a fast and efficient decision-based algorithm for the restoration of images that are highly corrupted by Salt-and-Pepper noise. The new algorithm utilizes previously processed neighbouring pixel values to get better image quality than the one utilizing only the just previously processed pixel value. The proposed algorithm is faster and also produces better result than a Standard Median Filter (SMF), Adaptive Median Filters (AMF), Cascade and Recursive non-linear filters. The proposed method removes only the noisy pixel either by the median value or by the mean of the previously processed neighbouring pixel values. Different images have been tested by using the proposed algorithm (PA) and found to produce better PSNR and SSIM values.

2.1.3 MDBA-Modified Decision Based BinaryAlgorithm

It is a modification applied to DBA. The first phase is a noise detection phase where a nonlinear decision based algorithm is used to detect impulse noise pixels. The second is a noise filtering phase where a new algorithm based on performing vector median first in RGB. The results of simulations performed on a set of standard test images on a wide range of noise corruption show that the proposed method is capable of detecting all the impulse noise pixels with almost zero false positive rates and removes noise while retaining finer image details.Proposed filter

2.1.4 MDBUTMF-Modified Decision Based Unsymmetric Trimmed Median filter

The Modified Decision Based Unsymmetric Trimmed Median Filter (MDBUTMF) algorithm processes the images by first detecting the impulse noise. The processing pixel is checked whether it is noisy or noisy free. That is, if the processing pixel lies between maximum and minimum gray level values then it is noise free pixel, it is left unchanged. If the processing pixel takes the maximum or minimum gray level then it is noisy pixel which is processed by MDBUTMF. In this the noise free and noisy pixels are classified based on empirical multiple threshold values. Then the median filtering technique is applied. So that noise free pixels are getting preserved and only noisy 30 pixels get restored. The proposed Modified Decision Based Un symmetric Trimmed Median Filter (MDBUTMF) algorithm removes this drawback at high noise density and gives better Peak Signal-to-Noise Ratio (PSNR) and Image Enhancement Factor (IEF) values than the existing algorithm.[10]

2.1.4.1 Proposed Algorithm

The proposed Modified Decision Based Un symmetric Trimmed Median Filter (MDBUTMF) algorithm processes the corrupted images by first detecting the impulse noise. The processing pixel is checked whether it is noisy or noisy free. That is, if the processing pixel lies between maximum and minimum gray level values then it is noise free pixel, it is left unchanged. If the processing pixel takes the maximum or minimum gray level then it is noisy pixel which is processed by MDBUTMF. The steps of the MDBUTMF are elucidated as follows

The algorithm includes

Step 1: Select 2-D window of size 3 3. Assume that the pixel being processed is p_{ij}.

Step 2: If then is an uncorrupted pixel and its value is left unchanged.

Step 3: If or then is a corrupted pixel then two cases are possible as given in Case i) and ii).

Case i): If the selected window contains all the elements as 0's and 255's. Then replace with the mean of the element of window.

Case ii)**:** If the selected window contains not all elements as 0's and 255's. Then eliminate 255's and 0's and find the median value of the remaining elements. Replace with the median value.

Step 4: Repeat steps 1 to 3 until all the pixels in the entire image are processed

A small modification is made to this algorithm as follows

- If the value of the last processed pixel is not 0 or 255, then the current pixel is considered as a noisy pixel. However in this case, simply using the last processed pixel to replace the noise pixel may not be consistent with the property of the local region.
- In order to ensure the preservation of fine details and textures, the proposed method first checks theproperty of the region defined by a window of size 3x3. If a noise-free median is found in the neighbourhood defined by this processing window, then it can be said that, replacing the noise pixel with the last processed pixel value will result smooth transition. Else, the window size is increased to 5x5. When a noise-free median is found in the larger window (5x5), the noise pixel is replaced by the last processed pixel. Otherwise, the noise pixel is replaced by the mode of the local neighbourhood.
- On the other hand, if the value of the last processed pixel is 0 or 255, then the local region is considered to have the maximum or minimum value in the dynamic range as a property of the original image. In this case, the mode of the local 3×3 neighbourhood is used as the correction term. The use of mode in this stage facilitates preserving smooth transitions in the restored image.

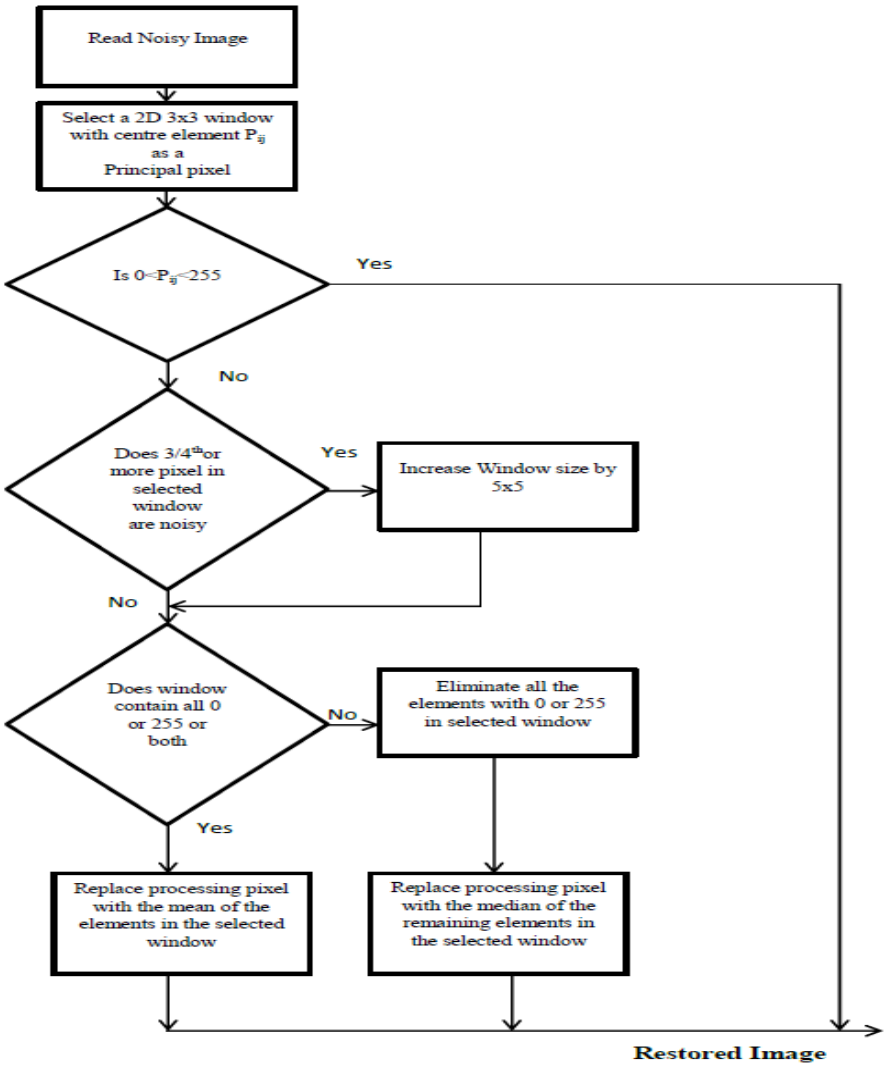

Fig.3 Flowchart of MDBUTMF

Noise %	PEAK SIGNAL TO NOISE RATIO			
	PSMF	DBA	MDBA	MDBUTMF(Proposed Filter)
0	82.13	82.13	39.85	77.29
10	53.14	53.14	39.86	63.84
20	49.71	49.71	39.85	60.28
30	47.55	47.55	39.86	58.42
40	46.46	46.46	39.86	54.45
50	46.31	46.31	39.86	50.56
60	58.07	58.07	39.87	46.32
70	34.44	39.88	34.44	42.68
80	32.25	32.25	39.92	38.47
90	30.56	30.56	40.02	34.21
100	29.18	29.18	34.51	29.17

Fig.4 Comparison chart between various filters based on PSNR

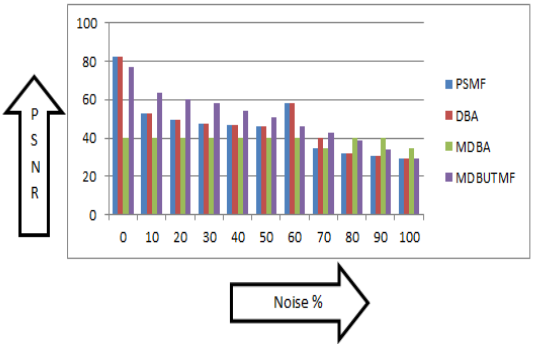

Fig.5 Graphical chart between various filters based on PSNR

III. SEGMENTATION USING GENETIC ALGORITHM

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse.Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

2.2.1 Genetic algorithm

In a genetic algorithm, a population of candidate solutions (called individuals, creatures, or phenotypes to an optimization problem is evolved toward better solutions. Each candidate solution has a set of properties (its chromosomes or genotype) which can be mutated and altered; traditionally, solutions are represented in binary as strings of 0s and 1s, but other encodings are also possible.

The evolution usually starts from a population of randomly generated individuals, and is an iterative process, with the population in each iteration called. a generation. In each generation, the fitness of every individual in the population is evaluated; the fitness is usually the value of the objective function in the optimization problem being solved. The more fit individuals are stochastically selected from the current population, and each individual's genome is modified (recombined and possibly randomly mutated) to form a new generation. The new generation of candidate solutions is then used in the next iteration of the algorithm. Commonly, the algorithm terminates when either a maximum number of generations has been produced, or a satisfactory fitness level has been reached for the population.

A typical genetic algorithm requires:

1. a genetic representation of the solution domain,
2. a fitness function to evaluate the solution domain.

2.2.2 Image Segmentation using Genetic Algorithm

The aim of segmentation is to obtain a new image in which it is easy to detect regions of interest, localize objects, or determine characteristic features such as edges. As a result, the image obtained by the segmentation process is a collection of disjoint regions covering the entire image whereby all the pixels of a particular region share some characteristic or property such as colour, intensity, or texture.

After the segmentation process, in order to access its result, the evaluation parameters such as Sensitivity, Specificity and accuracy have been calculated. They are calculated on the basis of TP, TN, FP and FN. They can be given by:

$$\text{Sensitivity} = \left(\frac{TP}{TP+TN}\right) * 100\% \quad \ldots\ldots\ldots\ldots\ldots (3)$$

$$\text{Specificity} = \left(\frac{TN}{TP+TN}\right) * 100\% \quad \ldots\ldots\ldots\ldots\ldots (4)$$

$$\text{Accuaracy} = \left(\frac{TP+TN}{TP+FN+TN+FP}\right) * 100\% \ldots\ldots\ldots\ldots (5)$$

The objective function is given by

value=Minimise((-x(1).*sin(abs(x(1)).^0.5)-
x(2).*sin(abs(x(2)).^0.5))…….. (6)

Here the lower band limits are (- 500 <obj<-500). The upper band limits are 500 <obj<500.

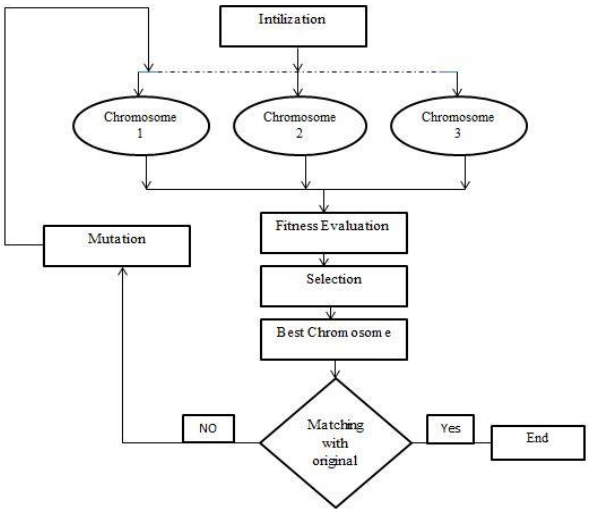

Fig.6 Proposed Flowchart of Image segmentation

- In this GA, the genes (pixels) from the denoised image are represented in binary form (chromosomes).
- Chromosomes thus obtained and the fitness evaluations of these chromosomes are done.
- Based upon the bounds defined in the GA, the suitable field is selected and the best chromosomes are taken
- A Comparison with the parent image is being done and the areas if match with the defined original pixels are turned to black.
- If it does not match, next chromosome is taken and same process is repeated. Hence the defective portion of the image is spotted out as white area

IV. RESULTS AND DISUSSIONS

A sample of 43 images has been taken. Mainly the images taken consist of the side view of the glass bottles. In this sample images the main objective is to segment those areas which seems to be defective by means of genetic algorithm. The images are mainly captured through camera at a distance of approximately 50 cm and are taken under proper illumination. These images taken contain defective bottles as well as non-defective bottles. A defect that will be associated with the glass bottle defect , or any other extra particles sticked on bottles, fine granules of dust on surface, hair or any other third party granules etc.

The images passed through the four different filters acquired a satisfied PSNR values. Salt and Pepper noise is the main noise that are considered here because it is the noise that are mainly added in the real time system. Suitable percentage of noise can be added manually and depending upon the filter efficiency it will de-noise. Mainly four filters are taken for the de-noising purpose The proposed filter MDBUTMF-Modified decision based unsymmetrical Trimmed median filter processed a high value of PSNR as compared to the existing other advanced filters PSMF,DBA and MDBA. The MDBA filter even though produced a low value of PSNR when compared to the proposed filter, it maintained an average constant range of PSNR value when subjected to the different variations in noise. For the DBA and the PSMF filter for a zero percentage of the noise, the PSNR values were high as compared to the other filters. But as the noise percentage increased, the PSNR value for the proposed filter MDBUTMF became high and stood at the top as compared to the other filters. The image passed through the proposed filter MDBUTMF is subjected to genetic algorithm. The genetic algorithm mainly concentrates on the pixel and threshold values defined. The main requirement for applying genetic algorithm is that the problem domain has to be converted to a mathematical language and hence a fitness function is defined for the image taken such that genetic algorithm can be applied to those image.

A pixel by pixel comparison is being carried out and the pixels that violate the threshold will be considered for the optimisation. The final result obtained after the Segmentation is mainly the calculation of TP, TN, FP and FN. All these parameters are evaluated and calculated for the algorithm. These parameters will determine the overall sensitivity, specificity and segmentation accuracy of the algorithm. These parameters will be used to compare with the results of the algorithms taken for the comparison purpose and finally a ROC curve will be plotted that relates the different algorithms in terms of their Specificity, Sensitivity and accuracy.[7]

Fig.7 Segmentation through Genetic algorithm

The Image filterd through MDBUTMF is subjected to segmentation using Genetic algorithm and thus found out areas of the defective portion of the glass bottle as shown in Fig. 7 which corressponds to hair,dust etc.The Sensitivity ,Specificity,accuracy has been found out.

Sensitivity =92.31%
Specificity =93.33%
Accuracy = 92.86%

FOR 10% of SALT AND PEPPER NOISE						
SL NO.	IMAGES	NOISY IMAGE	MDBUTMF IMAGE	MDBUTMF PSNR	MDBUTMF MSE	SEGMENTED IMAGE
1				65.1	0.02	
2				68.92	0.01	
3				71.7	0	
4				73.51	0	
5				74.64	0	
6				64.79	0.03	
7				67.5	0.01	

Fig.8 Segmentation on various glass images through GA

V. CONCLUSION

The segmentation using Genetic algorithm generates TP,FP,TN and FN values of the segmented image.Using the values obtained the Sensitivity,Specitivity and Accuracy is calculated.The Proposed filter MDBUTMF performs a smooth functioning of the salt and pepper noise that will be added in the real time.Compared to existing segmentation methods,Genetic algorithm shows more efficiency in segmenting and evaluation of the Image.Thus using this algorithm the defective portion of the glass bottle is highlighted and thus the area of defect is being found out.

The Proposed filter is Modified Decision Based Unsymmetric Trimmed Median Filter(MDBUTMF) because it produced a high value of Peak to Signal Ratio(PSNR) of 60-75db.

The defects in the images are segmented and highlighted. Thus the areas of defects are spotted out. The Genetic segmentation has produced Sensitivity, Specificity and Accuracy of 92%, 93% and 93% respectively. Thus the Proposed work produced effective results and hence this tool can be used for food processing industries for the Quality inspection of the Glass bottles and thus the productivity can be increased.

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A Comparative Analysis of Modulus of Rupture and Splitting Tensile Strength of Recycled Aggregate Concrete

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Abstract: **-** In this experimental investigation, an attempt is made to report the comparative analysis of the modulus of rupture and the splitting tensile strength of recycled aggregate concrete. The two properties are usually used to estimate the tensile strength of concrete; however, they don't usually yield the same results hence need to investigate each of the properties. Taguchi optimization technique was employed to reduce the number of trials needed to get the results. The results showed that the splitting tensile strength ranges between 60-80% of the modulus of rupture which is also known as the flexural strength.

Keywords: **-** *Splitting Tensile Strength, Modulus of Rupture, Recycled Aggregate Concrete.*

I. INTRODUCTION

The modulus of rupture and splitting tensile strength are usually used to estimate the tensile strength of concrete although they don't usually yield the same results. Rohi [1] reported that the splitting tensile strength was approximately between 60-65% of modulus of rupture. Troxell [2] also reported splitting tensile strength ranging between 50-75% of modulus of rupture. Meanwhile, several works found no significant difference in modulus of rupture of conventional concrete and recycled aggregate concrete made with coarse recycled aggregate and natural sand;([3]- [5]).

Katz [6] concluded in his work that the ratio of the flexural and the splitting strengths to the compressive strength is in the range of 16–23% and 9–13%, respectively.

II. MATERIALS AND METHODS

Modulus of Rupture

Tests to determine the modulus of rupture were performed on 100 x 100 x 400 mm prisms according to GB/T 50081[7] using the three-point loading method. The samples were prepared under standard laboratory conditions. The modulus of rupture of concrete was determined using a three-point loading flexural testing machine with a loading capacity of 300 KN. The loading rate for the modulus of rupture was 0.5-0.8 MPa/s.
The modulus of rupture was then calculated by the following equation;

$f_{f=} Fl/bd^2$ (1)

where:
$f_{f=}$ modulus of rupture, MPa
F = maximum applied load indicated by the testing machine in kN
l= span length, in mm
b = average width of specimen, in mm
d = average depth of specimen, in mm

If fracture initiates in the tension surface (i.e., the bottom surface) outside the middle third of the beam by not more than 5% of the span length, the modulus of rupture was calculated as follows:

$f_f = 3Fa / bd^2$ (2)

Where:

a = average distance between the line of fracture and the nearest support measured on the tension surface of the beam, in mm.

When the fracture occurs in the tension surface outside of the middle third of the span length by more than 5% of the span length, the results of the test was discarded. Fig. 1a –c, show the flexural test set-up.

Splitting Tensile Strength

The splitting tensile strength of concrete was measured by the application of a diametral compressive force on a cube concrete specimen placed with its axis horizontal between the platens of a testing machine. All the cubes were also prepared under standard laboratory conditions. This test was performed to compare with the modulus of rupture. It was also conducted in accordance with GB/T 50081[7] .The splitting tensile strength of the specimen was then calculated as follows:

$$f_t = 2F/\pi A = 0.637F/A \quad (3)$$

Where:
f_t = splitting tensile strength, in kPa
F = maximum applied load indicated by the testing machine, in KN
A = Area of the specimen
The set-up is shown in Fig. 2. Taguchi orthogonal array L16 (4^5 Series) as proposed by Taguchi [8] was used to proportion all the tested samples. The results were analyzed and Regression analyses were performed on the modulus of rupture and splitting tensile strength results obtained in this study using the following formula:

$$f_t = \mu(f_f) \quad (4)$$

Where, μ is coefficient that can be obtained from regression analysis

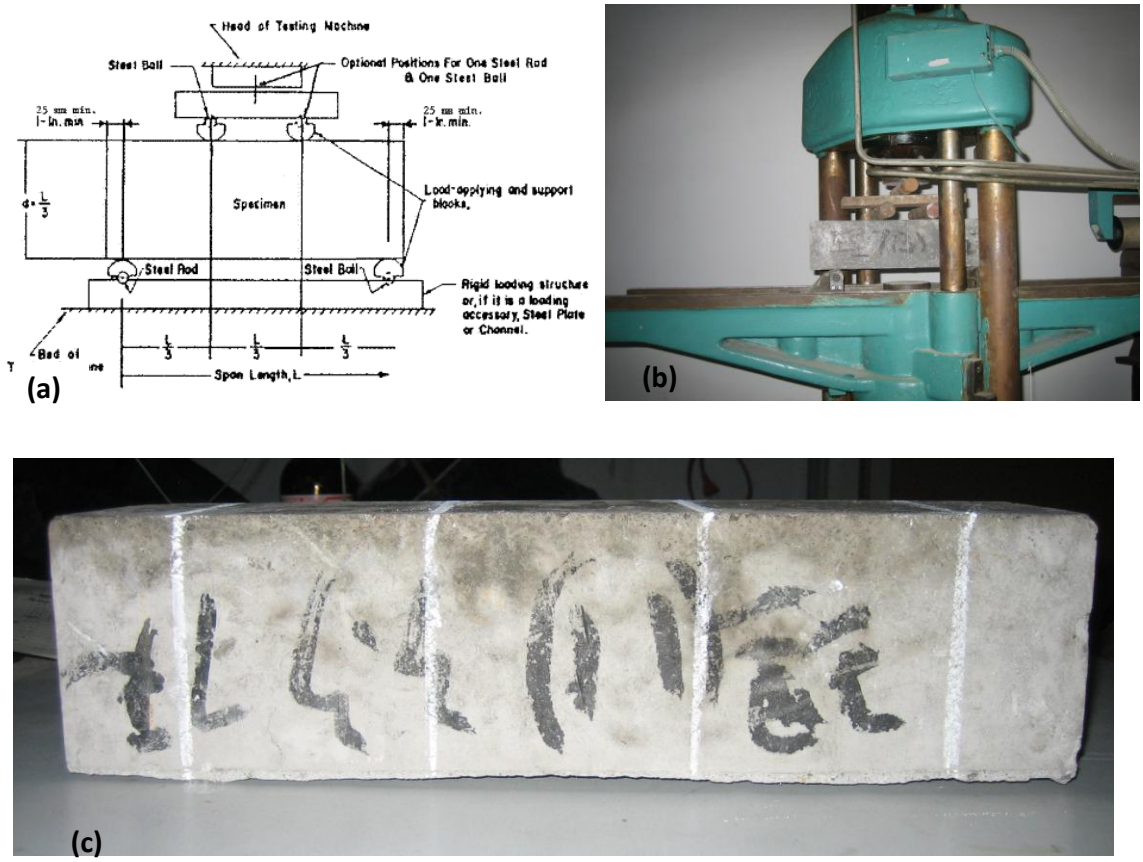

Fig. 1. Modulus of Rupture test set-up and beam sample. (a) General set-up for the three-point loading method (b) Three-point loading flexural testing device and set-up. (c) Flexural test beam.

Fig. 2. Test set-up for splitting tensile strength

III. RESULTS AND DISCUSSIONS

Modulus of Rupture (Flexural Strength)

Tables 1through 3 give all the physical properties and analysis for modulus of rupture for the mixes. As can be seen from the Table 1, the rate of development of strength was high at early ages but greatly reduced at later ages. This increase in strength at early ages and decrease at later ages may be attributed to the rough–textured recycled aggregates. According to Mehta[9] , a stronger physical bond between the rough-textured aggregate and the cement paste is responsible for the increased tensile strength at early ages. At later ages, however ,when chemical interaction between the aggregates and the paste begins to take effect, the effects of the surface texture may not be as important. The S/N ratio and the significance of the three factors follow the same trend (Tables 1 and 2).

Splitting Tensile Strength

The splitting tensile strengths results are given in Tables 4-6. As can be seen in Table 4, there is a sharp reduction in rate of strength development at later ages, the same explanation that was given for modulus of rupture applies to this trend as well. It should however be noted that at early ages, where there is a higher percentage of recycled aggregates, there was also a higher tensile strength compared to other mixes containing recycled aggregates. Also, for concrete containing high proportions of recycled aggregates the failure of the specimens occurred along the recycled aggregates having been the weakest point, Fig. 3 shows the failure pattern. The S/N ration also has the same pattern with previous results for modulus of rupture, and the same trend is observed in the analysis of variance along with the orthogonal analysis (Tables 5 and 6). Figure 4 also presents the summary of the relationship between modulus of rupture and splitting tensile strength, from the graph, given the same material and laboratory conditions the modulus of rupture is generally higher than the splitting tensile strength.

The Analysis of Variance (ANOVA) for the two properties also showed that significant factors in the development of both flexural and splitting tensile strengths are the water-cement ratios and recycled aggregate contents. Addition of fly-ash does not have a substantial effect on the final results.

Table 1 L16 (4^5 Series) orthogonal arrays used and test results for flexural strength

Test No.	Average flexural strength F_f(Mpa)			% Strength increment		S/N ratio for average flexural strength		
	7-Day	28-Day	90-Day	7-28 Days	28-90 Days	7-Day	28-Day	90-Day
1	2.48	4.09	4.36	64.92	6.6	7.9	12.23	12.79
2	2.42	3.87	4.31	59.92	11.37	7.65	11.73	12.68
3	2.31	3.74	4.2	61.9	12.3	7.21	11.45	12.46
4	2.26	3.72	4.1	64.6	10.22	7.08	11.39	12.25
5	2.11	3.72	4.06	76.3	9.14	6.48	11.4	12.15
6	2.05	3.31	3.93	61.46	18.73	6.17	10.36	11.85
7	2.04	3.26	3.9	59.8	19.63	6.2	10.24	11.81
S	1.92	3.22	3.87	67.71	20.19	5.65	10.11	11.73
9	1.89	3.20	3.34	69.31	4.37	5.54	10.01	10.37
10	1.89	2.97	3.26	57.14	9.76	5.52	9.35	10.15
11	1.86	2.92	3.03	56.99	3.77	5.39	9.3	9.62
12	1.88	2.83	2.96	50.53	4.59	5.45	9	9.32
13	1.88	3.04	2.95	61.7	-2.96	5.45	9.65	9.4
14	1.76	2.87	2.79	63.07	-2.79	4.86	9.14	8.88
15	1.69	2.83	2.81	67.46	-0.71	4.3	9.01	8.92
16	1.6	2.74	2.8	71.25	2.19	4.04	8.73	8.89

Table 2 Analysis of variance (ANOVA) for flexural strength

	Factor	DOF	SS	Contribution factors of SS (%)	F ratio	Prob >F
7-Day	W/C	3	0.88	89.80	103.54	<.0001*
	RA	3	0.07	7.14	7.96	0.0163*
	FA	3	0.01	1.02	0.86	0.5104
	Error	6	0.02	2.04	Prob >F	-
	Total	**15**	**0.98**	**100**	**-**	**0.0001***
28-Day	W/C	3	2.40	86.64	317.76	<.0001*
	RA	3	0.34	12.27	45.13	0.0002*
	FA	3	0.01	0.36	1.15	0.4031
	Error	6	0.02	0.72	Prob >F	-
	Total	**15**	**2.77**	**100**	**-**	**<.0001***
90-Day	W/C	3	5.19	96.65	289.80	<.0001*
	RA	3	0.14	2.61	7.97	0.0163*
	FA	3	0.00	0.00	0.1	0.9600
	Error	6	0.04	0.74	Prob >F	-
	Total	**15**	**5.37**	**100**	**-**	**<.0001***

Table 3 L16 (4^5 Series) orthogonal analysis for flexural strength

	Factors	E1	E2	E3	E4	R
7- Day flexural Strength f_f(Mpa)	W/C	2.37	2.03	1.88	1.74	0.63
	RA	2.09	2.03	1.98	1.92	0.17
	FA	2.00	2.03	1.97	2.02	0.06
28- Day flexural Strength f_f (Mpa)	W/C	3.86	3.38	2.98	2.87	0.99
	RA	3.51	3.25	3.19	3.13	0.38
	FA	3.27	3.31	3.26	3.25	0.06
90-Day flexural Strength f_f (Mpa)	W/C	4.24	3.94	3.15	2.84	1.4
	RA	3.68	3.57	3.48	3.43	0.25
	FA	3.53	3.53	3.55	3.55	0.02

Table 4 L16 (4^5 Series) orthogonal arrays used and test results for splitting tensile strength

Test No.	Average splitting tensile strength f_c (Mpa)			% Strength increment		S/N ratio for average splitting tensile strength		
	7-Day	28-Day	90-Day	7-28 Days	28-90 Days	7-Day	28-Day	90-Day
1	2.01	3.18	3.5	58.21	10.06	6.06	10.06	10.89
2	1.99	3.17	3.43	59.3	8.2	5.97	10.03	10.71
3	1.94	3.14	3.35	61.86	6.69	5.77	9.95	10.49
4	1.91	3.13	3.36	63.87	7.35	5.6	9.91	10.52
5	1.84	2.88	3.12	56.52	8.33	5.27	9.2	9.89
6	1.84	2.88	3.15	56.52	9.38	5.29	9.19	9.95
7	1.82	2.8	3.12	53.85	11.43	5.18	8.94	9.87
8	1.8	2.79	3.19	55	14.34	5.12	8.9	10.07
9	1.71	2.65	2.77	54.97	4.53	4.64	8.48	8.86
10	1.72	2.64	2.76	53.49	4.55	4.73	8.43	8.82
11	1.72	2.63	2.8	52.91	6.46	4.73	8.39	8.94
12	1.72	2.65	2.81	54.07	6.04	4.73	8.47	8.98
13	1.69	2.52	2.63	49.11	4.37	4.56	8.03	8.4
14	1.65	2.43	2.63	47.27	8.23	4.33	7.7	8.41
15	1.63	2.37	2.59	45.4	9.28	4.26	7.51	8.25
16	1.72	2.47	2.61	43.6	5.67	4.73	7.84	8.34

Table 5 Analysis of variance (ANOVA) for splitting tensile

	Factor	DOF	SS	Contribution factors of SS (%)	F ratio	Prob >F
7-Day	W/C	3	0.197	94.26	78.63	<.0001*
	RA	3	0.002	0.96	0.99	0.4602
	FA	3	0.005	2.39	2.11	0.2003
	Error	6	0.005	2.39	Prob >F	-
	Total	**15**	**0.209**	**100**	**-**	**0.0003**
28-Day	W/C	3	1.101	98.04	305.65	<.0001*
	RA	3	0.012	1.07	3.31	0.0990
	FA	3	0.003	0.27	0.75	0.5616
	Error	6	0.007	0.62	Prob >F	-
	Total	**15**	**1.123**	**100**	**-**	**<.0001***
90-Day	W/C	3	1.526	98.58	232.00	<.0001*
	RA	3	0.004	0.26	0.66	0.6071
	FA	3	0.005	0.32	0.77	0.5513
	Error	6	0.013	0.84	Prob >F	-
	Total	**15**	**1.548**	**100**	**-**	**<.0001***

Table 6 L16 (4^5 Series) orthogonal analysis for splitting tensile strength

	Factors	E1	E2	E3	E4	R
7- Day splitting tensile Strength f_f(Mpa)	W/C	1.96	1.82	1.72	1.67	0.29
	RA	1.81	1.80	1.78	1.79	0.03
	FA	1.82	1.80	1.78	1.79	0.04
28- Day splitting tensile Strength f_f (Mpa)	W/C	3.16	2.84	2.64	2.45	0.71
	RA	2.81	2.78	2.74	2.76	0.07
	FA	2.79	2.77	2.75	2.77	0.04
90-Day splitting tensile Strength f_f (Mpa)	W/C	3.41	3.14	2.79	2.62	0.79
	RA	3.01	2.99	2.96	2.99	0.05
	FA	3.02	2.99	2.99	2.97	0.05

Regression analysis was performed on the results and the following regression equations were gotten:

7-Day relationship

$\mu = 0.9684x_1 + 0.0699x_2 - 0.0901x_3 + 0.0901$; R=0.9159, n = 16 (5)

28-Day relationship

$\mu = -0.52234x_1 - 0.1069x_2 + 0.0229X3 + 1.4952$; R=0.8115, n = 16 (6)

90-Day relationship

$\mu = 1.2772x_1 + 0.0477x_2 - 0.\ 0.0495x_3 - 0.2152$; R=0.9395, n = 16 (7)

X_1 = W/C; X_2 = RA; X_3 = FA

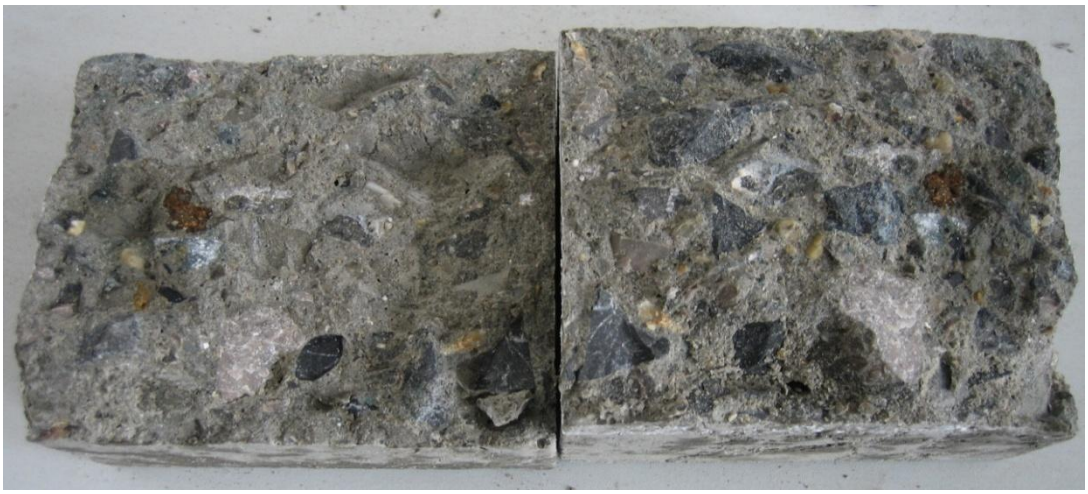

Fig. 3. Recycled Aggregate Concrete Failure by way of Tensile

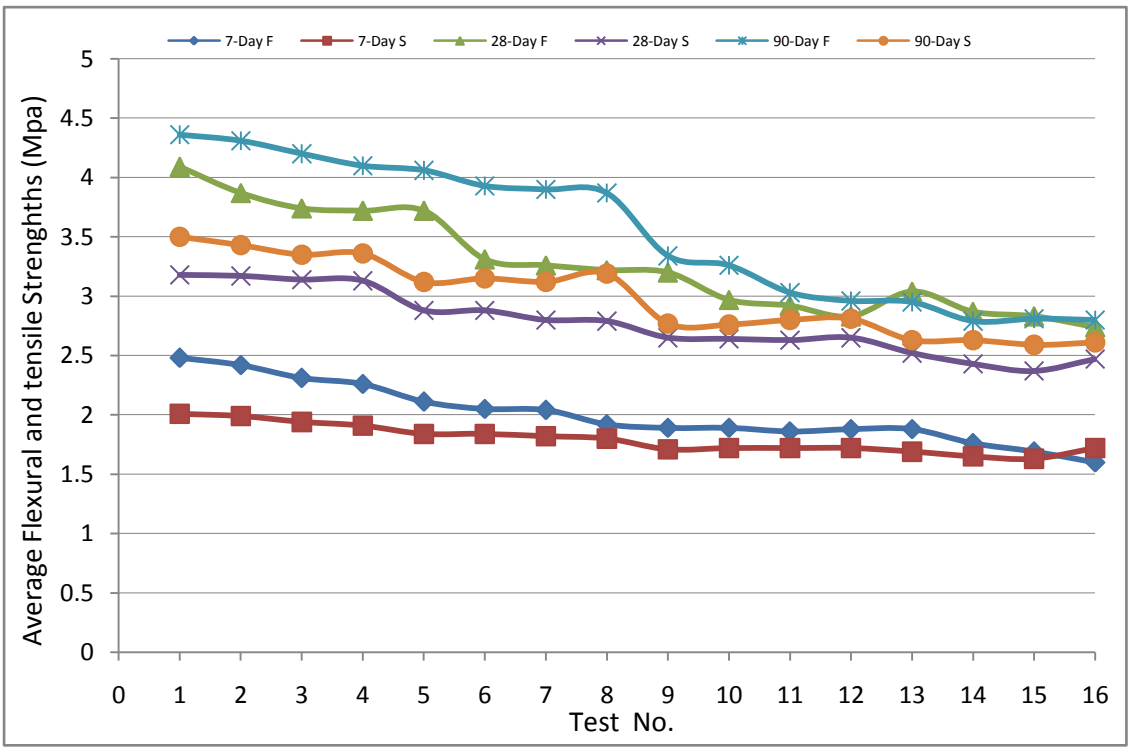

Fig. 4. Relationship Between Modulus of Rupture(Flexural Strength) and Splitting Tensile Strength
*F= Flexural Strength; S= Splitting Tensile Strength

IV. CONCLUSION

The splitting tensile strength is generally lower than the modulus of rupture ranging between 60-80% of modulus of rupture for both recycled aggregate concrete and conventional concrete. This assertion also agree with previous works ([1] - [4], [6]). Moreover, the rate of strength development in recycled aggregate concrete is similar to conventional concrete. The mathematical model generated can be used to estimate the relationship between the two properties investigated provided the factors are the same.

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Flow Analysis of Upstream Fluid Flow using Simulation for Different Positions of Optimized Inlet Guide Vane in Centrifugal Air Compressor

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Abstract: **-** The performance of Inlet Guide Valve is optimized with designing new efficient mechanism for their actuation. Inlet Guide Valve is an umbrella term which comprises both inlet Guide Vanes and the mechanism to actuate them. Guide vanes not only provide the inlet pressure drop but also impart a whirl motion to the gas as it enters the compressor impeller. Since this whirl motion is in the rotational direction of the impeller, it reduces the amount of work the impeller is required to do on the gas. This paper contains the basic concept behind Inlet Guide Vane, their working & importance. Also included is the new designed mechanism. The results of various positions of Inlet Guide Vane on Upstream Fluid Flow are analyzed & include in this paper.

Keywords: **-** *Centrifugal Air Compressor, Inlet Guide Vane, Upstream Fluid Flow¸ Variable Inlet Guide Valve, Whirl Motion.*

I. INTRODUCTION

Inlet Guide Valve is an umbrella term which comprises both inlet Guide Vanes and the mechanism to actuate them. A centrifugal compressor can be divided in four major parts viz., the inlet guide vanes, the impeller, the diffuser and the volute. And each of these components can improve performances of the centrifugal compressor.[6] Centrifugal compressors, sometimes termed radial compressors, are a sub-class of dynamic axis symmetric work-absorbing turbo machinery. It achieves a pressure rise by adding kinetic energy / velocity to a continuous flow of fluid through the rotor or impeller. This kinetic energy is then converted to an increase in potential energy / static pressure by slowing the flow through a diffuser. The pressure rise in impeller is in most cases almost equals to the rise in the diffuser section. One of the main components of the compressor is Inlet Guide Vane which is fitted at the suction end of the air compressor. Inlet guide vanes provide an efficient method of turndown for centrifugal compressors. Higher Energy savings can be realized using Inlet Guide Vanes compared to inlet throttling by butterfly valves. An inlet butterfly valve achieves turndown through an inlet pressure drop. Guide vanes not only provide the inlet pressure drop but also impart a whirl motion to the gas as it enters the compressor impeller. Since this whirl motion is in the rotational direction of the impeller, it reduces the amount of work the impeller is required to do on the gas. It is this whirl motion that results in energy savings at the design conditions.

II. LITERATURE REVIEW

2.1 Centrifugal Air Compressor

Centrifugal compressors; also known as turbo-compressors belong to the roto-dynamic type of compressors. In these compressors the required pressure rise takes place due to the continuous conversion of angular momentum imparted to the refrigerant vapor by a high-speed impeller into static pressure. Unlike reciprocating compressors, centrifugal compressors are steady-flow devices hence they are subjected to less

vibration and noise. This greatly improves life & reliability of the system. The operating costs are also greatly reduced thus making it economically viable.

1.2 Inlet Guide Valve

Inlet guide valve is an umbrella term which includes both Inlet guide vanes and the mechanism to actuate it. Inlet guide vanes provide an efficient method of turndown for centrifugal compressors. Higher Energy savings can be realized using Inlet Guide Vanes compared to inlet throttling by butterfly valves. An inlet butterfly valve achieves turndown through an inlet pressure drop. Guide vanes not only provide the inlet pressure drop but also impart a whirl motion to the gas as it enters the compressor impeller. Since this whirl motion is in the rotational direction of the impeller, it reduces the amount of work the impeller is required to do on the gas. It is this whirl motion that results in energy savings at the design conditions. Fig. 1 shows the velocity triangle at impeller of Inlet casing. Fig.2 shows the structure of compressor with inlet guide vanes.

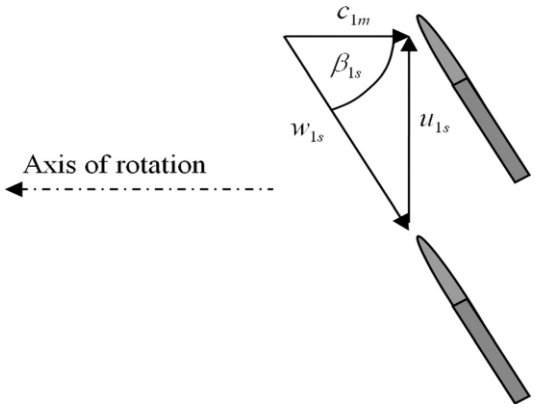

Figure 1 - Velocity triangle at Impeller of Inlet Casing

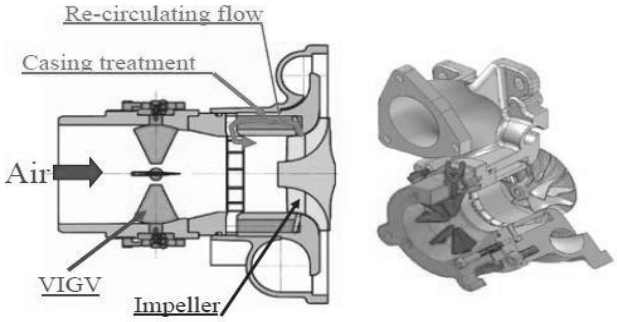

Figure 2 - Structure of Compressor with Variable Inlet Guide Vanes

III. DESIGNED MECHANISM

To actuate the Inlet Guide Vane a new efficient mechanism was designed - Linear Motion Mechanism. The mechanism as shown in below figures, fig. 3 & fig. 4, will slide in reciprocating fashion on the guides provided on the housing. This will in turn ensure that the angles of Inlet guide Vanes are changed according to the position of the mechanism. Fig.3 shows the mechanism in Fully Open Condition, while fig. 4 shows the mechanism in Fully Closed Condition.

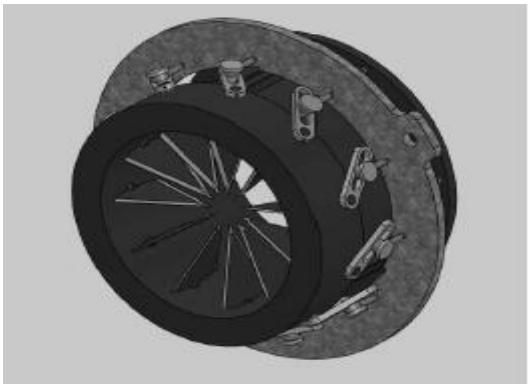

Figure 3 – Mechanism in Fully Open Condition

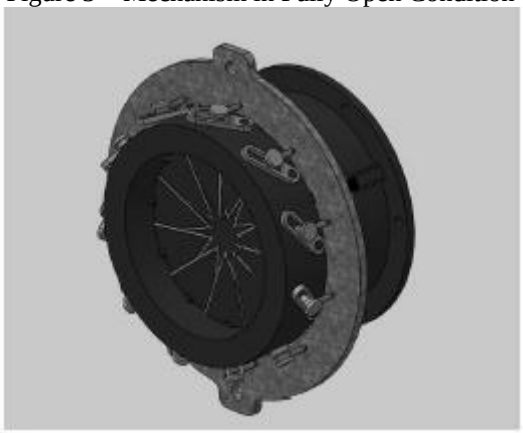

Figure 4 – Mechanism in Fully Closed Condition

The linear motion mechanism will consists of linear actuator for actuation. The linear actuator will be connected to the ring that will move on the housing. PTFE bearings will be provided in between the housing and ring for smooth movement of ring. Pin holder will be bolted to the ring and will mesh with the slotted link through a pin. The slotted link will be fitted on the guide vane using a grub screw. When the linear actuator provides linear actuation, the linear motion will be converted to rotary motion of the guide vane through the movement of slotted link and thus the vane angle can be changed.

The linear motion can be provided through suitable gearing arrangement if rotary motor is used. Linear actuators can also be used which have advantage over rotary motors, since no extra gearing setup needs to be done for actuation.

To prevent the friction / wear & tear of the sliding ring on the housing suitable self lubricating material can be provided on the housing. This will ensure that the mechanism remains external lubrication free to provide oil free air to the compressor.

Two linear actuators can be provided on the ring to facilitate better accuracy & faster response time, however this will also add to the overall cost of the mechanism.

IV. ANALYSIS

The primary aim of using Inlet Guide Vane is to provide Whirl Motion to the incoming air in air compressor. This is done so as to reduce the energy consumption & improve working efficiency. The designed mechanisms along with Inlet Guide Vane were analyzed using Flow Simulation Tool available in Solidworks 2012, the results of which are shared below.

The simulation tool was used to study two-dimensional laminar & turbulent flow arising due to different vane positions. A minimal opening of 0.025m diameter was kept at the centre, as a safety precaution.

The main aim of the analysis was to find the maximum velocity of air after it passes Inlet Guide Vane for safety considerations of compressor. The highest value to which the velocity of air can rise is 75m/s. Necessary modifications in vane design were done to bring the air velocity within the permissible limits.

The factors upon which the vane was designed & modified to reduce the air velocity are,
1. Aerodynamic Factors
2. Strength Factors
3. Economical Factors
4. Aesthetic & Ergonomics Factors

4.1 Analysis Parameters

The design was analyzed subjected to the following parameters,
1. Fluid Used – Air
2. Suction Pressure – Atmospheric Pressure i.e. 102642.23 Pa
3. Suction Temperature – Ambient Temperature – 293.20K
4. Vane rotation Possible – from 0^0 to $90^{0\backslash}$
5. Positions Analyzed – 3 Positions Analyzed,
   a. Initial Position - 0^0
   b. Intermediate Position - 45^0
   c. Final Position - 90^0
6. Minimum opening – 25mm
7. Maximum opening – 200mm

The air temperature & pressure after it passed through Inlet Guide Vanes relies on the amount of air being sucked by the compressor to meet the demand. For the compressor to work in safe condition air velocity after passing through the IGV should not exceed a certain safe value. This will ensure that internal mechanisms of compressor are not subjected to excessive stress due to high air velocity & operate safely.

4.2 At 0^0

The results of fluid flow simulation at 0^0 are shared below,

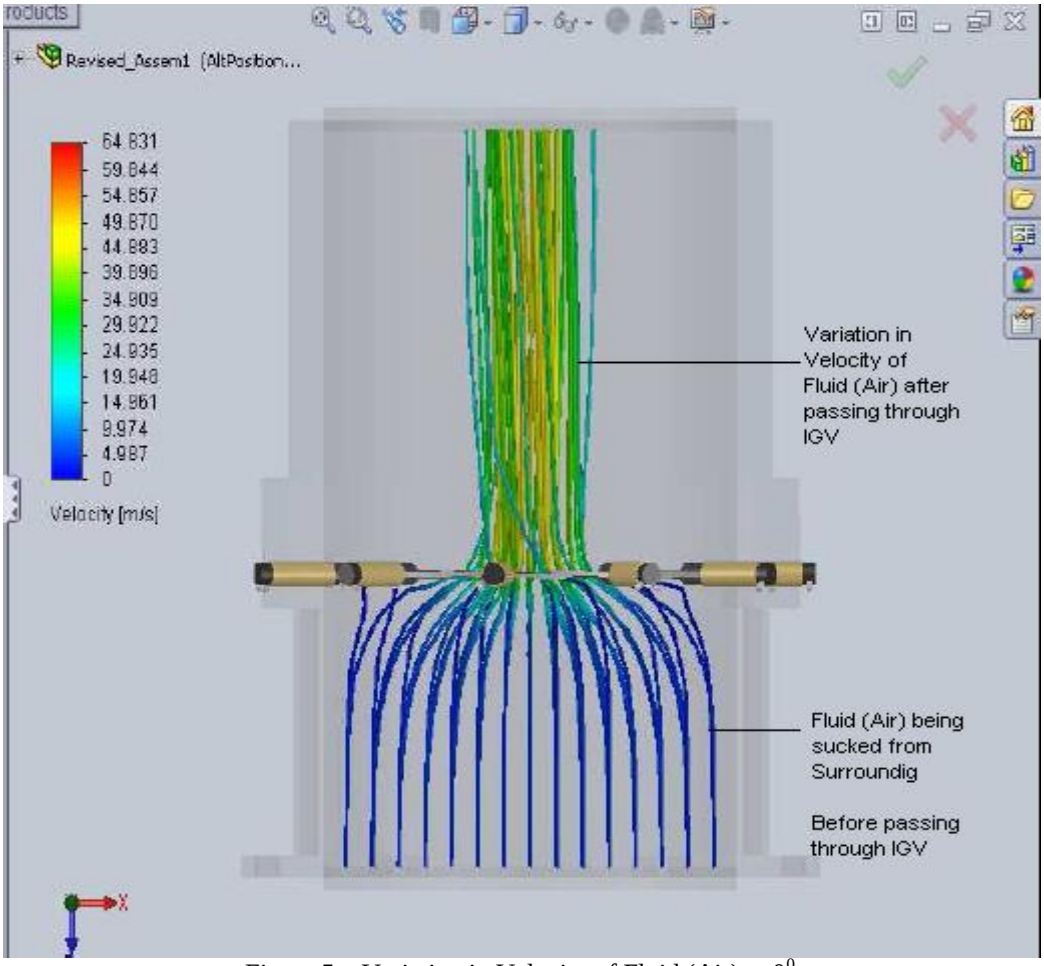

Figure 5 – Variation in Velocity of Fluid (Air) at 0^0

At 0^0, the air passes only through the small opening (of 25mm) provided. This simulates the initial condition when the IGV would be closed. This also ensures that the compressor is safe i.e. if the compressor is started when all the IGV are closed (above condition), then a minimal amount of air (through opening of 25mm) will pass in the compressor.

The velocity variation obtained at this position can be seen in the different colour lines with 0 m/s being the lowest and 59.498 m/s being the highest.
It is also worth noting that after passing through the IGV at 0^0, the air does not spread inside the housing. Thus, at this position the impact of the incoming air will be maximum as can be seen from the figure 5. Thus, maximum stress could be developed at this position both in the vanes and internal mechanisms of compressor.

4.2.1 Environment Condition 1 – Ambient Condition

TABLE 1 – Ambient Environmental Condition

Type	Environment Condition 1 – Ambient Condition
Value	Pressure - 102642.23 Pa Temperature - 293.20 K

4.2.2 Environment Condition 2 – After passing through IGV

TABLE 2 – Environmental Condition after passing through IGV

Type	Environment Condition 1 – Environmental Condition after passing through IGV
Value	Pressure - 104668.73 Pa Temperature - 333.00 K

The environmental conditions used are as in table 1 & table 2.

4.2.3 Result / Maximum Air Velocity

The maximum air velocity due to angle of vane at 0^0 is shown in table 3.

TABLE 3 – Maximum Air Velocity at 0^0

Parameter	Unit	Value
Maximum air Velocity	m/s	59.498

Thus, the maximum velocity achieved by air during 0^0 is 59.498 m/s.

4.3 At 45^0

At 45^0, the air has more space to enter the compressor and not only limited to small opening (of 25mm) provided. Here intermediate condition when the IGV would be partially open is simulated & analyzed.
The velocity variation obtained at this position can be seen in the different colour lines with 0 m/s being the lowest and 72.316 m/s being the highest.
It can also be noted that after passing through the IGV at 45^0, the air spreads inside the housing. Thus, at this position the impact of the incoming air will be somewhat less as compared to fully closed position and can be seen from the figure 6. Thus, relatively lesser stress would be developed at this position both in the vanes and internal mechanisms of compressor.

At positions between 0^0 and 45^0, maximum air velocity and stresses developed would lie in between the values for both 0^0 and 45^0.

It is also worth noting that due to more space available to air to enter the compressor, the temperature after passing through IGV has reduced due to lesser friction between the air molecules.

At this position maximum Whirl Motion as seen in fig. 6, is obtained in the air after it passes through the IGV. Thus, it would be theoretically most economical in terms of energy consumption to run the compressor at this position always during the operation of compressor.

However due to practical limitations it is not always feasible. Thus Inlet Guide Vanes need to provide Whirl Motion at most of the positions they are operated at.

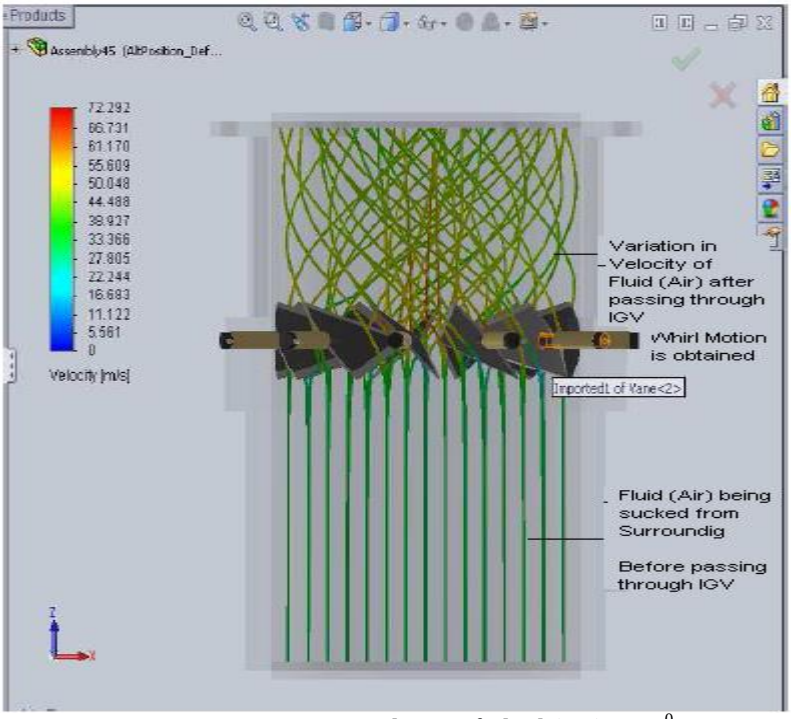

Figure 6 - Variation in Velocity of Fluid (Air) at 45^0

4.3.1 Environment Condition 1 – Ambient Condition

TABLE 4 – Ambient Environmental Condition

Type	Environment Condition 1 – Ambient Condition
Value	Pressure - 102642.23 Pa Temperature - 293.20 K

4.3.2 Environment Condition 2 – After passing through IGV

TABLE 5 – Environmental Condition after passing through IGV

Type	Environment Condition 1 – Environmental Condition after passing through IGV
Value	Pressure - 104668.73 Pa Temperature - 300.00 K

The environmental conditions used are as in table 4 & table 5.

4.3.3 Result / Maximum Air Velocity

The maximum air velocity due to angle of vane at 45^0 is shown in table 6.

TABLE 6 – Maximum Air Velocity at 45^0

Parameter	Unit	Value
Maximum air Velocity	m/s	72.316

Thus, the maximum velocity achieved by air during 45^0 is 72.316 m/s.

4.4 At 90^0

At 90^0, the air has most space available to enter the compressor and not limited to small opening (of 25mm) provided. Here final condition i.e. when the IGV would be fully open is simulated & analyzed.
The velocity variation obtained at this position can be seen in the different colour lines with 0 m/s being the lowest and 70.024 m/s being the highest.

It can also be noted that after passing through the IGV at 90^0, the air spreads inside the housing. Thus, at this position the impact of the incoming air will be somewhat less as compared to fully closed position and can be seen from the figure 7. Thus, relatively lesser stress would be developed at this position both in the vanes and internal mechanisms of compressor.
At positions between 45^0 and 90^0, maximum air velocity and stresses developed would lie in between the values for both 45^0 and 90^0.
It is also worth noting that due to more space available to air to enter the compressor, the temperature after passing through IGV has reduced due to lesser friction between the air molecules, compared to fully closed position.
This condition wherein Inlet Guide Vane is fully open would be sparingly used only when the compressor needs to work at full capacity.
Also minimal Whirl Motion is obtained in this position. Thus theoretically this position is the most inefficient position in terms of energy consumption and must be most sparingly used. However due to practical limitations this position need to be used every time there is maximum load demand from the compressor.

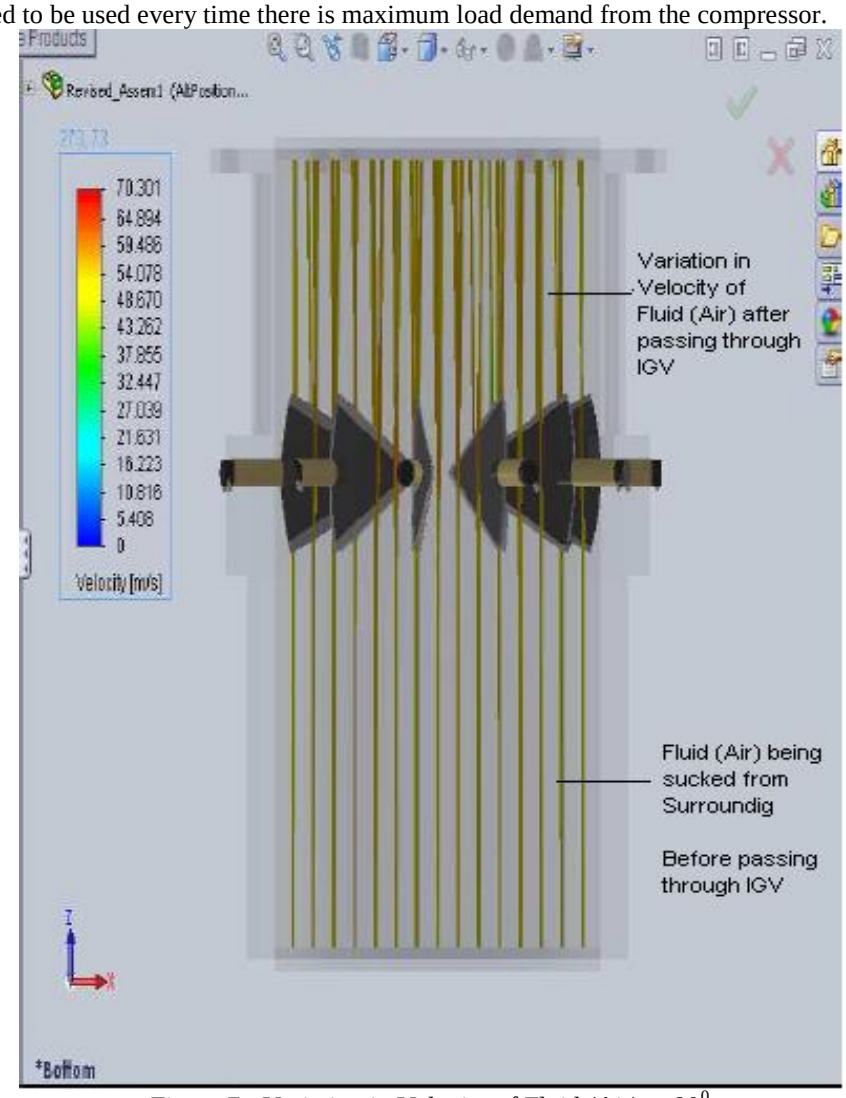

Figure 7 - Variation in Velocity of Fluid (Air) at 90^0

4.4.1 Environment Condition 1 – Ambient Condition

TABLE 7 – Ambient Environmental Condition

Type	Environment Condition 1 – Ambient Condition
Value	Pressure - 102642.23 Pa Temperature - 293.20 K

4.4.2 Environment Condition 2 – After passing through IGV

TABLE 8 – Environmental Condition after passing through IGV

Type	Environment Condition 1 – Environmental Condition after passing through IGV
Value	Pressure - 104668.73 Pa Temperature - 300.00 K

The environmental conditions used are as in table 4 & table 5.

4.4.3 Result / Maximum Air Velocity

The maximum air velocity due to angle of vane at 90^0 is shown in table 6.

TABLE 9 – Maximum Air Velocity at 90^0

Parameter	Unit	Value
Maximum air Velocity	m/s	70.024

Thus, the maximum velocity achieved by air during 90^0 is 70.024 m/s.

V. COMPARISON OF DIFFERENT VANE POSITIONS

The comparison of different parameters for the three vane positions studied is provided in table 10, while figure 8 shows Variation of Air Temperature after passing through IGV and figure 9 shows Variation in Maximum Air Velocity.

TABLE 10 – Comparative Analysis of Different Vane Positions

Sr. No.	Parameters	At 0	At 45	At 90
1	Ambient Pressure (in Pa)	102642.23	102642.23	102642.23
2	Ambient Temperature(in K)	293.2	293.2	293.2
3	Air Pressure after passing through IGV (in Pa)	104668.73	104668.73	104668.73
4	Air Temperature after passing through IGV (in K)	333	300	300
5	Maximum Air Velocity (in m/s)	59.498	72.316	70.024

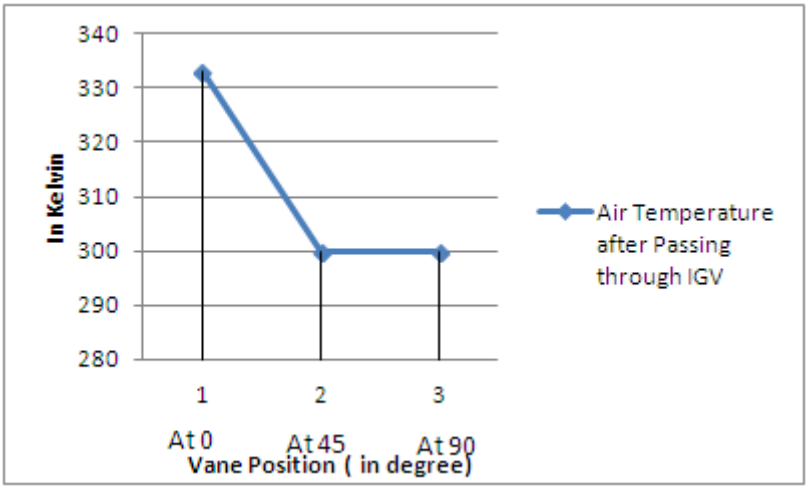

Figure 8 – Variation of Air Temperature after passing through IGV

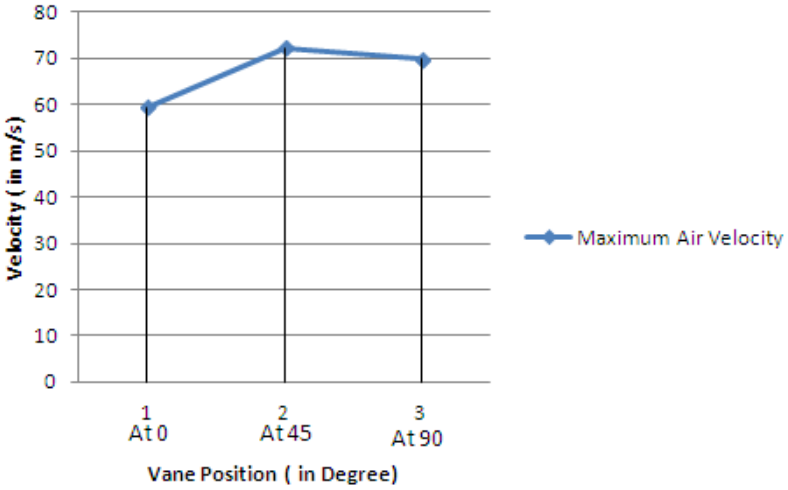

Figure 9 – Variation in Maximum Air velocity

VI. CONCLUSION

In this research work, flow simulation was carried out using Flow Simulation tool of Solidworks 2012 and most optimum vane position was found. The effect of different Vane angle positions on parameters of fluid flow such as Temperature of Fluid after passing through IGV and Maximum Air Velocity were studied, analyzed and compared. The most efficient vane position was identified to be at 45^0, since maximum Whirl Motion is obtained at this position. However, the velocity of air is also maximum at this position, hence maximum stresses would be induced. Future work would be carried out to minimize the stresses induced in optimum position by modifying the vane design.

VII. ACKNOWLEDGEMENTS

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Hepatoprotective Effects of Moringa Oleifera Leaf Extract On The Kidneys of Adult Wistar Rats

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Abstract: - Moringa oleifera is one of several nutritional supplements giving wide spread popularity in Nigeria and many other countries of the world. The leaves and flowers are being used by the population with great dietary importance. The aim of this study is to investigate the effects of oral administration of Moringa oleifera leaf extract on the kidneys of adult wistar rats. 24 apparently healthy adult wistar rats weighing between190-230kg were divided into four groups of six animals each. Group A served as the control and received 0.3ml of distilled water orally. The experimental groups B, C & D received 0.5ml, 0.6ml &0.7ml of Moringa oleifera extract orally respectively. The administration lasted for twenty one days. The animals were weighed, sacrificed using chloroform vapour. The kidney tissue were removed, weighed and trimmed down for histological studies. Result of this study showed non-distortion of the kidney cells. The findings of this study suggest that chronic Moringa oleifera consumption may not put the kidneys at risk of adverse histopathological conditions.

Keywords: - *Moringa oleifera, kidney weight, Body weight, Hepatoprotective, Wistar rat.*

I. INTRODUCTION

Moringa oleifera is the most widely cultivated species of the genus Moringa, which is the only genus in the family Moringaceae. The English common names include Moringa, drumstick tree from the appearance of the long slender, triangular seed pods, horseradish tree from the taste of the roots which resembles horseradish, and ben oil tree from the oil derived from the seed [1]

It is a fast-growing drought-resistant tree native to the sourthern foothills of the Himalayas in northwestern India, but widely cultivated in tropical and sub-tropical areas.

In developing countries, Moringa has potential to improve nutrition, boost food security, foster rural development and support sustainable landcare [2]. It may be used as forage for livestock, a micronutrient liquid, a natural anthelmintic and possible adjuvant [3, 4]

In some regions the young seed pods are most commonly eaten, while in others, the leaves are the most commonly used part of the plant. The flowers are edible when cooked and are said to taste like mushrooms. The bark, sap, roots, leaves, seeds, oil and flowers are used in traditional medicine in several countries [5]

The leaves are the most nutritious part of the plant, being a significant source of B vitamins, vitamin C, provitaminA as beta-carotene, vitamin K, manganese and protein, among other essential nutrients [6, 7].

When compared with common foods particularly high in certain nutrients per 100g fresh weight, cooked Moringa leaves are considerable sources of these same nutrients [8, 9].

Moringa is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce [10].

Moringa oleifera is undergoing preliminary research to investigate the potential properties of its nutrients and phytochemicals. [11, 12, 13, 14].

Therefore, there is need to investigate the hepatoprotective effects of Moringaa oleifera leaf extract on the kidneys of adult wistar rats. Hence this study aims at investigating the effects of Moringa oleifera leaf extract on the kidneys of adult wistar rats.

II. MATERIALS AND METHODS

2.1: Breeding of animals

Twenty four apparently healthy adult wistar rats were purchased from the animal house of Anatomy Department, University of Calaber, Cross River State, Nigeria and bred in the animal house of University of Uyo, Akwa Ibom State. They were allowed for seven days for acclimatization under normal temperature (27℃ - 30℃) before their weights were taken. They were fed ad-libitum with water and guinea feed pallets from Agro feed mill Nigeria Ltd.

2.2: Drug preparation

Moringa oleifera leaves were collected from Mbaise in Imo State and was dried in an oven at a temperature of 50℃ and crushed using laboratory blender. Extraction was done using ethanol. 250mg of this extract/1kg body weght was dissolved in 10mls of distilled water and administered to the animals.

2.3: Experimental protocols

The twenty four apparently healthy animals were weighed and allocated into four groups (A, B, C, & D) of six animals each. Group A served as the control and were administered 0.3ml of distilled water; the experimental groups B, C & D were administered 0.5ml, 0.6ml and 0.7ml of Moringa oleifera leaf extract respectively for twenty one days. Both the control and experimental groups were sacrificed using chloroform inhalation method. Kidney tissues were removed, weighed and trimmed down and fixed in zenkers fluid for histological studies.

2.4: Tissue Processing

The tissues were transferred into an automatic processor where they went through a process of fixation, dehydration, clearing, infiltration, embedding, sectioning and staining.

Fixation was carried out in zenkers fluid. The tissues remained in the fluid for four hours. After fixation, the tissues were washed overnight under a stream tap water. Dehydration of the fixed tissues were carried out in different percentages of alcohol 50%, 70% and 90% absolute. The tissues were then cleared in xylene and embedded in paraffin wax. Serial sections of 5micron thick were obtained using a rotatory microtome. The tissue sections were deparaffined hydrated and stained using the routing haematoxylin and eosin method (H&E). The stained sections were then examined under the light microscope.

III. RESULTS

3.1 Morphometric Analysis of Body Weights

Table 1: Comparison of mean initial and final body weight and weight change in all the groups (A, B, C & D) (Mean ±SEM given for each measurement)

	GP A	GP B	GP C	GP D	F-RATIO	PROB OF SIG
INITIAL BODY INT	198.20±4.50	206.80±3.60	219.10± 5.10	226.20±3.30	66.140	< 0.001
FINAL BODY INT	218.00±4.10	220.30±5.30	228.50±2.50	235.40±5.40	34.220	< 0.001
WEIGHT CHANGE	19.80±2.30	13.50±4.60	9.40±2.70	9.20±4.80	6.340	< 0.001

The final body weight for the experimental groups increased significantly ($P < 0.001$) relative to the control

3.2 Morphometric analysis of kidney weight

Table 2: Comparison of mean relative kidney weight of all the groups (A, B, C & D) (Mean $\pm$ SEM given for each measurement)

	GP A	GP B	GP C	GP D	F. RATIO	PROB OF SIG.
KIDNEY WT	5.30±0.200	5.25±0.310	5.26±0.500	5.27±0.410	52.10	< 0.001

The relative kidney weights for the experimental group increased significantly ($p < 0.001$) with the control.

3.3 Histopathological Findings:

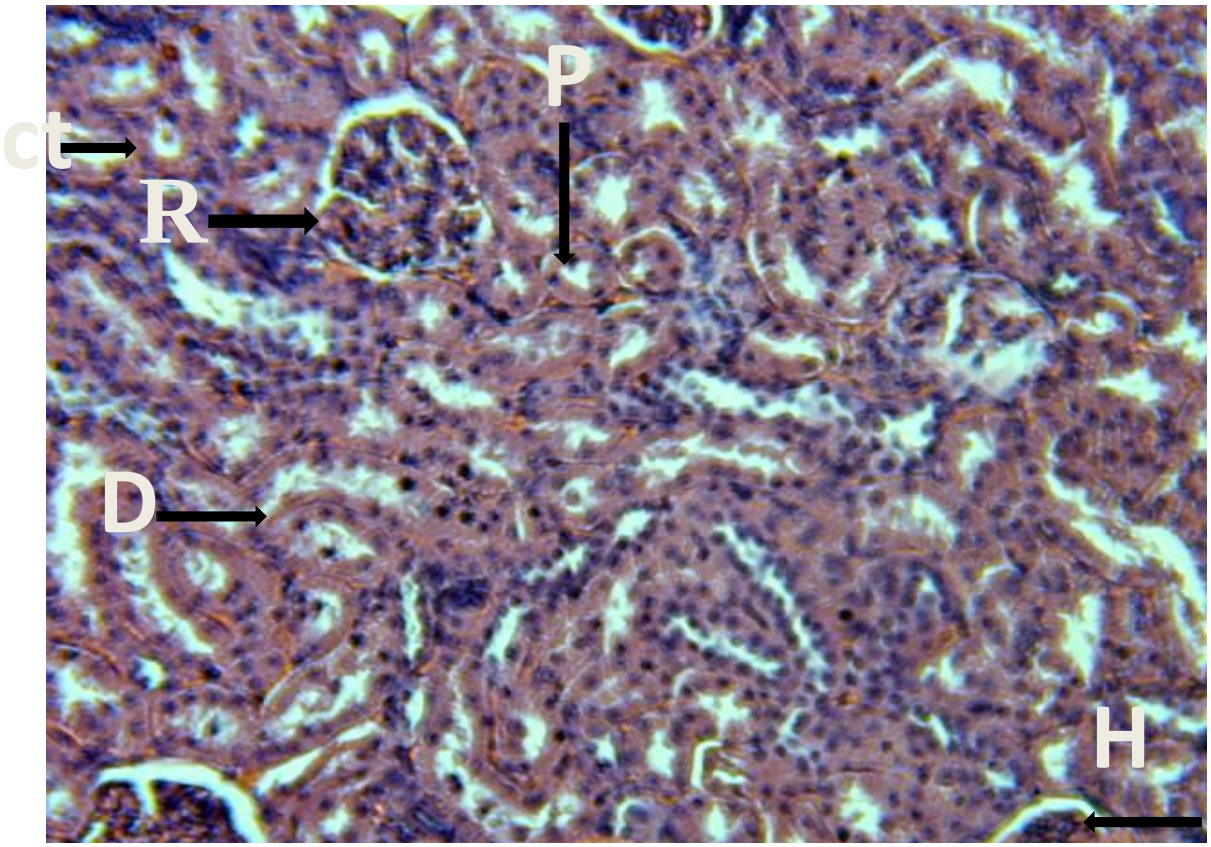

Fig. 1, Micrograph 1(control),showing normal histological structure of renal corpuscle (R), proximal convoluted tubule (P),distal convoluted tubule (D), henles loop (H), and collecting tubule (ct), stained by H & E technique, x 200.

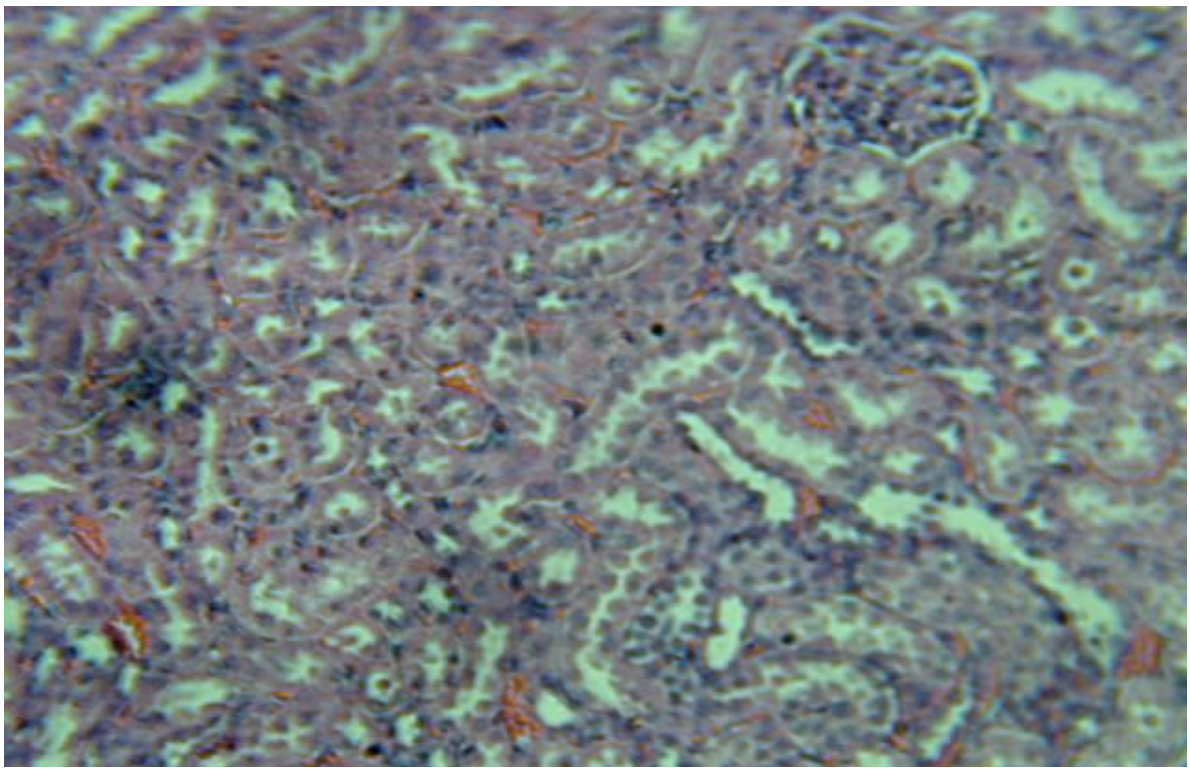

Fig 2, Micrograph 2 Group B, (treated with 0.5ml of Moringa oleifera leaf extract), shows normal histological structure of the kidney, stained by H & E technique, x 200.

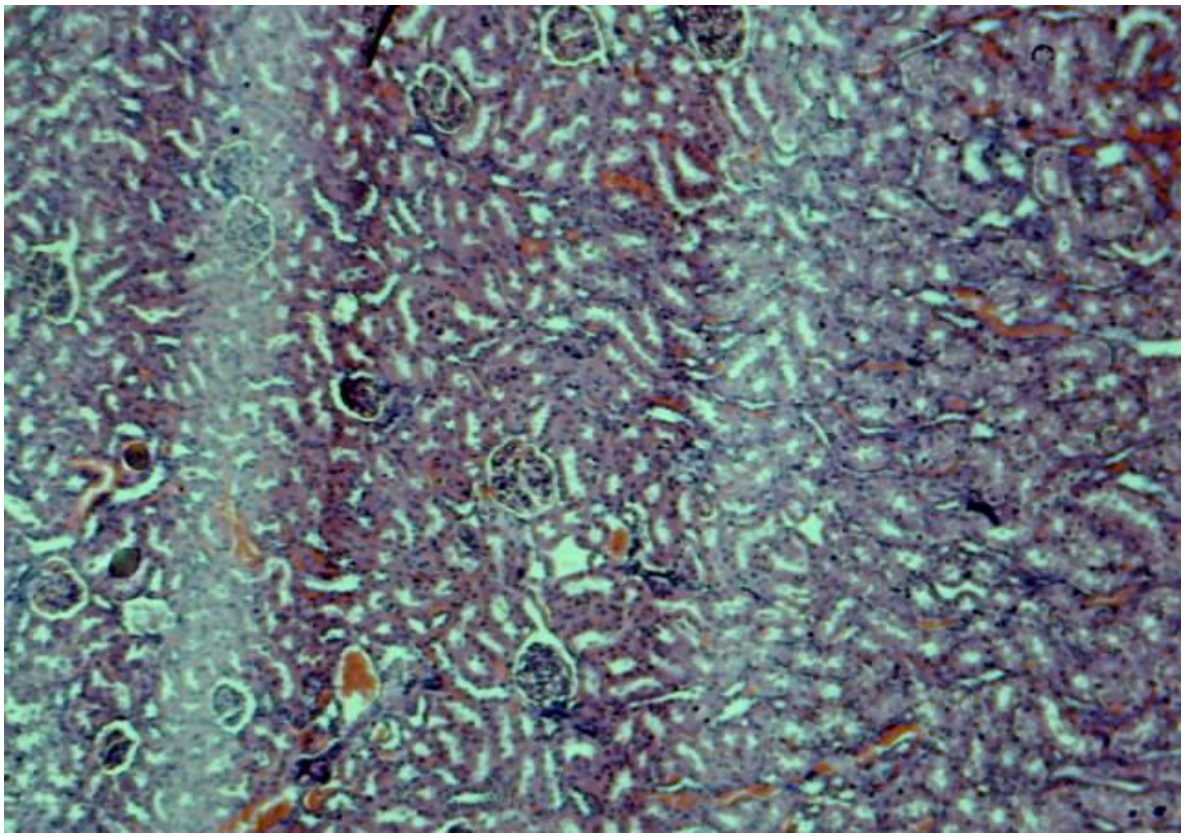

Fig 3, Micrograph 3 Group C,(treated with 0.6ml of Moringa oleifera leaf extract), showing normal histoarchitecture of the kidney, stained by H & E technique, x 100.

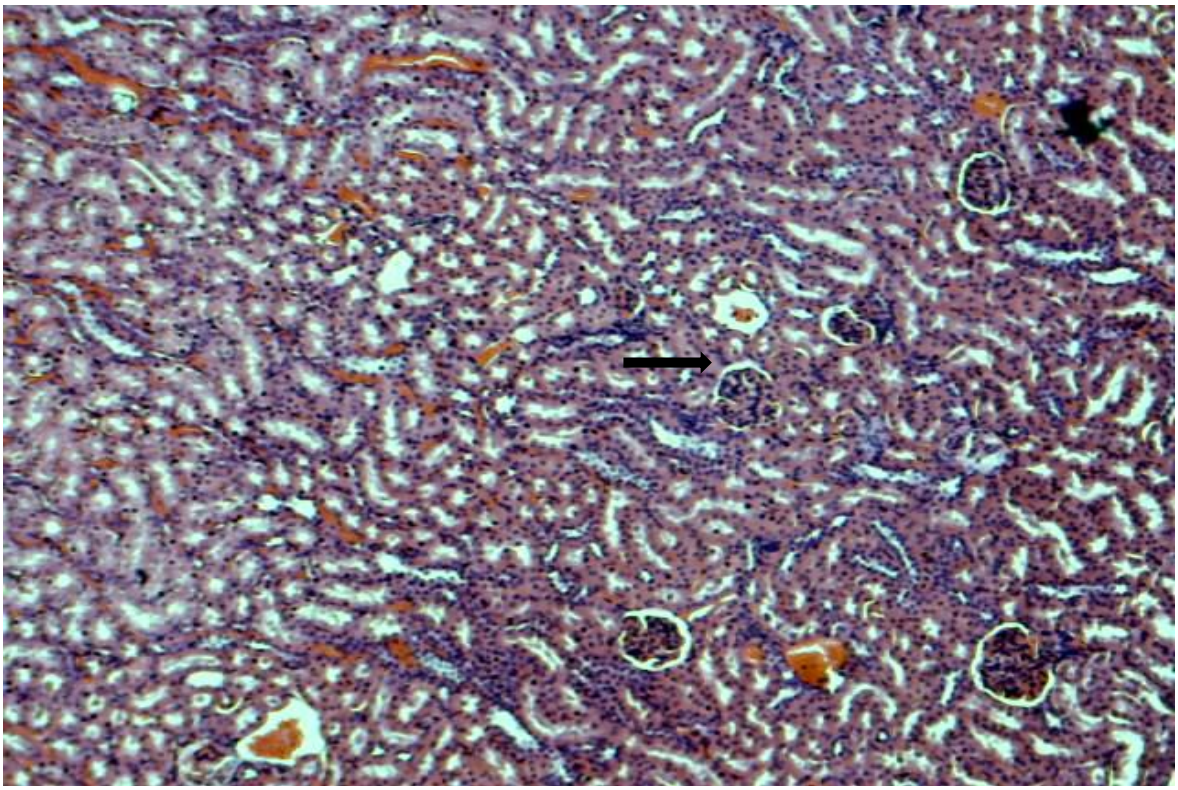

Fig 4, Micrograph 4 Group D, (treated with 0.7ml of Moringa oleifera leaf extract) showing normal histoarchitecture of the kidney, though, there is a homogeneous material at the centre(Arrow), which has a mild or no effect on the kidney, stained by H & E technique, x 100.

IV. DISCUSSION

Twenty four (24) apparently healthy adult wistar rats feed with low and high doses of leaf extract of Moringa oleifera were used in the present study. The final body weights of the experimental animals increased significantly relative to the control. The leaf extract of Moringa oleifera in this instance functions primarily as a dietary supplement enhancing growth;

The relative kidney weights of the experimental animals were statistically similar to the control as seen in table 2. There were no histopathological lesions observed in the kidney tissues.

This could be as a result of its hepatoprotective and antioxidant properties of Moringa oleifera leaf extract.

Jaiswal et al reported that in mice subject to DMBA-induced kidney who received 200-400mg/kg of a hydroalcoholic extract of Moringa oleifera for two weeks prior to DMBA, supplementation was able to dose-dependently reduce changes in oxidative status (with the higher dose normalizing GST and glutathione transferase and fully normalized changes in renal enyzmes (AST, ALP, ALT)[15]. The protective effect of Moringa oleifera was greater than 0.5-1% butylated hydroxyanisole (BHA; antioxidant) [15]

When measuring urinary proteins and sugar in rats model of diabetes, Moringa oleifera appears to abolish all urinary proteins and sugars with 14 day of treatment with 200mg/kg of water extract of the leaves [16].

The antioxidant properties appear two underlie a reduction in urinary proteins and glucose in diabetic animals, suggesting protective effects that may attenuate the rate of kidney failure in diabetes.

Therefore, the result present study agrees with previous researches in hepatoprotective and antioxidant properties possessed by Moringa oleifera leaf extract.

V. CONCLUSION

From this study, we therefore inferred that leaf extract of Moringa oleifera has nutritional effects and ability to prevent damage to the kidney cells in low and high doses.

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Design of an Optimized Enzyme Catalysed Batch Bioreactor for the Production of Ethanol from Corn

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Abstract: - This paper addresses the challenge of designing an optimized enzyme catalysed batch bioreactor of high efficiency and yield for the production ethanol from raw corn starch. Mathematical models developed predicted the batch reaction time of 25, 25 and 41hrs in relation to the substrate, enzyme and product concentration respectively compared with experimental batch time of 56hrs in all cases. The results obtained also showed that the velocity of reaction of the enzymes (V_{max}) and the maximum specific growth rate (μ_{max}) are key parameters in the design of the batch bioreactor with higher values of each predicting shorter batch reaction time profile. Hence, they are useful for predicting the most appropriate batch reaction conditions and the efficiency of the bioreactor. The mathematical model predictions showed that it can be considered as a good complimentary tool to real system since the simulation results of the mathematical model agrees with experimental data reported in literature.

Keywords: - *Batch Bioreactor, Corn, Enzyme, Ethanol, Fermentation*

I. INTRODUCTION

Ethanol production is an aged long process that has been in practice for some decades. Irrespective of this fact we are still faced with the problem of designing and installing processes for ethanol production that will give a more efficient yield. As such, we are faced with the task of designing an optimized enzyme catalysed batch bioreactor of high efficiency and yield. To ensure that the process that is to be designed will be efficient in terms of capacity and product yield the reactor will be stirred. This will improve the rate of ethanol production in the world at large.

Hisayoriet al [1], worked on the direct production of ethanol from raw com starch via fermentation by the use of "Novel surface engineered yeast strain displaying glucoamylase and amylase". Nkechi[2] also worked on the production of ethanol from high yeast molasses gotten from the shredded sugarcane juice. Yeast was used as a source for enzyme used the fermentation was maintained at a pH of 5.3 the end result showed that an ethanol yield concentration 8-10% was produced. Nnnachi[3] also worked on the process synthesis for the industrial production of ethanol from cassava. He used yeast under an anaerobic condition and controlled the pH within the range of 4.5 in conclusion he was able to produce ethanol of concentration 8-12%. Brink [4] also explored ethanol production from cotton gin waste based on approximation of the composition of the cotton plant. He developed a general design for 2-4million gallons per year ethanol production plant. The idealized design considered simultaneous methane production, as well as avenues for recycling energy. The general outlook for cotton gin waste usage that he presented is very optimistic.

The relevance of this study is tied to the importance of the preferred choice of feedstock (corn) to be used and as well as the uses and importance of the product (ethanol). This study showsthe need for large scale com production because the usefulness of com goes beyond its consumption as food, because that it can also be used for the manufacture of a relevant chemical of great importance and uses to man.

Ethanol serves as a solvent for the manufacture of paints, drugs, perfumes, dyes, gums and as a fuel in cars, spirit lamps and store.It is used in the preparation of a large number of organic compounds like ester and as a solvent for sterilization of clinical and laboratory apparatus.It is also used as a preventative for biological specimens and as an intoxicating agent in alcoholic beverages and drinks [5].

II. DEVELOPMENT OF MATHEMATICAL MODEL

The mathematical model for the batch bioreactor is developed based on the general mole balance design equation for reactors, which gives that the rate of mass inflow of reacting specie minus the rate of mass outflow of the reacting specie plus rate of generation of specie by chemical or biochemical reaction within the system is equal to rate of accumulation of mass within the system.A mole balance on specie A at any point in time "t" yields the following equation [6]:

Rate of mass Inflow of A into the system (moles/time)	+	Rate of generation of A by chemical or biochemical reaction within the system (moles/time)	−	Rate of mass outflow of A from the system (moles/time)	=	Rate of Accumulation within the system (moles/time)

Inflow + generation – outflow = Accumulation

$$F_{A0} + G_A - F_A = \frac{dN_A}{dt} \quad \text{---------- (1)}$$

Where N_A represents the number of moles of A in the system

The total rate of generation within the system volume is then sum of all the rates of generation in each of the sub-volumes.By taking appropriate limits and also making use of the definition of an integral, we can write the following equation for the total rate of generation:

$$G_A = \int_O^V r_A d_V \quad \text{---------- (2)}$$

From this equation, we see that r_A is in an indirect function, since the properties of the reacting materials (e.g. concentration, temperature) can have different values at different locations in the reactor.So then, rearranging equation (1) and replacing G_A into it with now yield:

$$F_{Ao} - F_A + \int_o^v - r_A d_V = \frac{dN_A}{dt} \quad \text{---------- (3)}$$

Equation (3) is therefore the general mole balance equation from which we can develop the design equations for various types of industrial or laboratory scale reactors. The batch time and reactor volume (continuous flow) necessary to convert a specified amount of the reactants into products can also be determined from it. But for the purpose of this work we are only interested in developing models that describe the design of an enzyme catalyzed batch bioreactor.

2.1 MODEL ASSUMPTIONS

The mathematical models that describe the batch bio-reactor are developed based on the following assumptions.

(a) There is no mass flow of material in or out of the reactor.
(b) The reaction of the reacting species changes with time.
(c) The reactor is well mixed and there is no spatial variation within the reactor volume.
(d) For most liquid-phase reactions, the density change with the reaction is usually small and can be neglected (i.e. $V=V_0$).
(e) The volume is constant i.e. ($V=V_0$) since it is a closed metal system.
(f) The batch-bioreactor is operated isothermally as most fermentation processes are carried out at either room temperatures or temperatures slightly above room temperatures.
(g) The work term is negligible and the specific heat capacity is constant.
(h) The batch bio-reactor is designed to be a cylindrical vessel with height 50cm (500mm), and diameter 30cm (300mm) since the design is based on a small scale laboratory setup. But the vessel will still give appreciable output and will not occupy much space when fully installed.

Volume of the reactor (V_R) = $\pi r^2 h$
= (3.142 x 15^2 x50)cm^3
= 35, 347.5cm^3

2.2 MODEL EQUATIONS

C_X
C_S
$C_P V$

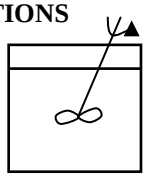

Fig. 1: Flow sheet for a batch bioreactor

General Mass Balance:

$F_{A0} - F_A + G_A - C_A = \frac{dN_A}{dt}$ ---------- (4)

Where:

F_{A0}= Mass inflow of reacting specie into the system.
F_A = Mass outflow of reacting specie out of the reactor.
G_A = Rate of generation of specie within the system.
C_A = Rate of consumption of specie within the system.
$\frac{dN_A}{dt}$ = Rate of accumulation of mass within the system per unit time.

Thus, applying the underlying assumptions, and integrating gives the batch time (t_b) required for enzymatic conversion of substrate into product in the batch bio-reactor as:

$$t_b = \frac{K_m}{V_{\max}} ln \frac{C_{so}}{C_s} + \frac{C_{so} - C_s}{V_{\max}}$$ ---------- (5)

However, enzymes are subject to deactivation, thus the concentration of active enzyme in the reactor, and therefore the value of V_{max} may change during reaction when deactivation is significant, variation of V_{max} with time can be expressed by:

$V_{max} = V_{max0}e^{-kdt}$ ---------- (6)

Thus, equation (5) becomes:

$$t_b = -\frac{1}{kd} \ln \left[1 - Kd \left(\frac{K_m}{V_{\max 0}} \ln \frac{C_{so}}{C_s} + \frac{C_{so} - C_s}{V_{\max 0}} \right) \right]$$ ---------- (7)

Similarly, we can also carry out a mass balance on the cell culture in the batch bioreactor. Starting from inoculums, C_{xo} at t=0, and an initial quantity of limiting substrate C_{so} at t = 0, the biomass will grow after a short lag phase and will consume substrate. The growth rate slows as the substrate concentration decreases and becomes zero when all the substrate has been consumed.

Based on the model assumptions, we can write mass balance for the constant volume zero feed batch fermentation, using the generalized mass balance equation:

$$\frac{1}{V} \frac{d(y.v)}{dt} = \Sigma r_{gen} - \Sigma r_{con} + Dy_i - rDy$$ ---------- (8)

Where y is a general extensive property

Therefore the mass balance equations for the state variables (viable cells, non-viable cells, substrate and product) are given below as follows [7]:

Viable cells: $\frac{dc_{xv}}{dt} = \mu C_{xv} - K_d C_{xv}$ ---------- (9)

Non-viable cells: $\frac{dc_{xd}}{dt} = K_d C_{xv}$ ---------- (10)

Substrate: $\frac{dC_s}{dt} = -\left\{ \frac{\mu C_{xv}}{Y_{x/s}} + M_s C_{xv} + \frac{\alpha \mu C_{xv} + \beta C_{xv}}{Y_{p/s}} \right\}$ ---------- (11)

Product: $\frac{dC_p}{dt} = \alpha \mu C_{xv} + \beta C_{xv}$ ---------- (12)

Including a set of initial conditions at the time of inoculation, the profiles of these variables with time can be determined by integration to yield the following equations for viable cells, substrate and product respectively:

$$t_b = \frac{1}{\mu_{\max}} Ln \left(\frac{C_{xv}}{C_{xvo}} \right)$$ ---------- (13)

$$t_b = \frac{1}{\mu_{\max}} Ln \left\{ 1 + \frac{C_{so} - C_s}{\left(\frac{1}{Y_{x/s}} + \frac{M_s}{\mu_{\max}} \right) C_{xvo}} \right\}$$ ----------(14)

$$t_b = \frac{1}{\mu_{\max}} Ln \left[\left(1 + \frac{\mu_{\max}}{q_p C_{xvo}} \right) (C_p - C_{po}) \right]$$ ---------- (15)

Therefore the total downtime (t_{dn}) and operation time T_t are given below as:

$t_{dn} = t_p + t_1 + t_{hv}$ ----------(16)

and

$T_t = t_b + t_{dn}$ ----------(17)

Where; t_b is the time required for enzymatic conversion or the time required to achieve a given microbial cell concentration, substrate concentration and product concentrations in a batch culture or system.
t_{hv}isthe time taken to harvest the contents inside the batch bioreactor.
t_p is the time needed to clean, sterilize and otherwise prepare the bioreactor for the next operation.
t_1 isa lag time of duration that occurs after inoculation during there is no growth or product formation

2.3 MODELING OF THE ENZYME KINETICS IN THE BATCH BIOREACTOR

The enzyme kinetics in the batch bioreactor is described by two models, the "Michaelis-Menten" model [8] and the "Briggs-Haldane" model [9].
The Michaelis-Menten equation represents the kinetics of many simple enzyme-catalyzed reactions which involves a single substrate.
Also, we have that the concentration of the substrate will always have an effect on the reaction rate ($-r_s$), according to simple Michaelis-Menten Kinetics:

$$(-r_S) = \frac{V_{\max} C_s}{K_m + C_s} \quad \text{---------- (18)}$$

TheBriggs-Haldane model is a mathematical description of enzymatic kinetic reaction based on the assumption that, after a short initial startup period, the concentration of the enzyme-substrate complex is in a pseudo-steady state. For a constant volume batch bioreactor operating isothermallythe material balance is:

$$(+r_p) = \frac{V_{\max} C_S}{K_m + C_S} \quad \text{----------(19)}$$

For a constant volume batch bioreactor, combining equations (18) and (19) give a form of an equation that can be linearized to give:

$$\frac{1}{t} Ln\left[\frac{C_{so}}{C_s}\right] = \frac{V_{\max}}{K_m} - \frac{1}{K_m}\left[\frac{C_{so} - C_s}{t}\right] \quad \text{---------- (20)}$$

Equation (20) shows $\frac{1}{t} Ln\left[\frac{C_{so}}{C_s}\right]$ as a linear function of $\frac{(C_{so} - C_s)}{t}$. The parameters K_m and V_{max}can be estimated from equation (20), using measured values of C_s as a function of t for a given C_{so}.

III. RESULTS AND DISCUSSION

The purpose of simulation is to make a comparison with real experimental data presented for a real process and check the adequacy of the models and the underlying assumptions. However, the data are best obtained experimentally, but in the absence of experiment, such data can also be gotten from Journals and literatures. Therefore, the kinetic data for simulation and validation of the mathematical modelsfor the fermentation of corn starch into ethanol in a batch system were obtained from Manikandan et.al [10].The values of the parameters used to simulate the mathematical models are presented in Table 1.

Table 1:Parameters for Model Validation

PARAMETER	DESCRIPTION	VALUE	SOURCE
V_{max}	Maximum rate or velocity of reaction of the enzymes	35.50($\frac{gmol}{l.hr}$)	Calculated
K_m	Michaelis-Menten Constant	826.45 ($^{gmol}/_{l}$)	Calculated
α	Growth related product formation coefficient	2.67$\frac{g\ product}{g\ of\ biomass\ -hr}$	[10]
β	Non-growth related product formation coefficient.	0.062$\frac{g\ product}{g\ biomass\ -hr}$	[10]
μ_{max}	Maximum specific growth rate	0.10049 (hr^{-1})	Calculated
K_d	Endogenous decay coefficient	0.01416 (hr^{-1})	Calculated
$Yc_{x/cS}$	Yield of cell weight per unit weight of substrate utilized	10.104$\frac{kg\ Cx}{kg\ Cs}$	Calculated
M_s	Maintenance coefficient	0.005402577	Calculated
$Yc_{p/CS}$	Yield of product weight per unit weight of substrate utilized	0.05436 kg Cp/kg Cs	Calculated

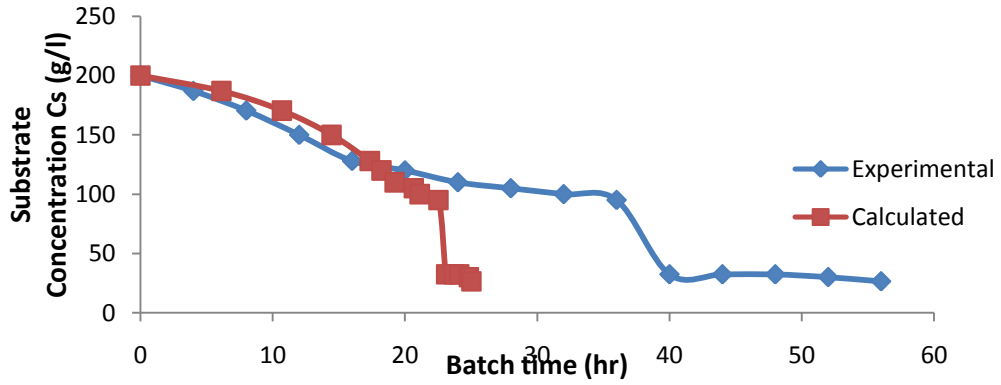

Fig. 2: Substrate Concentration versus Batch Reaction Time

Fig. 2 shows that the concentration of the substrate decreases as the batch reaction time increases, and the calculated batch reaction time gives the same substrate concentration profile but at a shorter time frame of 25hrs when compared with the experimental batch reaction time of 56hrs. The behavior of the plot graphically confirms that the mathematical model predicted an optimized fermentation process for the substrate compared with the experimental values.

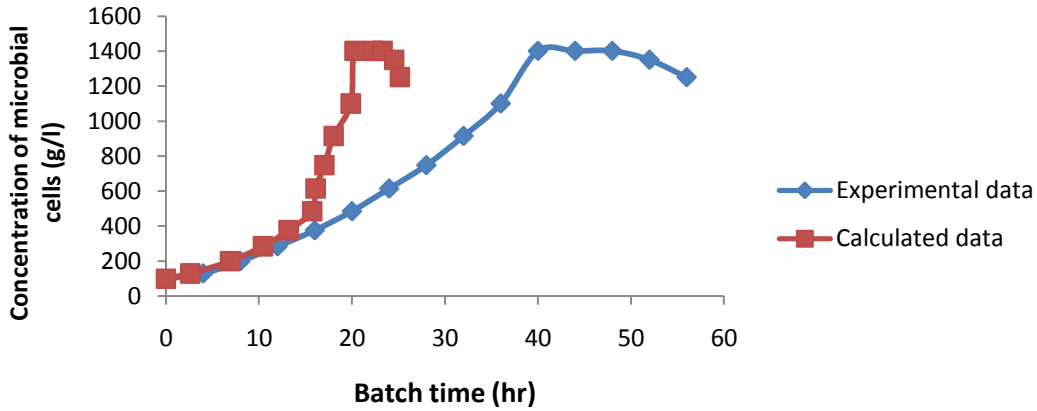

Fig. 3: Concentration of Microbial Cells versus Batch Reaction Time

Fig. 3 shows that the concentration of the microbial cells increase as the batch reaction time increases and the calculated batch reaction time gives the same microbial cell concentration profile but in an acceleratedtime frame of 25hrs when compared with the experimental batch reaction time 56hrs. Thus, the plot graphically confirms that the mathematical model predicted an accelerated microbial growth rate and fermentation for the substrate compared with the experimental values.

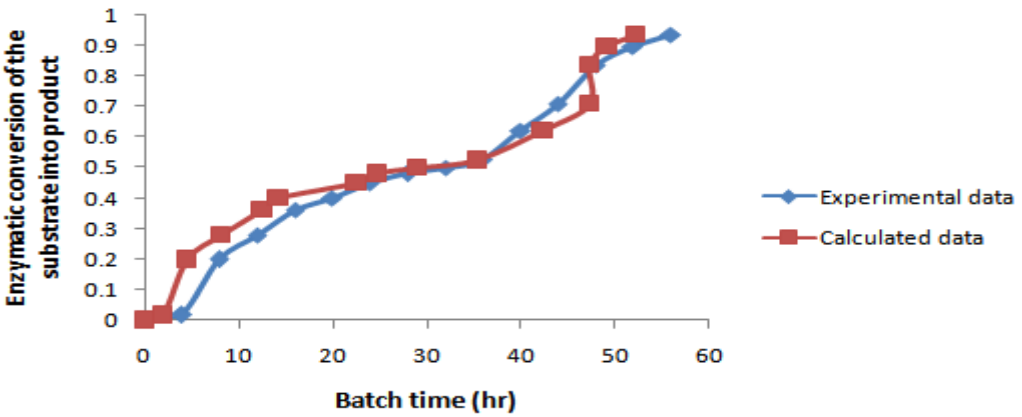

Fig. 4: Enzymatic Conversion of Substrate into Product versus Batch Reaction Time

Fig. 4 shows that the enzymatic conversion of the substrate into product (ethanol) increase as the batch reaction time increases.The calculated batch reaction time predicted the same profile compared with the experimental batch reaction time. Thus, the mathematical model prediction agrees with the experimental value as the calculated values werealmost the same with the experimental values.

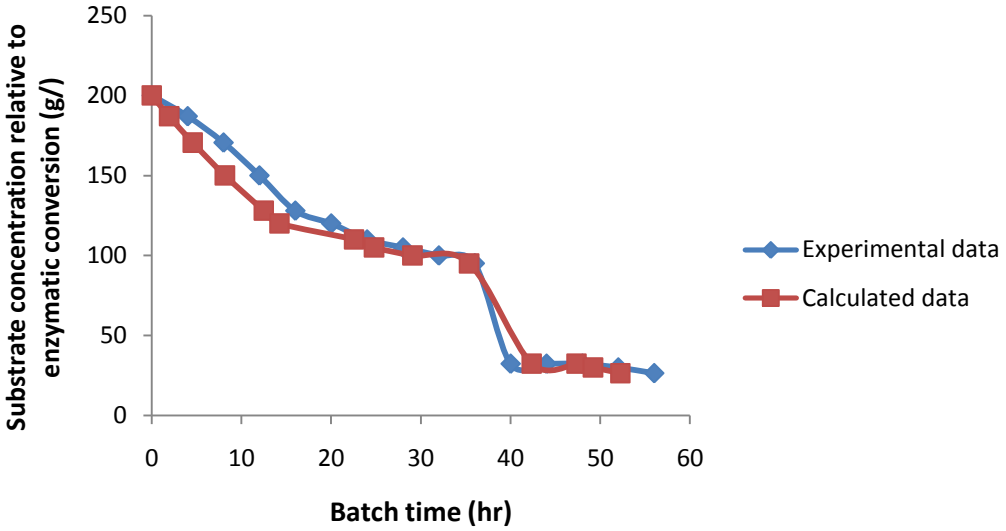

Fig. 5: Substrate Concentration relative to Enzymatic Conversion versus Batch Reaction Time

Fig. 5 shows that the concentration of the substrate (corn) relative to enzymatic conversion of the substrate into product (ethanol) decreases with increase in batch reaction time.The simulated batch reaction time predicted almost the same substrate concentration profile when compared with the experimental batch reaction time. Thus, the mathematical model prediction agrees with the experimental values showinguniform rate of substrate decomposition.

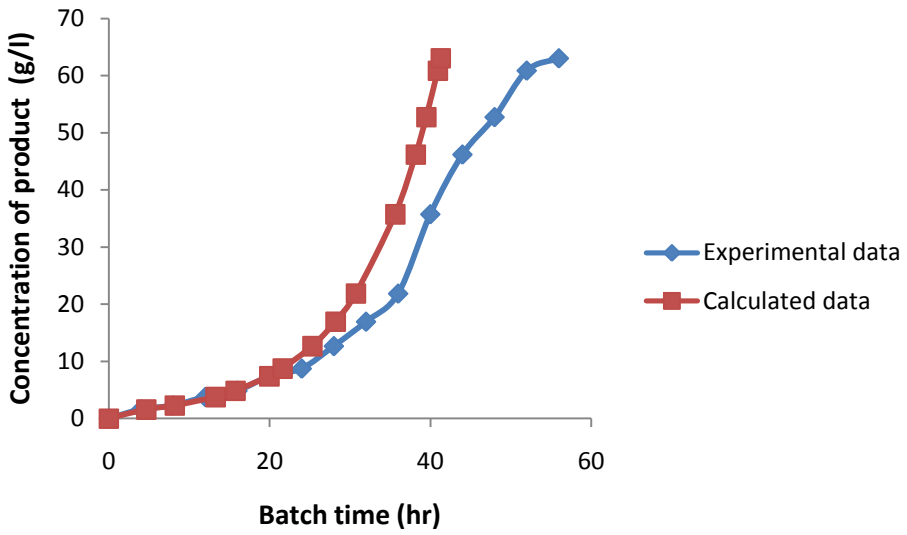

Fig. 6: Concentration of Product versus Batch Reaction Time

Fig. 6 shows that the concentration of the product increaseswith batch reaction time and the calculated batch reaction time predicteda faster product concentration profile of 41hrs when compared with the experimental batch reaction time 56hrs. Thus,the simulated result showed enhanced reactor performance and efficiency in product formation. The mathematical model prediction showed an optimized compliance with the experimental values.

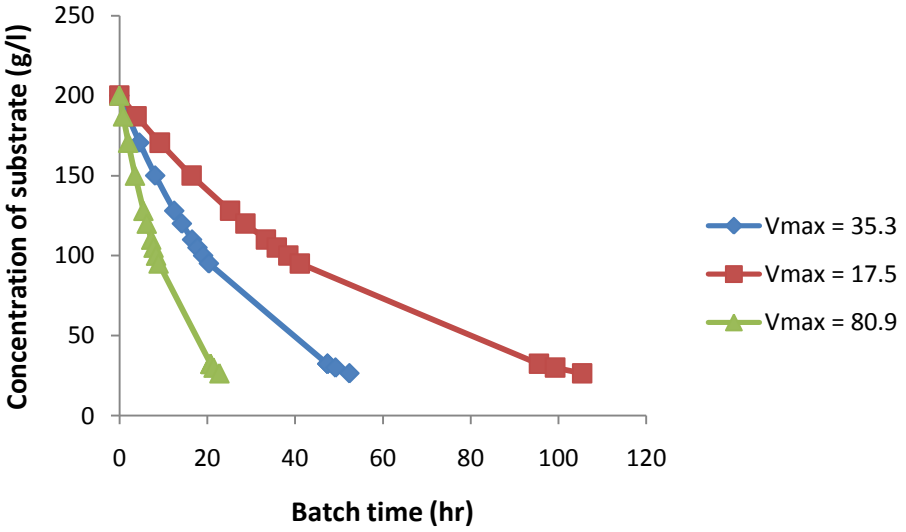

Fig. 7: Substrate Concentration versus Batch Reaction Time at different Velocities of Reaction

Fig. 7 shows that the maximum rate or velocity of reaction of the enzymes when varied has an effect on the batch reaction time required to achieve a given substrate concentration relative to enzymatic conversion of the substrate into product.The higher the maximum rate or velocity of reaction of the enzymes, the quicker the batch reaction time required to achieve a given substrate concentration relative to enzymatic conversion of the substrate into product and vice-versa.

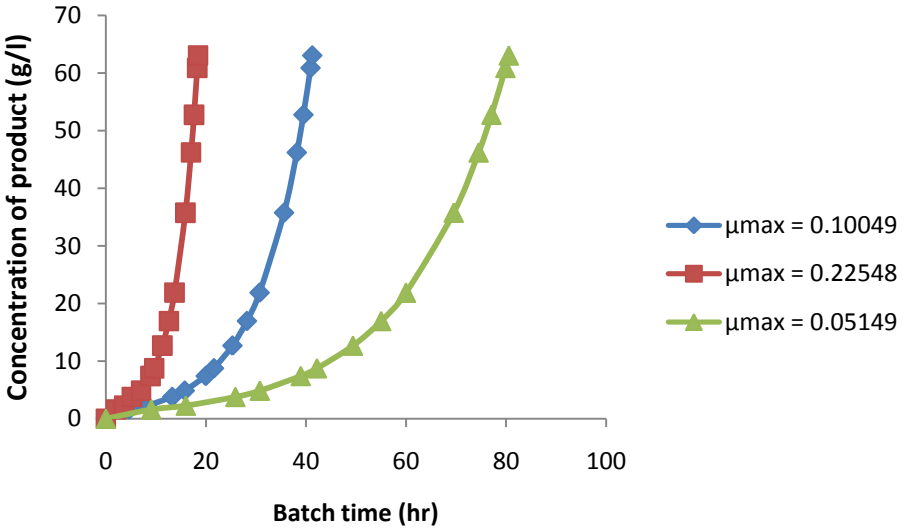

Fig. 8: Concentration of Product versus Batch Reaction Time at different Values ofμ_{max}

Fig. 8 shows that the effect of the maximum specific growth rate (μ_{max}) of the microbial cells on the batch reaction time required to achieve a given product concentration profile. The higher the maximum specific growth rate of the microbial cells the quicker the batch reaction time required to achieve a given product concentration profile, and vice-versa. Thus, operating the reactor with higher values of μ_{max} will yield more products in a short time frame.

IV. CONCLUSION

Thisstudy predicted the effects of various operating kinetic parameters on the batch time profile for the whole conversion process of the substrate (corn) into product (ethanol) with the following observations;The simulated data showed an optimized profile for the batch time profile of 25, 25, 56 and 41hrs required to achieve a given concentration of substrate, concentration of the microbial cells, enzymatic conversion of the substrate

into product and the concentration of the product respectively, compare with experimental batch time of 56hrs for all cases. An increase in the maximum rate or velocity of reaction (V_{max}) of the enzyme activity promotes a quick and rapid conversion of the substrate into product, and an increase in the maximum specific growth rate (μ_{max}) of the microbial cells rapidly increases the concentration of the microbial cells at a fasterrate and vice versa. An increase in the maximum specific growth rate (μ_{max}) of the microbial cells also increases the concentration of the product. Thus, it can be concluded that the parameters (V_{max}) and (μ_{max}) are key factors in the design of a batch biochemical reactor, because they are useful for predicting the most appropriate batch reaction conditions and the efficiency of the bioreactor.

The adequacy of the mathematical model predictions showed that it can be considered as a goodcomplimentary tool for the real system since the simulation results of the mathematical models agree with experimental values reported in literature. The simulation results however, predicted higherperformance efficiency for the bioreactor than the experimental results due to the fact that experiments are most times prone to experimental errors.

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Design of Discrete Optimal Multirate-Output Controllers Applied to a Hydrogenerator Power System

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Abstract: **-** In the present work an H^{∞} -control technique is presented and applied to the design of optimal multirate-output controllers. The technique is based on multirate-output controllers (MOCs) having a multirate sampling mechanism with different sampling period in each measured output of the system. The proposed technique relies on multirate-output controllers. Its main feature consists in reducing the original problem, to an associate discrete H^{∞}-control problem for which a fictitious static state feedback controller is to be designed. The proposed H^{∞}-control technique is applied to the discrete linear open-loop system model which represents a 117 MVA hydrogenerator unit supplying power through a step-up transformer and a transmission line to a infinite grid and give good assurance that the controllers designed by the H^{∞} -control technique may be implementable.

Keywords: **-** *Digital multirate control, Disturbance attenuation, H^{∞}-control, hydrogenerator system*

I. INTRODUCTION

The H^{∞}-control problem for discrete-time and sampled data singlerate and multirate systems has successfully been treated in the past [1-9,11,12]. Generally speaking, when the state vector is not available for feedback, the H^{∞}-control problem is usually solved in both the continuous and the discrete-time cases, by the use of dynamic measurement feedback.

This technique is based on multirate-output controllers (MOCs). MOCs contain a multirate sampling mechanism with different sampling period to each system measured output. The technique proposed[10], relies mainly on the reduction, under appropriate conditions, of the original H^{∞} -disturbance attenuation problem, to an associated discrete H^{∞}-control problem for which a fictitious static state feedback controllers is to be designed, even though state variables are not available for feedback. This fact has beneficial impact on the theoretical and the numerical complexity of the problem since using the technique reported in [10,11], only one algebraic Riccati equation is to be solved, as compared to two algebraic Riccati equations needed by other well known H^{∞} -control techniques.

In the present paper the ultimately investigated discrete linear open-loop power system model was obtained through a systematic procedure using a linearized continuous, with impulse disturbances, 6^{th}-order SIMO open-loop model representing a practical power system, which consists of a 117 MVA hydrogenerator with a single stage excitations system supplying power to an infinite gird via a step-up transformer and a double-circuit transmission line [14]. The digital controller, which will lead to the associated designed discrete closed-loop power system model displaying enhanced dynamic stability characteristics, is accomplished by applying properly the presented MOCs technique.

II. OVERVIEW OF RELEVANT MATHEMATICAL CONSIDERATIONS

The general description of the controllable and observable continuous, linear, time-invariant, multivariable mimo dynamical open-loop system expressed in state-space form is:

$$\dot{\mathbf{x}}(t) = \mathbf{A}\mathbf{x}(t) + \mathbf{B}\mathbf{u}(t)$$
$$\mathbf{y}(t) = \mathbf{C}\mathbf{x}(t) \quad (1)$$

where: $\mathbf{x}(t) \in R^n$, $\mathbf{u}(t) \in R^m$, $\mathbf{y}(t) \in R^p$ are state, input and output vectors respectively; and **A**, **B** and **C** are real constant system matrices with proper dimensions.

The associated general discrete description of the system of equation 1 is as follows

$$\mathbf{x}(k+1) = \mathbf{A}\mathbf{x}(k) + \mathbf{B}\mathbf{u}(k)$$
$$\mathbf{y}(k) = \mathbf{C}\mathbf{x}(k) \quad (2)$$

where: $\mathbf{x}(k) \in \mathrm{R}^n$, $\mathbf{u}(k) \in \mathrm{R}^m$, $\mathbf{y}(k) \in \mathrm{R}^p$ are state, input and output vectors respectively; and **A**, **B** and **C** are real constant system matrices with proper dimensions.

III. OVERVIEW OF H^∞- CONTROL TECHNIQUE USING MOC [5,8]

Consider the controllable and observable continuous linear state-space system model of the general form:

$$\dot{\mathbf{x}}(t) = \mathbf{A}\mathbf{x}(t) + \mathbf{B}\mathbf{u}(t) + \mathbf{D}\mathbf{q}(t), \ \mathbf{x}(0) = \mathbf{0} \quad (3a)$$

$$\mathbf{y}_m(t) = \mathbf{C}\mathbf{x}(t) + \mathbf{J}_1\mathbf{u}(t), \ \mathbf{y}_c(t) = \mathbf{E}\mathbf{x}(t) + \mathbf{J}_2\mathbf{u}(t) \quad (3b)$$

where: $\mathbf{x}(t) \in R^n$, $\mathbf{u}(t) \in R^m$, $\mathbf{q}(t) \in \mathbf{L}_2^d$, $\mathbf{y}_m(t) \in R^{p_1}$, $\mathbf{y}_c(t) \in R^{p_2}$ are the state, input, external disturbance, measured output and controlled output vectors, respectively. In equation 3, all matrices have real elements and appropriate dimensions. Now follows a useful definition.

Definition. For an observable matrix pair $(\mathbf{A}, \mathbf{C})$, with $\mathbf{C}^T = \begin{bmatrix} \mathbf{c}_1^T & \mathbf{c}_2^T & \cdots & \mathbf{c}_{p_1}^T \end{bmatrix}$ and $\mathbf{c}_i$ with i=1, …,p_1, the *i*th row of the matrix **C**, a collection of p_1 integers $\{n_1, n_2, \cdots, n_{p_1}\}$ is called an *observability index vector* of the pair $(\mathbf{A}, \mathbf{C})$, if the following relationships simultaneously hold

$$\sum_{i=1}^{p_1} n_i = n \ , \ rank\left[\mathbf{c}_1^T \ \cdots \ \left(\mathbf{A}^T\right)^{n_1-1}\mathbf{c}_1^T \ \cdots \ \mathbf{c}_{p_1}^T \ \cdots \ \left(\mathbf{A}^T\right)^{n_{p_1}-1}\mathbf{c}_{p_1}^T\right] = n$$

Next the multirate sampling mechanism [6,8,10], is applied to system 3.

Assuming that all samplers start simultaneously at t = 0, a sampler and a zero-order hold with period T_0 is connected to each plant input $u_i(t)$, i=1,2,…,m, such that

$$\mathbf{u}(t) = \mathbf{u}(kT_0), \ t \in [kT_0, (k+1)T_0) \quad (4)$$

while the ith disturbance $q_i(t)$, i=1,…,d, and the ith controlled output $y_{c,i}(t)$, i=1,…, p_2, are detected at time kT_0, such that for $t \in [kT_0, (k+1)T_0)$

$$\mathbf{q}(t) = \mathbf{q}(kT_0), \ \mathbf{y}_c(kT_0) = \mathbf{E}\mathbf{x}(kT_0) + \mathbf{J}_2(kT_0) \quad (5)$$

The ith measured output $y_{m,i}(t)$, i=1,…, p_1, is detected at every T_i period, such that for $\mu = 0,...,N_i - 1$

$$y_{m,i}(kT_0 + \mu T_i) = \mathbf{c}_i\mathbf{x}(kT_0 + \mu T_i) + (\mathbf{J}_1)_i\mathbf{u}(kT_0) \quad (6)$$

where $(\mathbf{J}_2)_i$ is the ith row of the matrix $\mathbf{J}_2$. Here $N_i \in Z^+$ are the output multiplicities of the sampling and $T_i \in R^+$ are the output sampling periods having rational ratio, i.e. $T_i = T_0 / N_i$ with i=1,…, p_1.

The sampled values of the plant measured outputs obtained over $[kT_0, (k+1)T_0)$ are stored in the N^*-dimensional column vector given by

$$\hat{\gamma}(kT_0) = \left[y_{m,1}(kT_0) \ \cdots \ y_{m,1}\left(kT_0 + (N_1 - 1)T_1\right) \ \cdots \ y_{m,p_1}(kT_0) \ \cdots \ y_{m,p_1}\left[kT_0 + (N_{p_1} - 1)T_{p_1}\right]\right]^T \quad (7)$$

(where $N^* = \sum_{i=1}^{p_1} N_i$), that is used in the MROC of the form

$$\mathbf{u}[(k+1)T_0] = \mathbf{L}_\mathbf{u}\mathbf{u}(kT_0) - \mathbf{L}_\gamma\hat{\gamma}(kT_0) \quad (8)$$

where $L_\mathbf{u} \in R^{m \times m}$, $L_\gamma \in R^{m \times N^*}$.

The H^{∞}-disturbance attenuation problem treated in this paper, is as follows: Find a MOC of the form (2), which when applied to system (1), asymptotically stabilizes the closed-loop system and simultaneously achieves the following design requirement

$$\left\|\mathbf{T}_{\mathbf{qy}_c}(z)\right\|_{\infty} \le \gamma \tag{9}$$

for a given $\gamma \in \mathbf{R}^{+}$, where $\left\|\mathbf{T}_{\mathbf{qy}_c}(z)\right\|_{\infty}$ is the H$^{\infty}$-norm of the proper stable discrete transfer function $\mathbf{T}_{\mathbf{qy}_c}(z)$, from sampled-data external disturbances $\mathbf{q}(kT_0) \in \ell_2^d$ to sampled-data controlled outputs $\mathbf{T}_{\mathbf{qy}_c}(z)$, defined by

$$\left\|\mathbf{T}_{\mathbf{qy}_c}(z)\right\|_{\infty} = \sup_{\mathbf{q}(kT_0)\in l_2} \frac{\left\|\mathbf{y}_c(kT_0)\right\|_2}{\left\|\mathbf{q}(kT_0)\right\|_2} = \sup_{\theta\in[0,2\pi]} \sigma_{\max}\left[\mathbf{T}_{\mathbf{qy}_c}\left(e^{j\theta}\right)\right] = \sup_{|z|=1} \sigma_{\max}\left[\mathbf{T}_{\mathbf{qy}_c}(z)\right]$$

where, $\sigma_{\max}\left[\mathbf{T}_{\mathbf{qy}_c}(z)\right]$ is the maximum singular value of $\mathbf{T}_{\mathbf{qy}_c}(z)$, and where use was made of the standard definition of the ℓ_2-norm of a discrete signal $\mathbf{s}(kT_0)$

$$\left\|\mathbf{s}(kT_0)\right\|_2^2 = \sum_{k=0}^{\infty} \mathbf{s}^T(kT_0)\mathbf{s}(kT_0)$$

Our attention will now be focused on the solution of the above H^{∞}-control problem. To this end, the following assumptions on system (1) are made:

Assumptions:

a) The matrix triplets $(\mathbf{A}, \mathbf{B}, \mathbf{C})$ and $(\mathbf{A}, \mathbf{D}, \mathbf{E})$ are stabilizable and detectable.

b) $\operatorname{rank}\begin{bmatrix} A & D \\ C & 0_{\mathrm{p_1 x d}} \end{bmatrix} = \mathrm{n} + \mathrm{d}, \quad \operatorname{rank}\begin{bmatrix} A & B & D \\ C & 0_{\mathrm{p_1 x m}} & 0_{\mathrm{p_1 x d}} \end{bmatrix} = \mathrm{n} + \mathrm{m} + \mathrm{d}$

c) $\mathbf{J}_2^T\begin{bmatrix}\mathbf{E} & \mathbf{J}_2\end{bmatrix} = \begin{bmatrix}\mathbf{0}_{m\times n} & \mathbf{I}_{m\times m}\end{bmatrix}$

d) There is a sampling period T_0, such that the open-loop discrete-time system model in general form becomes

$$\begin{aligned} \mathbf{x}[(k+1)T_0] &= \Phi\mathbf{x}(kT_0) + \hat{\mathbf{B}}\mathbf{u}(kT_0) + \hat{\mathbf{D}}\mathbf{q}(kT_0) \\ \mathbf{y}_c(kT_0) &= \mathbf{E}\mathbf{x}(kT_0) + \mathbf{J}_2\mathbf{u}(kT_0) \end{aligned} \tag{10}$$

where $\Phi = \exp(AT_0)$, $(\hat{B},\hat{D}) = \int_0^{T_0} \exp(A\lambda)(B,D)\mathrm{d}\lambda$

is stabilizable and observable and does not have invariant zeros on the unit circle.

From the above it follows that the procedure for H^{∞}-disturbance attenuation using MOCs essentially consists in finding for the control law a fictitious state matrix **F**, which equivalently solves the problem and then, either determining the MOC pair $(\mathbf{L}_{\gamma}, \mathbf{L}_u)$ or choosing a desired $\mathbf{L}_{\mathbf{u}}$ and determining the $\mathbf{L}_{\gamma}$. As it has been shown in [3], matrix **F** takes the form

$$\mathbf{F} = \left(\mathbf{I} + \hat{\mathbf{B}}^T\mathbf{P}\hat{\mathbf{B}}\right)^{-1}\hat{\mathbf{B}}^T\mathbf{P}\Phi \tag{11}$$

where **P** is an appropriate solution of the following Riccati equation

$$\mathbf{P} = \mathbf{E}^T\mathbf{E} + \Phi^T\mathbf{P}\Phi - \Phi^T\mathbf{P}\hat{\mathbf{B}}\left(\mathbf{I} + \hat{\mathbf{B}}^T\mathbf{P}\hat{\mathbf{B}}\right)^{-1}\hat{\mathbf{B}}\mathbf{P}\Phi + \mathbf{P}\hat{\mathbf{D}}_{\gamma}\left(\mathbf{I} + \hat{\mathbf{D}}_{\gamma}^T\mathbf{P}\hat{\mathbf{D}}_{\gamma}\right)\hat{\mathbf{D}}_{\gamma}^T\mathbf{P}\ ,\ \hat{\mathbf{D}}_{\gamma} = \gamma^{-1}\hat{\mathbf{D}} \tag{12}$$

It is to be noted that $\gamma \in R^{+}$, such that $\left\|T_{qy_c}(\mathrm{z})\right\| \ge \gamma$ where $\left\|T_{qy_c}(\mathrm{z})\right\|_{\infty}$ is the H$^{\infty}$-norm of the proper stable discrete transfer function $T_{qy_c}(\mathrm{z})$, from sampled-data external disturbances $q(\mathrm{kT_o}) \in \ell_2^d$ to sampled-data controlled output $y_c(\mathrm{kT_o})$.

Once matrix **F** is obtained the MROC matrices $\mathbf{L}_{\gamma}$ and $\mathbf{L}_{\mathbf{u}}$ (in the case where $\mathbf{L}_{\mathbf{u}}$ is free), can be computed according to the following mathematical expressions

$$\begin{aligned} \mathbf{L}_{\gamma} &= \begin{bmatrix}\mathbf{F} & \mathbf{0}_{m\times d}\end{bmatrix}\tilde{\mathbf{H}} + \Lambda\left(\mathbf{I}_{N^*\times N^*} - \begin{bmatrix}\mathbf{H} & \Theta_{\mathbf{q}}\end{bmatrix}\tilde{\mathbf{H}}\right) \\ \mathbf{L}_{\mathbf{u}} &= \left\{\begin{bmatrix}\mathbf{F} & \mathbf{0}_{m\times d}\end{bmatrix}\tilde{\mathbf{H}} + \Lambda\left(\mathbf{I}_{N^*\times N^*} - \begin{bmatrix}\mathbf{H} & \Theta_{\mathbf{q}}\end{bmatrix}\tilde{\mathbf{H}}\right)\right\}\Theta_{\mathbf{u}} \end{aligned} \tag{13}$$

where $\tilde{\mathbf{H}}\begin{bmatrix}\mathbf{H} & \Theta_{\mathbf{q}}\end{bmatrix}=\mathbf{I}$ and $\Lambda \in \mathbf{R}^{\mathbf{mxN}^*}$ is an arbitrary specified matrix. In the case where $\mathbf{L}_u=\mathbf{L}_{u,sp}$, we have

$$\mathbf{L}_\gamma=\begin{bmatrix}\mathbf{F} & \mathbf{L}_{\mathbf{u},sp} & \mathbf{0}_{m\times d}\end{bmatrix}\hat{\mathbf{H}}+\Sigma\left(\mathbf{I}_{N^*\times N^*}-\begin{bmatrix}\mathbf{H} & \Theta_{\mathbf{u}} & \Theta_{\mathbf{q}}\end{bmatrix}\hat{\mathbf{H}}\right)$$

where $\hat{\mathbf{H}}\begin{bmatrix}\mathbf{H} & \Theta_{\mathbf{u}} & \Theta_{\mathbf{q}}\end{bmatrix}=\mathbf{I}$ and $\Sigma \in \mathbf{R}^{\mathbf{mxN}^*}$ is arbitrary.

The resulting closed-loop system matrix $(\mathbf{A}_{\mathbf{cl/d}})$ takes the following general form

$$\mathbf{A}_{\mathbf{cl/d}}=\mathbf{A}_{\mathbf{ol/d}}-\mathbf{B}_{\mathbf{ol/d}}\mathbf{F} \quad (14)$$

where **cl** = closed-loop, **ol** = open-loop and **d** = discrete.

IV. DESIGN AND SIMULATIONS OF OPEN- AND CLOSED-LOOP MODELS OF THE POWER SYSTEM

In the present work, the aforementioned optimal control strategy is used to design a desirable excitation controller of a hydrogenerator system, for the purpose of enhancing its dynamic stability characteristics. The hydrogenerator system studied [14], is an 117 MVA hydrogenerator unit of the Greek Electric Utility Power System, which supplies power through a step-transformer and a transmission line to an infinite grid.

The numerical values of the parameters, which define the total system as well as its operating point, come from [14] and are given in Appendix A.

Based on the state variables Fig. 1 and the values of the parameters and the operating point (see Appendix A), the system of Fig. 1 may be described in state-space form, in the form of system 3, where

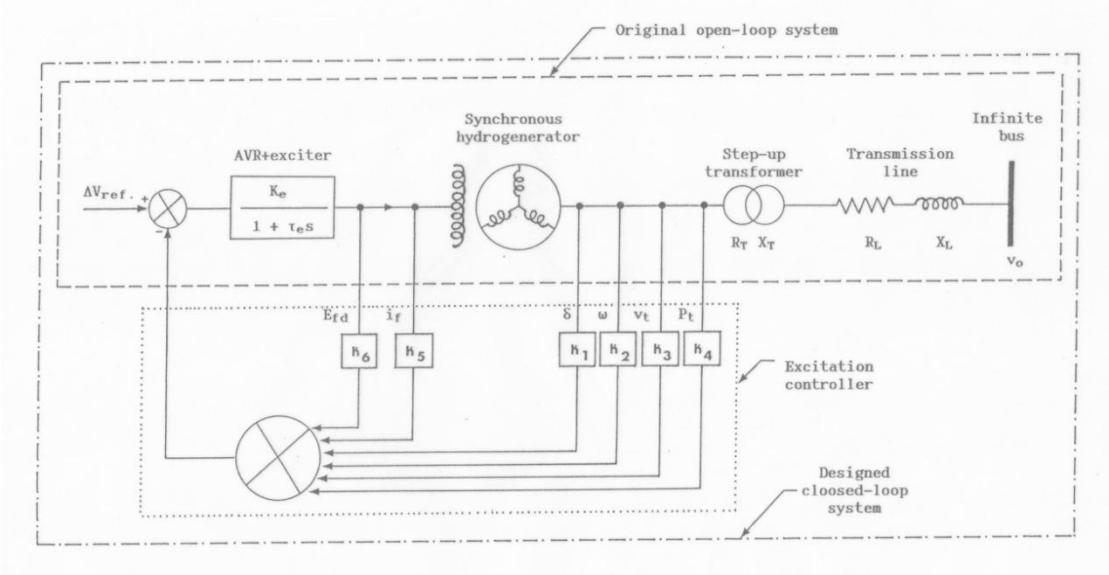


Fig. 1. Simplified representation of hydrogenerator system supplying power by an infinite grid.

$$\mathbf{x}=\begin{bmatrix}\Delta\delta & \Delta\omega & \Delta v_t & \Delta P_t & \Delta i_f & \Delta E_{fd}\end{bmatrix}^T,$$

$\mathrm{u}=\Delta\mathrm{V}_{\mathrm{ref.}}$, $\mathbf{y}=\mathbf{x}$, $\mathrm{q}=\mathrm{u}$, $\mathbf{y}_{\mathbf{m}}=\mathbf{x}$, $\mathbf{y}_{\mathbf{c}}=\mathbf{x}$,

$\mathbf{E}=\mathbf{I}_{6x6}$, $\mathbf{J}_1=\mathbf{0}_{6x1}$, $\mathbf{J}_2=\mathbf{0}_{6x1}$.

The matrices **A**, **B**, **C** and **D** are given in Appendix B.

The eigenvalues of the original continuous open-loop power system models and the simulated responses of the output variables $\left(\Delta\delta, \Delta\omega, \Delta v_t, \Delta P_t, \Delta i_f, \Delta E_{fd}\right)$, are shown in Table 1 and Fig. 2, rispectivly.

Table 1. Eigenvalues of original open-loop power system models.

Original open-loop power system model	λ	-25.6139 0.0931+7.7898i 0.0931-7.7898i -8.1191+6.2036i -8.1191-6.2036i -6.4021

As it can be easily checked the above linear state space model is unstable, since matrix **A** has two unstable complex eigenvalues at $\lambda_{1,2}=0.0931\pm j7.7898$.

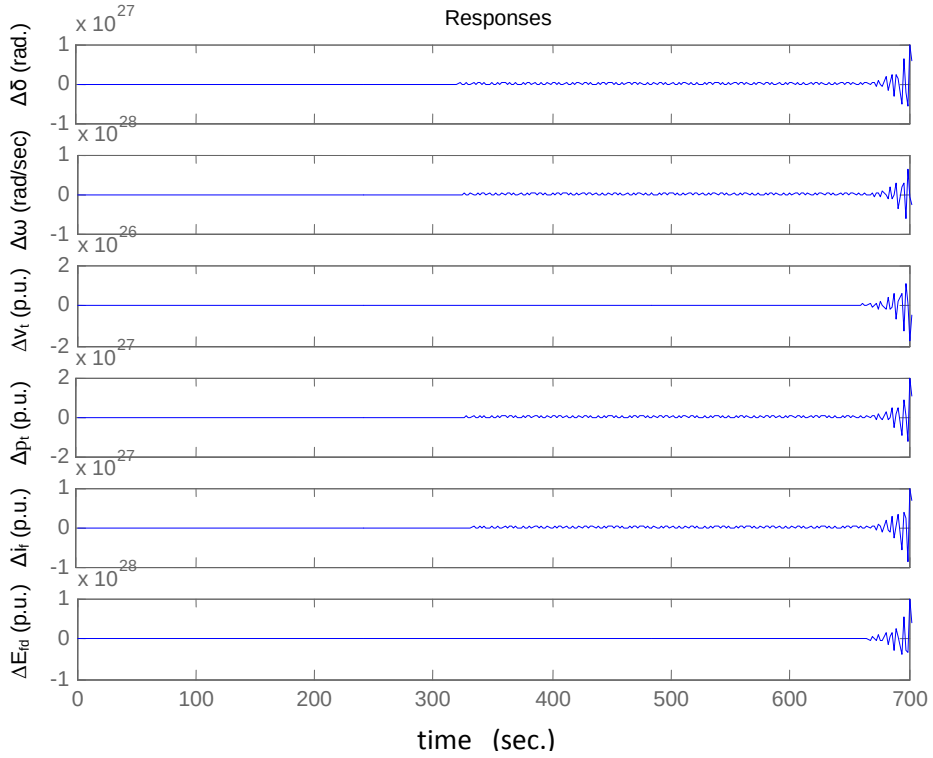


Fig. 2. Responses of the output variables of the original continuous open-loop power system models to step input change: $\Delta V_{ref.}=0.05$ p.u.

The computed discrete linear open-loop power system model, based on the associated linearized continuous open-loop system model described in Appendix B, is given below in terms of its matrices with sampling period $T_0 = 1.0$ sec.

$$\mathbf{A}_{ol/d} = \begin{bmatrix} -0.5757 & 0.1325 & -1.6853 & 0.2743 & -0.0556 & -0.0005 \\ -13.9929 & -0.0004 & -15.0928 & 3.2806 & -1.6663 & -0.0703 \\ 0.2546 & -0.0197 & 0.4331 & -0.0805 & 0.0284 & 0.0009 \\ -0.1185 & 0.2090 & -1.8064 & 0.2483 & 0.0065 & 0.0032 \\ 0.3721 & 0.1108 & -0.4875 & 0.0289 & 0.0553 & 0.0039 \\ -7.4355 & 1.0654 & -16.5864 & 2.8682 & -0.7774 & -0.0176 \end{bmatrix}$$

$$\mathbf{B}_{ol/d} = \begin{bmatrix} -0.4208 & -0.4652 & 0.7994 & 0.6004 & 2.6836 & 10.9119 \end{bmatrix}^T$$

$$\mathbf{C}_{ol/d} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}, \quad \mathbf{D}_{ol/d}=\mathbf{B}_{ol/d}$$

The H^{∞} -control using MOCs, the computed discrete linear open-loop model of the power system under study, and the two discrete closed-loop power system models were designed considering two distinct cases:

a) with $\gamma = 10.5$, the $\mathbf{L_u}$ and $\mathbf{L}_{\gamma}$ feedback gain matrices were computed as

$\mathbf{L_u} = 0.00000256$

$\mathbf{L_\gamma} = \begin{bmatrix} -0.1583 & 0.0897 & -0.8912 & 0.1314 & -0.0100 & 0.0009 \end{bmatrix}$

and

b) with γ=5.5, the associated $\mathbf{L_u}$ and $\mathbf{L_\gamma}$ feedback gain matrices were computed as

$\mathbf{L_u} = 0.00000029$

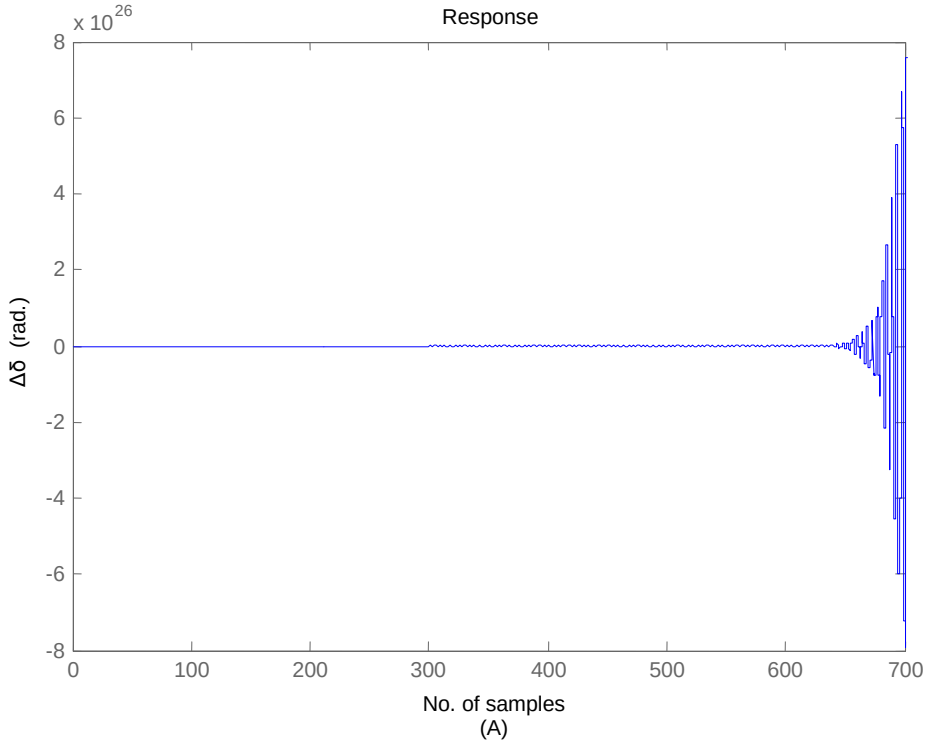
$\mathbf{L_\gamma} = \begin{bmatrix} -0.1248 & 0.0928 & -0.8803 & 0.1269 & -0.0056 & 0.0011 \end{bmatrix}$

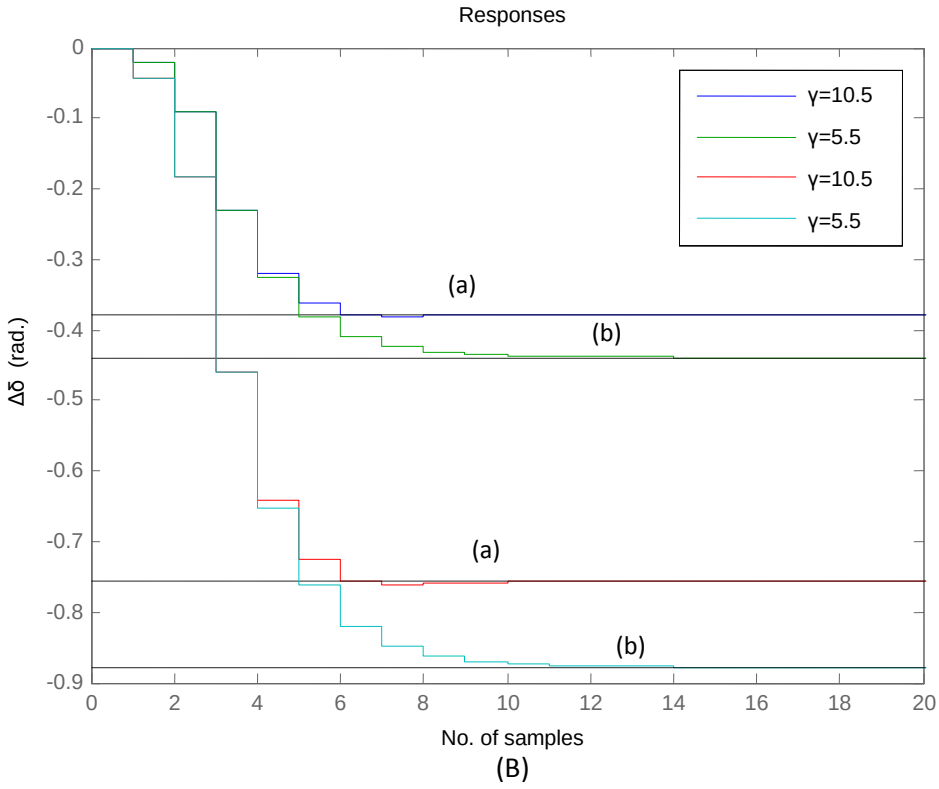
The numerical values of the matrices referring to the discrete closed-loop power system models of the above two cases are not included here due to space limitations.
The magnitude of the eigenvalues of the discrete original open-loop and designed closed-loop power system models are shown in Table 2.

Table 2. Magnitude of eigenvalues of discrete original open-loop and designed closed-loop power system models.

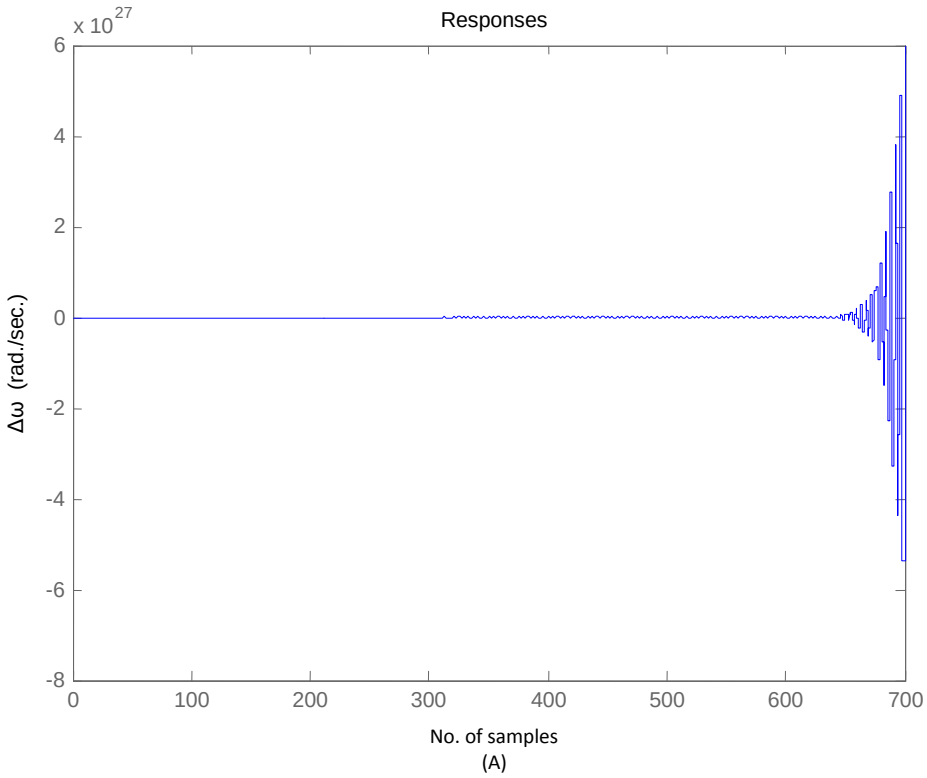
Original open-loop power system model		$\lvert\lambda\rvert$	1.0976 1.0976 0.0017 0.0 0.0003 0.0003
Designed closed-loop power system model	with γ=10.5	$\lvert\hat{\lambda}\rvert$	0.4426 0.4426 0.0053 0.0 0.0003 0.0003
	with γ=5.5	$\lvert\hat{\lambda}\rvert$	0.4933 0.2626 0.0081 0.0 0.0003 0.0003

By comparing the eigenvalues of the designed closed-loop power system models to those of the original open-loop power system model the resulting enhancement in dynamic system stability is judged as being remarkable.
The responses of the output variables ($\Delta\delta$, $\Delta\omega$, Δv_t, ΔP_t, Δi_f, ΔE_{fd}) of the original open-loop and designed closed-loop power system models for zero initial conditions and unit step input disturbance are shown in Figs. 3, respectively.

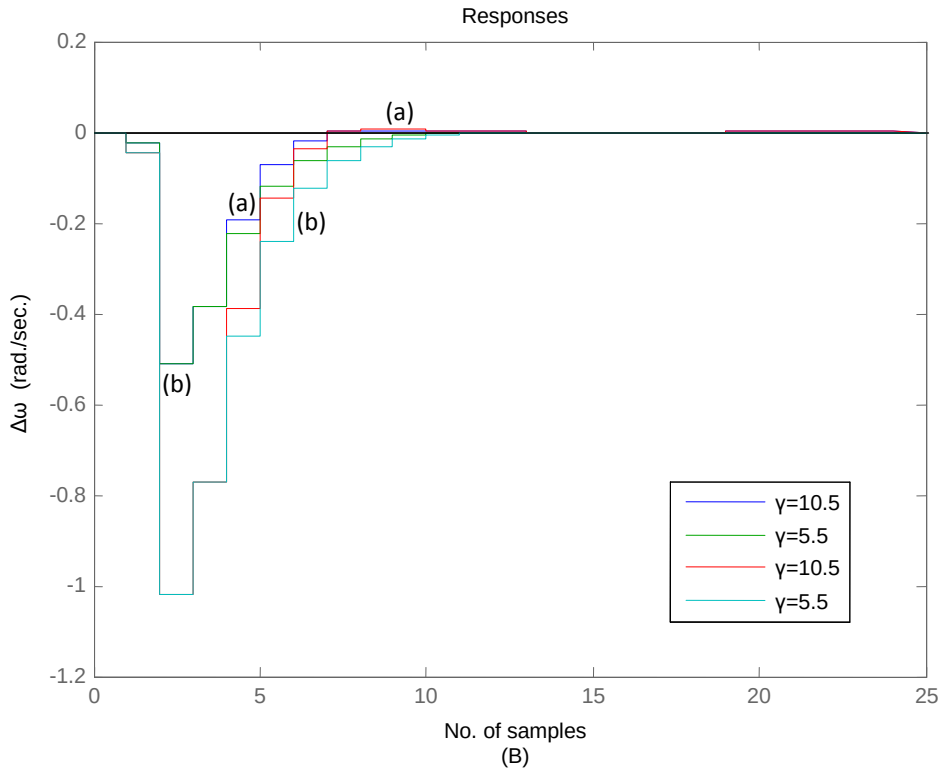



Responses
γ=10.5
γ=5.5
γ=10.5
γ=5.5
(a)
(b)
(a)
(b)
Δδ (rad.)
No. of samples

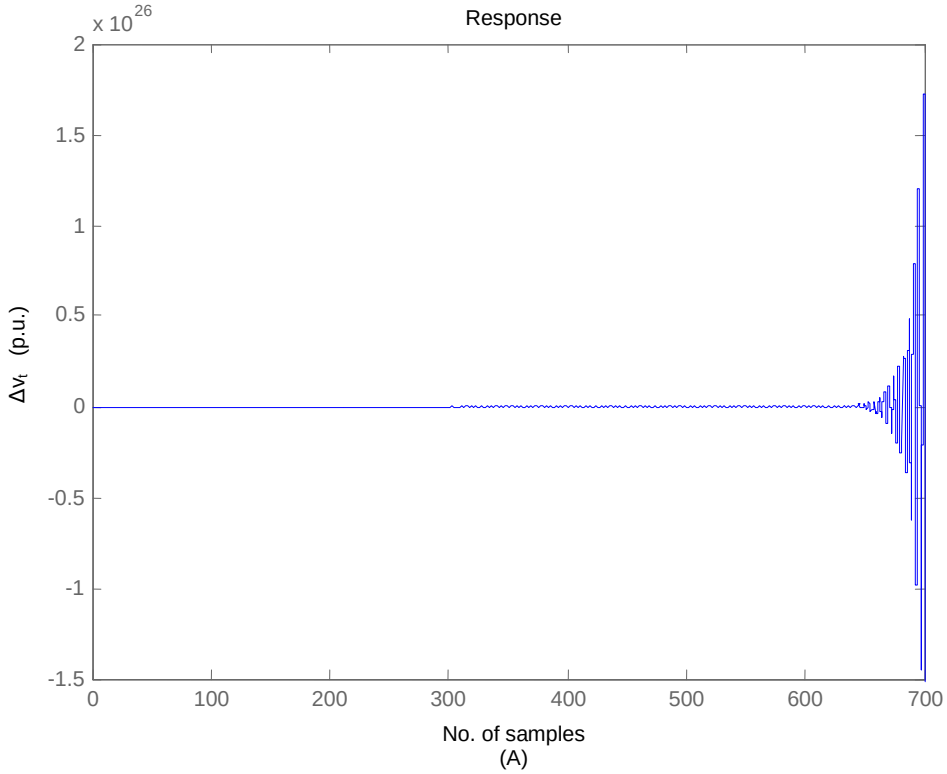
(B)


x 10^27
Responses
Δω (rad./sec.)
No. of samples

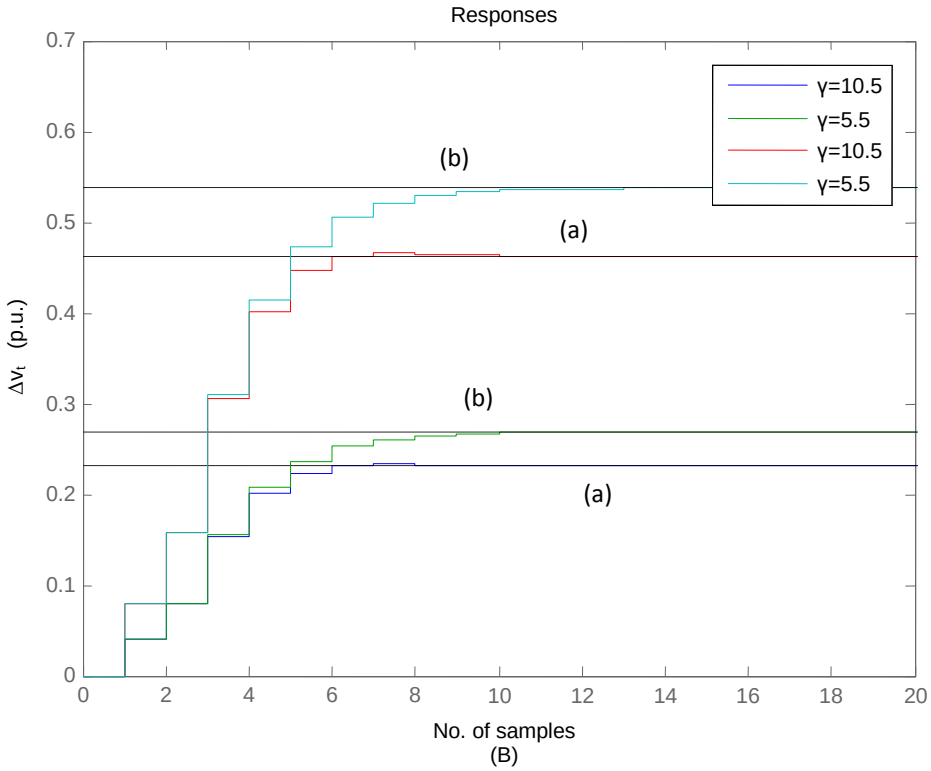
(A)

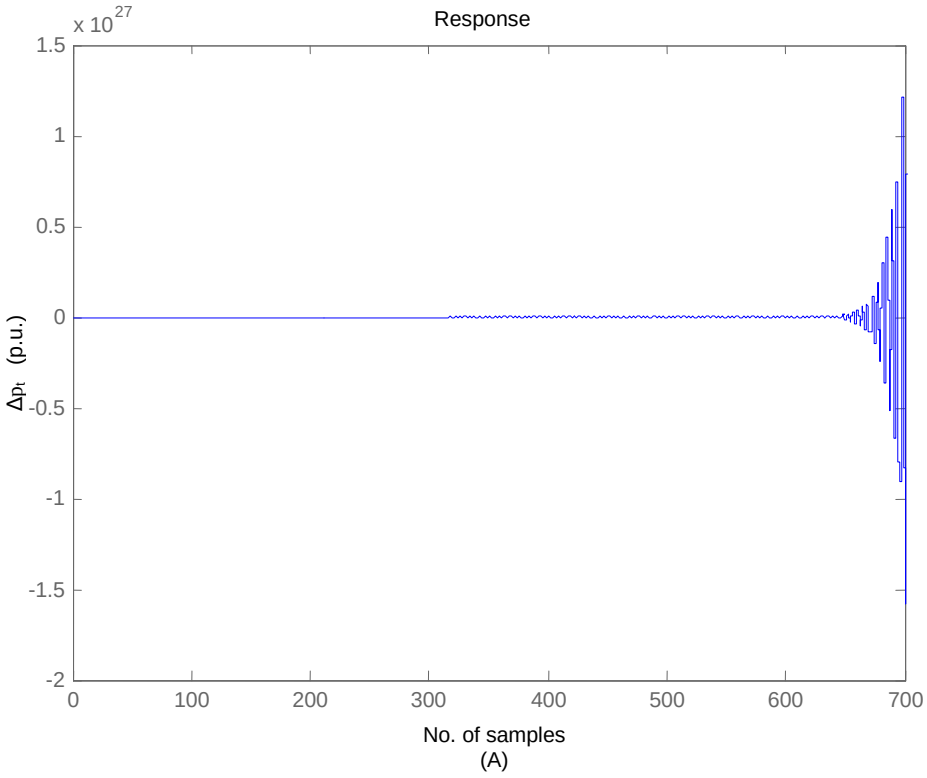

Responses
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
0
5
10
15
20
25
(a)
(a)
(b)
(b)
Δω (rad./sec.)
No. of samples
γ=10.5
γ=5.5
γ=10.5
γ=5.5

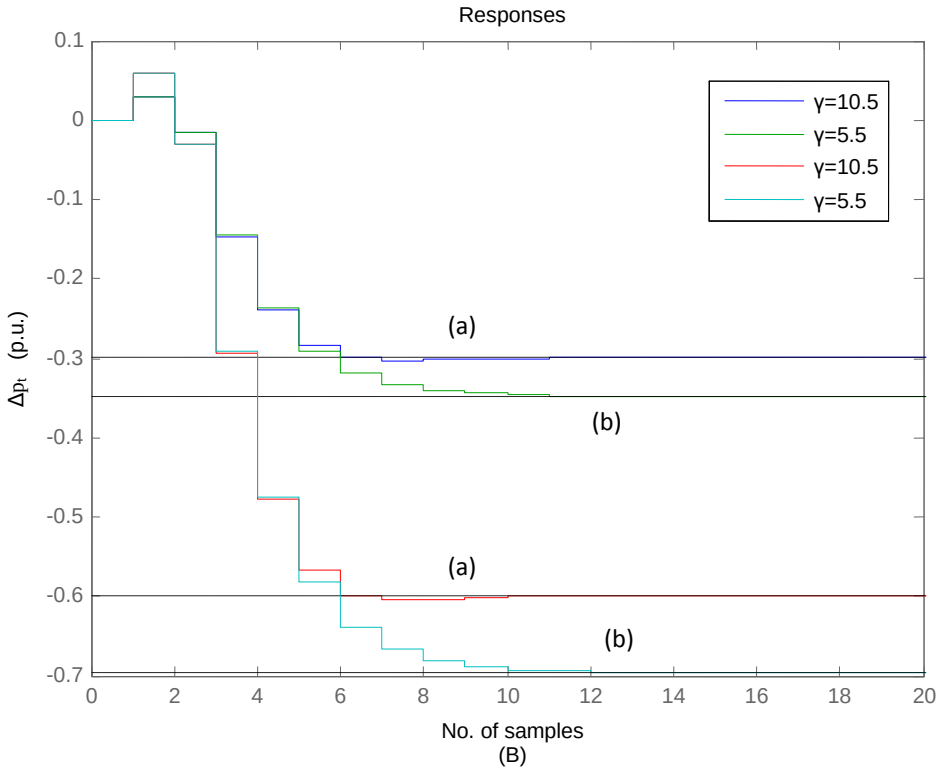
(B)

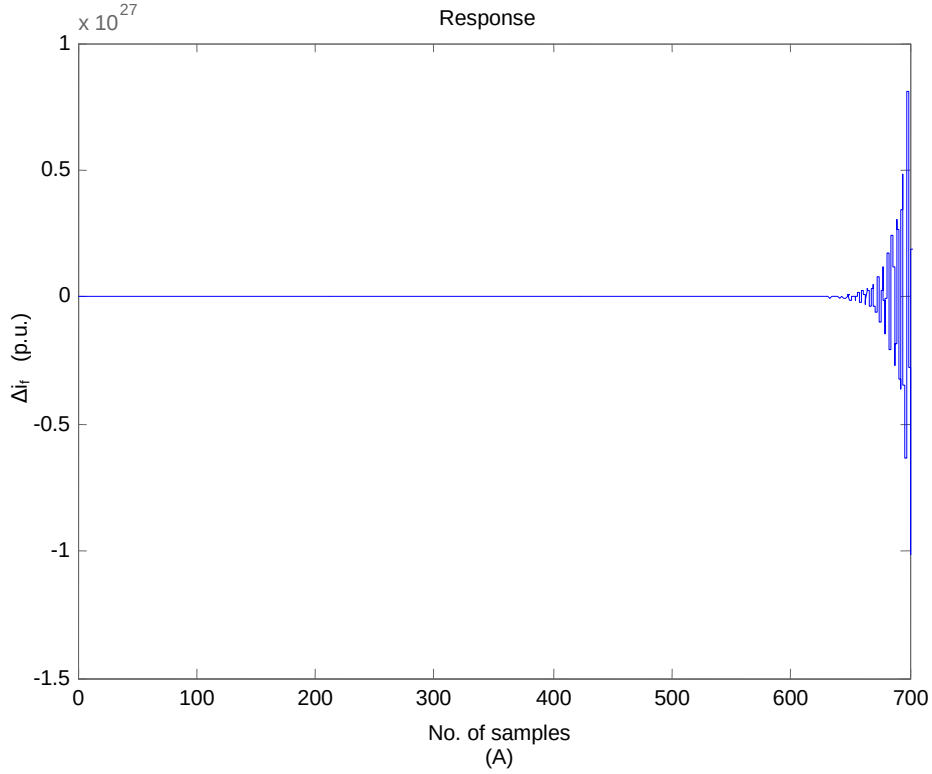

Response
x 10^26
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
100
200
300
400
500
600
700
Δv_t (p.u.)
No. of samples

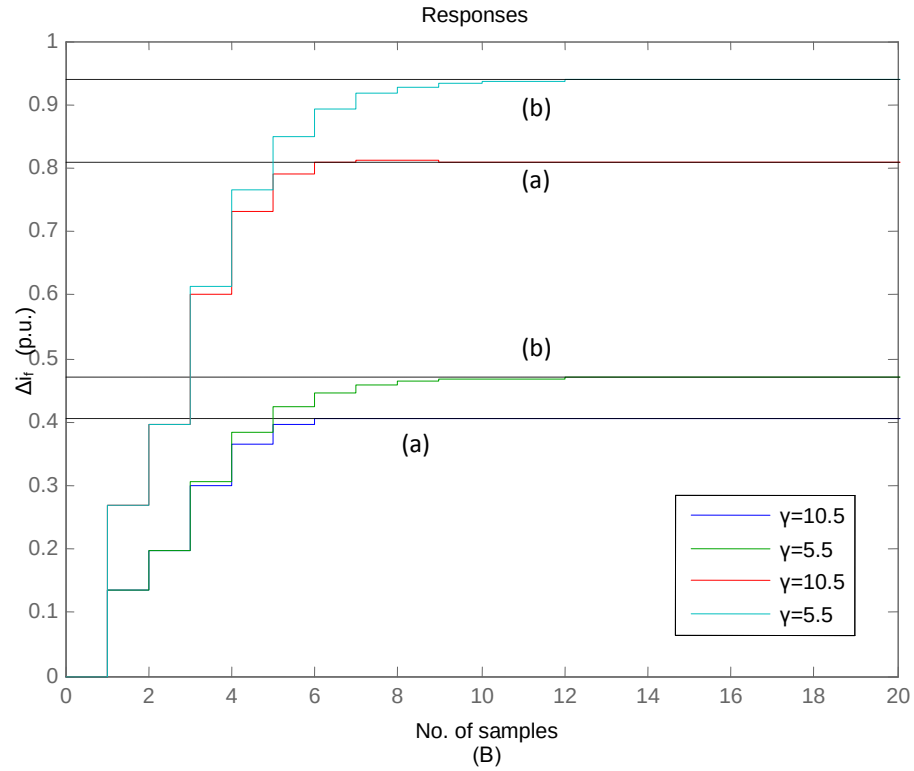
(A)


Responses
γ=10.5
γ=5.5
γ=10.5
γ=5.5
(b)
(a)
(b)
(a)
Δv_t (p.u.)
No. of samples
(B)

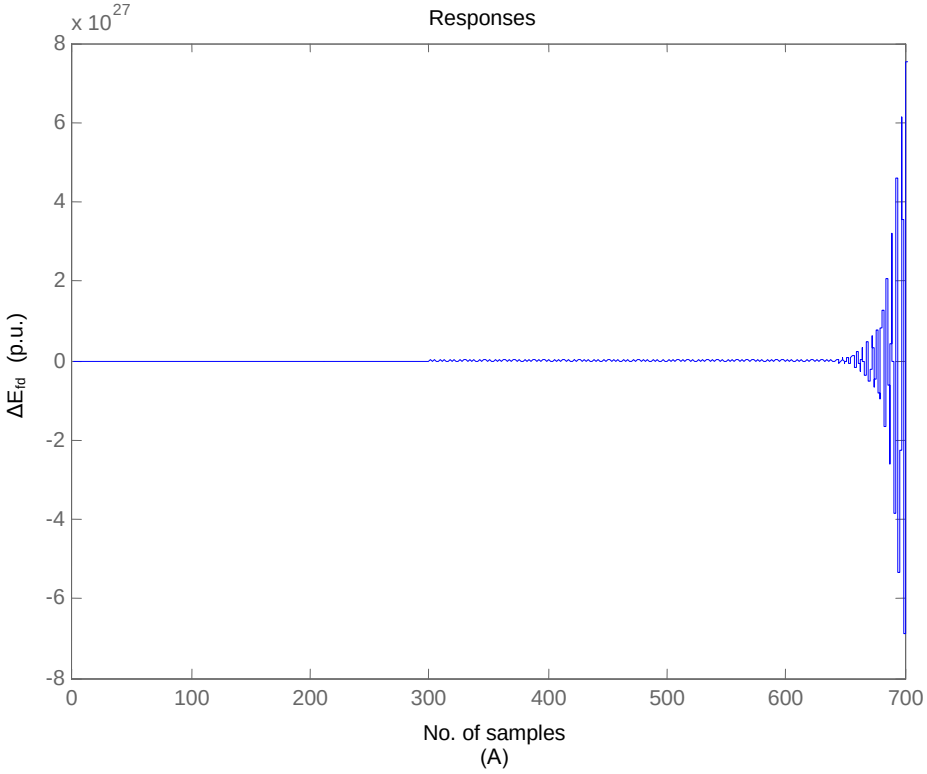

Response
x 10^27
Δp_t (p.u.)
No. of samples
(A)


Responses
γ=10.5
γ=5.5
γ=10.5
γ=5.5
(a)
(b)
(a)
(b)
Δpf (p.u.)
No. of samples
(B)


Response
x 10^27
Δif (p.u.)
No. of samples
(A)


Responses
(b)
(a)
(b)
(a)
γ=10.5
γ=5.5
γ=10.5
γ=5.5
Δi_f (p.u.)
No. of samples

(B)


Responses
x 10^27
ΔE_fd (p.u.)
No. of samples

(A)

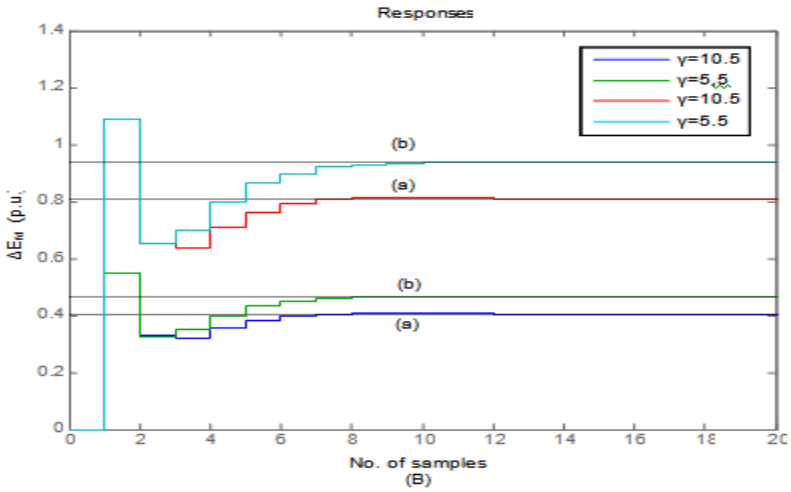


Fig. 3. Responses of $\Delta\delta$, $\Delta\omega$, Δv_t, ΔP_t, Δi_f, ΔE_{fd}, of:

(A): discrete open-loop system model subject to step input changes $\Delta V_{ref.}$=0.05 p.u.
(B): designed discrete closed-loop model:
(a): with γ=10.5 and to step input changes, $\Delta V_{ref.}$=10.5 p.u. & $\Delta V_{ref.}$=0.10 p.u. respectively.
(b): with γ=5.5 and to step input changes, $\Delta V_{ref.}$=0.05 p.u. & $\Delta V_{ref.}$=0.10 p.u. respectively.

From Figs. 3 it is clear that the dynamic stability characteristics of the designed discrete closed-loop system-models are far more superior than the corresponding ones of the original open-loop model, which attests in favour of the proposed H^{∞} -control technique.
It is to be noted that the solution results of the discrete system models , i.e. eigenvalues, eigenvectors, responses of system variables etc., for zero initial conditions were obtained using a special software program, which is based on the theory of & II and runs on MATLAB program environment.

In Fig. 4 , the maximum singular value of $T_{qy_C}(z)$ is depicted, as a function of the frequency ω.

Clearly, the design requirement $\left\|T_{qy_c}(z)_{\infty}\right\| \geq 10.5$, is satisfied. Moreover, as it can be easily checked the poles of the closed loop system, (see, Table 2), lie inside the unit circle. Therefore, the requirement for the stability of the closed-loop system is also satisfied.
Not that, the H^{∞}-norm of the open-loop system transfer function between disturbances and controlled outputs has the value $\left\|\mathbf{C}(j\omega\mathbf{I}-\mathbf{A})^{-1}\mathbf{B}\right\|_{\infty} = 479$.

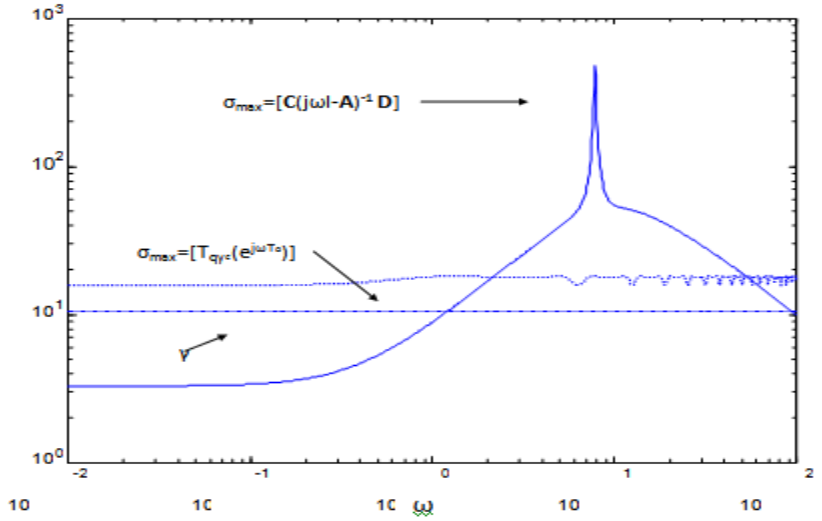


Fig. 4. The maximum singular value of $T_{qy_c}(z)$ over ω, for the unsaturated machine and for γ=10.5

In Fig. 5 , the maximum singular value of $T_{qy_C}(z)$ is depicted, as a function of the frequency ω.

Clearly, the design requirement $\left\| T_{qy_c}(z)_{\infty} \right\| \geq 5.5$, is satisfied. Moreover, as it can be easily checked the poles of the closed loop system, (see, Table 2), lie inside the unit circle. Therefore, the requirement for the stability of the closed-loop system is also satisfied.

Not that, the H^{∞}-norm of the open-loop system transfer function between disturbances and controlled outputs has the value $\left\| \mathbf{C}(j\omega\mathbf{I}-\mathbf{A})^{-1}\mathbf{B} \right\|_{\infty} = 479$.

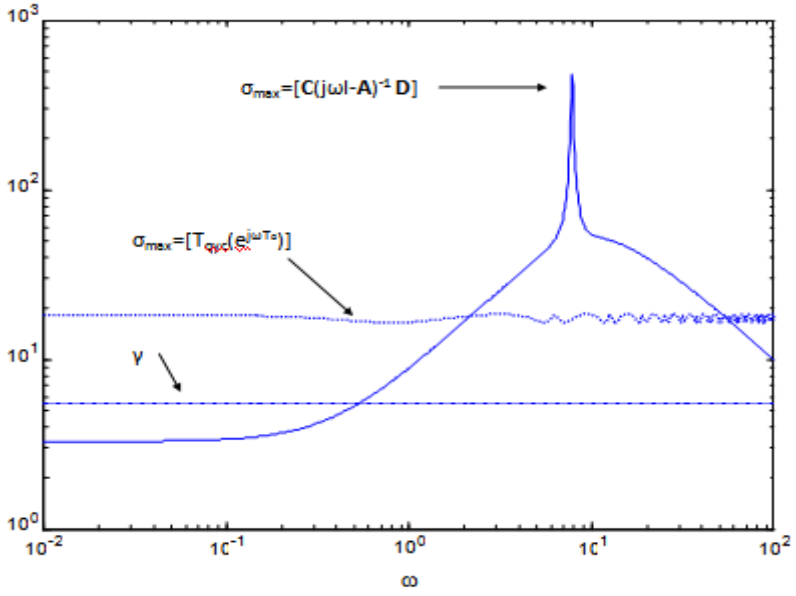


Fig. 5. The maximum singular value of $T_{qy_c}(z)$ over ω, for the unsaturated machine for γ=5.5

V. CONCLUSIONS

The method, H^{∞}-control was applied successfully to a discrete open-loop power system model, which was computed from an original continuous linearized open-loop one, resulting in the design of an associated discrete closed-loop power system model. The results of the simulations performed on the discrete open- and closed-loop power system models demonstrated clearly the significant enhancement of the dynamic stability characteristics achieved by the designed closed-loop model. Thus this H^{∞}-control technique was proved to be a reliable tool for the design of implementable MOCs. Moreover, it has been shown that the control effort in attenuating disturbances is decreased if the sampling period related to the multirate mechanism is increased and vice versa.

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Appendix A

Numerical values of the system parameters and the operating point (p.u. values on generator ratings).

Hydrogenerator: 117MVA, kV=15.75, RPM=125, H=3.0, x_d=0.935 p.u., x_q=0.574 p.u., x_D=0.992 p.u., x_Q=0.551p.u., x_f=0.221 p.u., i_q=0.665 p.u., i_d=0.746 p.u., v_q=0.924 p.u., v_d=0.381 p.u.
External system: R_e=0.015 p.u., X_e=0.40 p.u. (on a 117MVA base).
Operating point: v_{to}=1.0 p.u., P_{t0}=1.1 p.u., Q_{t0}=0.5 p.u., δ_{nom} =0.9604 rad., ω_{nom}=100π rad./sec, $i_{fnom.}$=1.9634 p.u., $E_{fdnom.}$=1.7720 p.u.

Appendix B

Numerical values of matrices **A**, **B**, **C** and **D** of the original continuous 6th-order system

$$\mathbf{A}=\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -150.5484 & 0 & -196.0696 & 38.49705 & 0 & 0 \\ -2.5353 & -0.1258 & -7.9768 & -0.0193 & 2.1392 & 0.0401 \\ 11.4595 & 1.3822 & 0.2009 & -7.9565 & 4.6095 & 0.0865 \\ 26.2471 & 0.2898 & 55.2988 & -5.9203 & -12.1345 & 0.6411 \\ 0 & 0 & -1000 & 0 & 0 & -20 \end{bmatrix}$$

$$\mathbf{B}=\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1000 \end{bmatrix}^T$$

$$\mathbf{C}=\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \qquad \mathbf{D}=\mathbf{B}$$

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Performance and Emission analysis of Compression Ignition engine in Dual fuel mode using Rice bran biodiesel and LPG

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Abstract: **-** In the modern world, pollution levels are increasing to a great extent mainly due to vehicular emissions which drives the industries towards finding alternative fuel sources like Hydrogen, CNG, LPG, Vegetable oil and many more. In the present study, Rice bran biodiesel was used along with liquefied petroleum gas in the dual fuel mode in a single cylinder, air cooled compression ignition engine and its performance and emission characteristics were studied. Rice bran ethyl ester was derived using ethanol and sodium hydroxide through Transesterification process. 7.5 mg/cycle of rice bran ethyl ester was injected with liquefied petroleum gas as pilot fuel. The experimental investigation revealed that the brake thermal efficiency was found to be comparatively better than straight diesel. The brake specific energy consumption was noticed to be lower for dual fuel mode than straight diesel mainly at part load operations. The CO and UBHC emissions was found to be reducing with an increase in NO_x at high loading condition due to better combustion.

Keywords: **-** *Transesterification, Rice bran biodiesel, Compression ignition engine, Performance and Emission.*

I. INTRODUCTION

The need for alternative fuels has been increasing in today's world due to greater depletion of natural petroleum reserves and increasing exhaust emissions from internal combustion engines leading to environmental pollution. Compression ignition engine generally uses diesel as the fuel for combustion which expels more power and better efficiency. But it ultimately leads to environmental hazards like HC, CO and NO_x emission. As an opportunity to reduce the level of pollution, various alternate fuels like producer gas, biogas, alcohols, vegetable oils, microbial oil and many more find its application as a whole or mixed under various proportions along with diesel are used. The properties of diesel fuel closely resembles with esterified vegetable oil which is very suitable for its replacement. Researchers are continuously investigation the use of various vegetable oil like neem, soyabean, jatropha, ricebran, mahua and others in blended and dual fuel mode to obtain a very similar or better performance to petroleum diesel [3,8]. Now-a-days dual fuel technique is most widely adopted with blended fuel and gaseous fuel. In the present study, rice bran biodiesel and LPG are used in compression ignition engine in dual fuel mode to reduce emission and increase the performance characteristics. LPG suits as a better gaseous fuel due to lower carbon content, clean combustion and ease of availability. It also reduces the cylinder wear and improves engine life to a great extent.

Kapilan*et al.* [7] has made extensive study on the combustion and emission parameters of mahua oil and liquefied petroleum gas in dual fuel mode and observed that exhaust emission like smoke, UBHC and CO were lower in conventional fuel. The higher injection pressure and proper pilot fuel quantity also resulted in better atomization, penetration of methyl ester and better combustion of fuel. Sethi *et al.*[10] analyzed the emission and performance characteristics of dual fuel engine which was close to diesel operation but the exhaust emission of CO, HC and NO_x was reduced to a great extent.Poonia *et al.*[9] experimentally investigated the engine performance and exhaust emission in a LPG-Diesel dual fuel engine in which diesel fuel was used as pilot fuel and LPG as main fuel inducted in the intake manifold. The study revealed that poor exhaust emission at lighter loads can be improved by employing longer pilot fuel quantity, using exhaust gas recirculation, increasing intake temperature and injection timing.

In the present study, rice bran oil was used to derive rice bran biodiesel along with ethanol as an esterifying agent. The rice bran biodiesel was analyzed for various compounds using gas chromatography mass

spectrometry analysis. The experimental investigation was divided into three phases in which the effect of diesel fuel, biodiesel blended with diesel and biodiesel blended with liquefied petroleum gas were analyzed in detail from low load to full load and the corresponding performance and emission characteristics were studied. In the dual fuel mode, 7.5 mg/cycle rice bran biodiesel was used as combustion initiator and rest with liquefied petroleum gas was used as fuel in various modes of operation.

II. MATERIALS AND METHODS

Rice bran oil was extracted from the germ and inner husk of rice and it contains mono-unsaturated, poly-unsaturated and saturated fat of 47%, 33% and 20% respectively. The various fatty acid composition of raw rice bran oil was found as palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, arachidic acid and behenic acid at 15%, 1.9%, 42.5%, 39%, 1.1%, 0.5% and 0.2% respectively. The Transesterification process was used to derive biodiesel from rice bran oil using and alcohol and a base. The alcohol replaces the triglycerides into glycerol and three fatty acid esters of rice bran oil in the presence of a catalyst [4]. Due to high free fatty acid content, rice bran oil was converted into ethyl esters using ethanol in a two stage process. In the first stage, neutralization of free fatty acids from 12% to 2% was carried out by adding 2% of dilute hydrochloric acid to 1000 ml of rice bran oil at 60^{o}C for 2 hrs. In the second stage 490 ml of ethanol was mixed with 2.5 gms of sodium hydroxide to form sodium ethoxide. The solution was mixed to 1000 of neutralized rice bran oil for esterification. The entire mixture was transferred to a round bottomed flask and maintained at 75^{o}C for 1.5 hrs. The mixture was allowed to react in a rotating agitator at 150 rpm for 3 hrs and then it was kept for 24 hrs as settling period. The formation of glycerol takes place resulting in the production of rice bran ethyl ester. The glycerol was then carefully removed using a separating funnel and RBEE was washed with 5% distilled water. By this process, 84% of RBEE was obtained [5,11].

The GC/MS spectrum and fatty acid esters of rice bran ethyl ester are shown in figure (1) and table (1). The various properties like flash point, fire point, calorific value, kinematic viscosity, density and cetane number were studied for diesel, RBEE and LPG as shown in table (2). The composition of liquefied petroleum gas was found to be butane, propane & propylene, ethane & ethylene and pentane as 70.4%, 28.6%, 0.5% and 0.5% respectively. The maximum flame temperature in air was found to be 2000^{o}C and the self-ignition temperature for LPG was noted as 525^{o}C [6]. In the dual fuel mode, RBEE blend was used as pilot fuel injection and LPG as the primary fuel and the pilot fuel quantity of 7.5 mg/cycle was considered to study the effect of pilot fuel quantity.

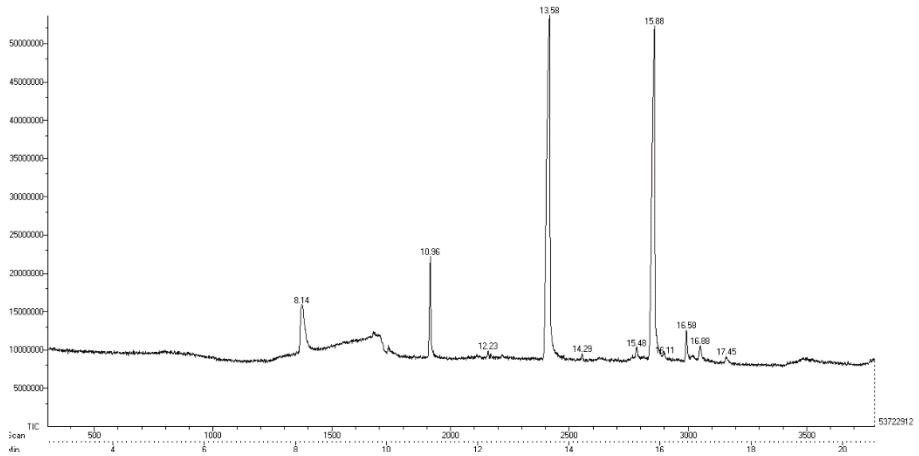

Figure 1. Gas Chromatography Mass Spectrometry spectrum of Rice bran ethyl ester

Table 1. Fatty acid ethyl esters of Rice bran ethyl ester

Retention time	Name of ester	Name of fatty acid	No of Ions	Scan
8.15	Octanoic acid ethyl ester	Caprylic acid	2418	1375
10.96	Decanoicacid ethyl ester	Capric acid	2247	1915
13.59	Dodecanoic acid ethyl ester	Lauric acid	2507	2419
15.89	Tetradecanoic acid ethyl ester	Myristic acid	2533	2861

Table 2. Properties of RBEE and Straight diesel

Property	Units	RBEE	St. Diesel
Flash point	^{o}C	125	56-58
Fire point	^{o}C	114	62-64
Calorific value	MJ/Kg	33.14	42.6
Kinematic viscosity	at 40^{o}C (CST)	6.21	2.62
Density	at 40^{o}C (kg/m^{2})	884	832
Cetane number	-	44	45-60

III. EXPERIMENTATION

A single cylinder, four stroke, air cooled, constant speed direct injection compression ignition engine was used in the experimental study with the following specification as given in table (3). The engine speed was noted using inductive pickup sensor calibrated with digital speed indicator. The mass flow rate of blended fuel was calculated using volumetric basis using a burette and a stop watch. The exhaust gas temperature was measured using a thermocouple attached with digital temperature indicator was employed. The engine was slightly modified in the dual fuel mode by connecting LPG lines to the intake manifold with flame trap and mixing unit as shown in figure (2).

Table 3. Test engine specification

Engine type	Single cylinder, four stroke, constant speed, vertical mounted, air cooled, direct injection, compression ignition engine
Make & model	Kirloskar DM 10
Bore & Stroke	102 x 118 mm
Capacity	984 cc
Maximum power	10 HP
Compression ratio	17.5 : 1
Injection timing	27^{o} bTDC
Injection pressure	110 bar
Rated speed	1500 rpm

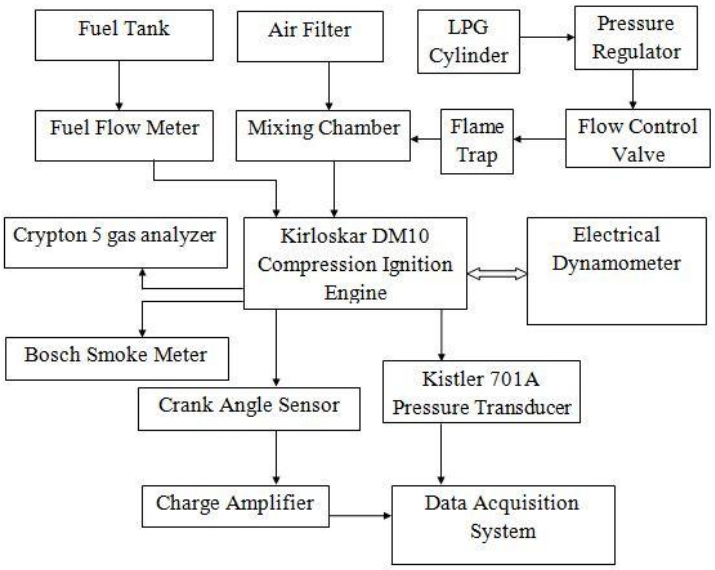

Figure 2. Experimental setup

Kistler 701A quartz pressure transducer was fitted on to the cylinder head and a crank angle encoder was fixed on the engine shaft for cylinder pressure and crank angle measurement. The signals were routed to the personal computer through high speed data acquisition system for further studies. The pilot flow rate of RBEE was varied using fuel injection pump and the LPG flow rate was adjusted using flow control valve as shown in

figure (2). All the investigationswere carried out at 1500 rpm at full loading condition. Initially pilot injection of RBEE was inducted during cranking of engine and gradually LPG was allowed to enter through the mixing chamber and intake manifold. The pilot injection was increased upto 5.5 mg/cycle and maintained at a constant engine speed of 1500 rpm by increasing the flow rate of LPG. Finally, the pilot injection was increased upto 7.5 mg/cycle at constant engine speed of 1500 rpm. During this period, important observations like LPG flow rate, air flow rate, cylinder pressure, exhaust gas temperature and emission were recorded. The same procedure was repeated by varying the engine load.

IV. RESULTS AND DISCUSSIONS

Performance Analysis

The performance parameters like brake thermal efficiency, brake specific fuel consumption, brake specific energy consumption and mechanical efficiency were analyzed and discussed below.

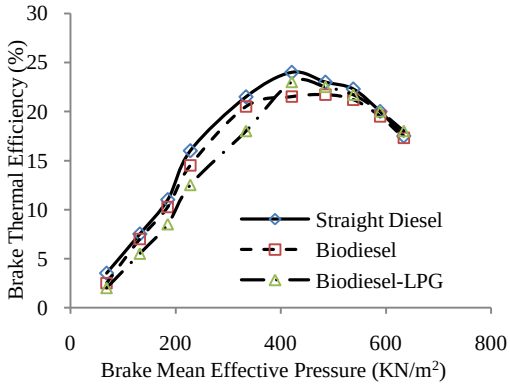

Figure 3. Variation of Brake thermal efficiency with Brake mean effective pressure

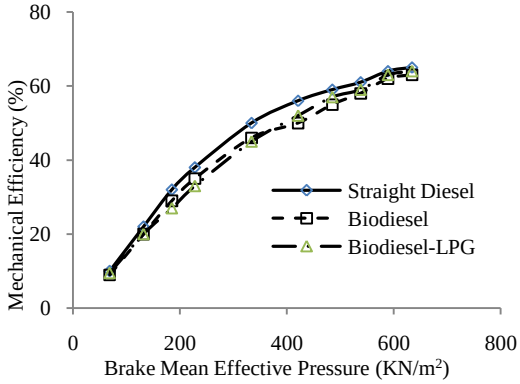

Figure 4. Variation of Mechanical efficiency with Brake mean effective pressure

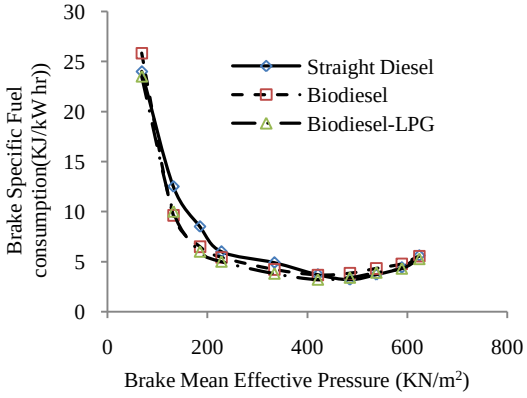

Figure 5. Variation of Brake specific fuel consumption with brake mean effective pressure

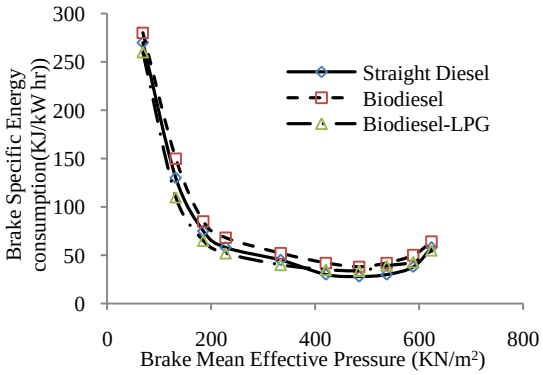

Figure 6. Variation of Brake specific Energy consumption with brake mean effective pressure

The comparison of brake thermal efficiency and brake mean effective pressure for diesel, blended biodiesel and blended LPG are shown in the figure (3). It can be observed that at low loading conditions, all the three variants of fuel show minimal efficiency at about 3 to 5%. The brake thermal efficiency of biodiesel, biodiesel-LPG at low loading conditions was 9.6% and 10.9% respectively which may be due to lower cylinder temperature. At part load condition, the efficiency of blended biodiesel-LPG and biodiesel was found to be 23% and 21.7% respectively which was due to complete combustion of LPG at high temperature and pressure [4]. When the load is increased to full load, the efficiency of diesel, biodiesel blend and LPG gradually decrease as shown in figure (3). It can be also seen that for all loading conditions, the brake thermal efficiency of biodiesel blends was lower than straight diesel due to lower calorific value.

The figure (4) shows the variation in mechanical efficiency between diesel, biodiesel blend and biodiesel-LPG in dual fuel mode. The mechanical efficiency remains almost similar to each other during starting and low loading conditions which may be due to low in-cylinder temperature and effect of residual gases.At part load condition, mechanical efficiency of straight diesel and biodiesel-LPG in dual fuel mode was found to be 52% and 46% respectively. During full load, the mechanical efficiency reaches a maximum of 55% for dual fuel mode which may be due to reduced combustion efficiency caused by increased compression work due to

extensive air-gas induction.Figure (5) and Figure (6) show the variation between brake specific fuel consumption and brake specific energy consumption with straight diesel, biodiesel blends and biodiesel-LPG in dual fuel mode. From the figure (5), it can be seen that BSFC for all fuel variants remain high initially at low loading conditions. At part load, biodiesel-LPG in dual fuel mode exhibits lower BSFC which may be due to higher calorific value and continue to be lower at higher loading conditions due to complete combustion process.Figure (6) shows variation in BSEC for all blends and dual fuel mode which resemble a similar trend to BSFC. The BSEC for biodiesel-LPG in dual fuel mode was found to be higher for all loading conditions which may be due to better atomization, spray characteristics and initiation of complete combustion [1,2].

Exhaust Emission analysis

The variation of unburned hydrocarbon emissions for straight diesel, biodiesel blend and biodiesel-LPG in dual fuel mode is shown in figure (7). Hydrocarbon emission was found to be higher for Biodiesel-LPG in dual fuel mode for the entire range of loading and operating conditions which may be due to insufficient ignition sources which resulted in incomplete combustion especially at low loads. At part load and high loading conditions, the HC emission for dual fuel mode was found to be 1.34 g/KWh and 0.79 g/KWh respectively. Diesel and biodiesel blends exhibit low HC emission than dual fuel mode at high loading conditions which was less than 0.7 g/KWh.

Carbon Monoxide emissions are formed due to incomplete combustion, insufficient air and improper ignition delay. Figure (9) shows the variation of carbon monoxide between straight diesel, biodiesel blends and biodiesel-LPG in dual fuel mode for various loading conditions. CO emission was found to reduce gradually with increase in load throughout all blends and dual fuel mode at shown. Higher CO emission was found to be as 69.2 g/KWh for biodiesel-LPG in dual fuel mode at low loading conditions which may be due to incomplete combustion and presence of residual gases. At part loading conditions, CO emission for straight diesel, biodiesel blend and biodiesel-LPG in dual fuel mode was found to be 35.5 g/KWh, 24.6 g/KWh, 18.92 g/KWh respectively. The variation of carbon monoxide was very minimal at full load condition with 3-5% variation as shown in figure (9).

The variation of oxides of nitrogen with BMEP for straight diesel, biodiesel and biodiesel-LPG in dual fuel mode is shown in figure (8). The NO_x emission constitutes of nitric oxide, nitrous oxide and nitrogen dioxide in various proportions which are formed mainly due to peak in-cylinder temperature during combustion. At low loading conditions, NO_x emission was found to be high for straight diesel and biodiesel due to better mixing and combustion but for dual fuel mode, it was found to be 4.3 g/KWh due to reduced in-cylinder temperature. The part load operations showed increased NO_x emissions up to 5% to 8% for dual fuel mode as shown. At full load conditions, straight diesel, biodiesel and biodiesel-LPG showed 6.2 g/KWh, 5.6 g/KWh and 5.9 g/KWh of NO_x emission [12].

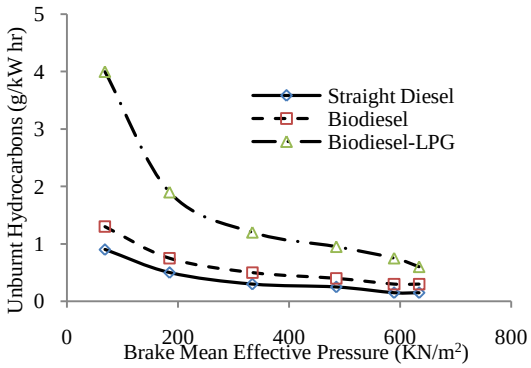

Figure 7. Variation of Unburnt hydrocarbon with brake mean effective pressure

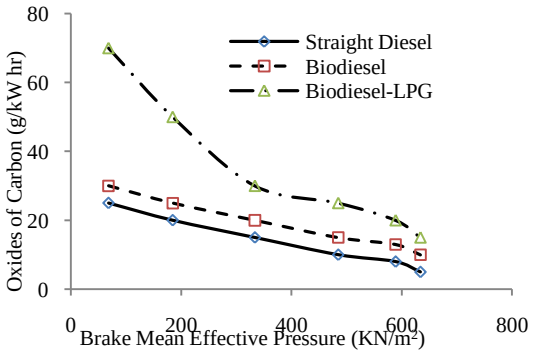

Figure 9. Variation of Oxides of carbon with brake mean effective pressure

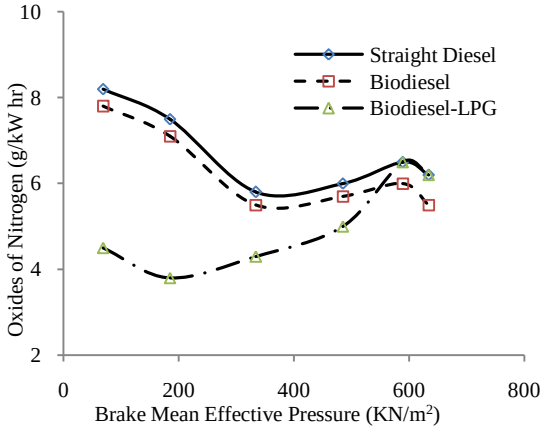

Figure 8. Variation of Oxides of Nitrogen with brake mean effective pressure

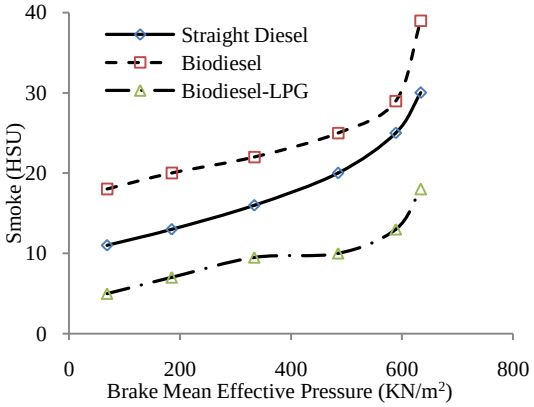

Figure 10. Variation of Smoke emission with brake mean effective pressure

The effect of brake mean effective pressure on smoke formation for straight diesel, biodiesel blend and biodiesel-LPG in dual fuel mode is shown in figure (10). The trend of smoke emission was found to gradually increase from low load to full loading condition. At low load condition, biodiesel blend showed high emission of smoke then straight diesel and dual fuel operation which may be due to lower carbon availability in LPG dual fuel mode and possibility of premixed and homogeneous combustion [12]. At part load, smoke emission was gradually increased from 5% to 8% as shown in figure (10). At full load condition, straight diesel and biodiesel blend showed 30.4 HSU and 39.5 HSU of smoke emission while biodiesel-LPG in dual fuel mode showed 14.5 HSU of smoke emission.

V. CONCLUSION

From the experimental studies, the following conditions were drawn.

- Biodiesel was prepared through Transesterification method using ethanol and sodium hydroxide and 84% of rice bran ethyl ester were obtained.GC/MS analysis revealed the presence of Caprylic acid, Capric acid, Lauric acid and Myristic acid in prominent proportions.
- The smooth function of the engine was seen at 2.5-7.5 mg/cycle of RBEE and rest of LPG with injector opening pressure of 110 bars.
- Brake thermal efficiency and mechanical efficiency was low at minor load and high at part load operations.
- The admittance of 7.5 mg/cycle of RBEE with LPG in dual fuel operation at injector pressure of 110 bar showed better brake thermal efficiency and optimal brake specific energy consumption. But increased HC and CO with low NO_x was also observed.

VI. ACKNOWLEDGEMENTS

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A Secure Hierarchical Protocol for Wireless Sensor Networks

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Abstract: - The literature for considering routing protocols in wireless sensor networks (WSNs) is very broad. However, security of these routing protocols has fallen beyond the scope so far. Routing is a fundamental functionality in wireless networks, thus hostile interferences aiming to disrupt and degrade the routing service have a serious impact on the overall operation of the entire network. Gathering sensed information in an energy efficient manner is also critical for increasing the lifetime of the network. We propose a formal framework for the security analysis of a clustering-based hierarchical routing protocol, S-PEGASIS, for wireless sensor networks. Our approach is based on the well-known simulation paradigm that has been used to enhance the security of the protocol. Our main contribution is the application of the simulation approach to incorporate security into the model in order to make it more energy efficient as compared to the others in its class. We further point out that our protocol is scalable and its transmission time complexity is logarithmic in nature. We also point out that security can be further extended by providing link layer and physical layer security mechanisms so that trusted nodes on the chain (S-PEGASIS) can never be hacked.

Keywords: - *Clustering, Energy Efficiency, Hierarchical, Routing Protocols, Security, Wireless Sensor Networks*

I. INTRODUCTION

Sensor networks are dense wireless networks of small, low-cost sensors, which collect and disseminate environmental data. Wireless Sensor Networks (WSNs) consist of numerous tiny sensors deployed at high density in regions requiring surveillance and monitoring. They are deployed at a cost much lower than the traditional wired sensor system. A large number of sensors deployed will enable for accurate measurements. A sensor node consists of one or more sensing elements (motion, temperature, pressure, etc.), a battery, and low power radio trans-receiver, microprocessor and limited memory, mobilizer (optional), a position finding system. An important aspect of such networks is that the nodes are unattended, have limited energy and the network topology is unknown. The emerging field of wireless sensor networks combines sensing, computation, and communication into a single tiny device. The power of wireless sensor networks lies in the ability to deploy large numbers of tiny nodes that assemble and configure themselves.

Recent advances in micro-electro-mechanical systems and low power and highly integrated digital electronics have led to the development of micro-sensors. Such sensors are generally equipped with data processing and communication capabilities. The sensing circuitry measures ambient conditions related to the environment surrounding the sensor and transform them into an electric signal. Processing such a signal reveals some properties about objects located and/or events happening in the vicinity of the sensor. The sensor sends such collected data, usually via radio transmitter, to a command center (sink) either directly or through a data concentration center (a gateway). The decrease in the size and cost of sensors, resulting from such technological advances, has fuelled interest in the possible use of large set of disposable unattended sensors. Such interest has motivated intensive research in the past few years addressing the potential of collaboration among sensors in data gathering and processing and the coordination and management of the sensing activity and data flow to the sink. A natural architecture for such collaborative distributed sensors is a network with wireless links that can be formed among the sensors in an ad hoc manner.

Routing protocol is a set of rules defining the way a router finds the way that packets containing information have to follow to reach the intended destination. In this section, we discuss some of the routing

protocols to be used in designing the WSN. In general, routing protocols can be considered to belong to one of the following models:

i) Data-centric protocols,
ii) Hierarchical protocols, and
iii) Location-based protocols.

In data-centric routing, the sink sends queries to certain regions and waits for data from the sensors located in the selected regions. Since data is being requested through queries, attribute-based naming is necessary to specify the properties of data. SPIN is the first data-centric protocol, which considers data negotiation between nodes in order to eliminate redundant data and save energy. Later, Directed Diffusion was developed and it has now become a breakthrough in data-centric routing. The main aim of hierarchical routing is to efficiently maintain the energy consumption of sensor nodes by involving them in multi-hop communication within a particular cluster and by performing data aggregation and fusion in order to decrease the number of transmitted messages to the sink. Cluster formation is typically based on the energy reserve of sensors and sensor's proximity to the cluster head. LEACH is one of the first hierarchical routing approaches for sensors networks along with a few others like PEGASIS, TEEN, and APTEEN. Most of the routing protocols for sensor networks require location information for sensor nodes. In most cases location information is needed in order to calculate the distance between two particular nodes so that energy consumption can be estimated. Since, there is no addressing scheme for sensor networks like IP-addresses and since they are spatially deployed on a region, location information can be utilized in routing data in an energy efficient way. For instance, if the region to be sensed is known, using the location of sensors, the query can be diffused only to that particular region which will eliminate the number of transmission significantly. An example of location based protocol is GEAR.

WSNs are prone to many types of attacks because they use wireless communication which is very insecure due to high probability of eavesdropping by attackers. Secondly, it is not possible to employ stringent security measures due to highly constrained resources. These attacks may occur at physical layer, data link layer or the network layer during communication between nodes. We are trying to develop a routing protocol which can detect and prevent such attacks. We will, however, concentrate on network layer attacks only. This model will be a hierarchical one. The advantage of using hierarchical protocol is that they are much more energy efficient as compared to other protocols and hence enhance lifetime of the network. Secondly, they are prone to smaller number of attacks as compared to other protocols due to a fixed path of data delivery and small number of hops each packet has to go. Thirdly, they provide better scalability due to less number of node-to-base station communications and corresponding network congestion.

Akyildiz et al. has reviewed the factors that influence the design of WSNs and has also surveyed the underlying architecture needed to execute the protocols developed in each layer of the protocol stack in. The design of WSNs is motivated by factors viz. fault tolerance, scalability, production costs, operating environment, underlying topology, transmission media and power consumption. The communication architecture has been researched upon. The protocol stack consisting of the 5 layers, application, transport, network, data link and physical, task management plane, mobility management plane and power management plane. It integrates functions like node coordination to accomplish the sensing task and lower the overall power consumption [1]. The power management plane helps in proper utilization of power by the nodes, which turns off its receiver after receiving a message from one of its neighbors. If the power level of the node is low, a message is broadcast to the neighboring nodes that the node in question cannot participate in routing. The balance power is reserved for sensing. The mobility management plane detects the trajectory of the nodes, registers its neighbors in order to balance power usage. Finally the task management plane schedules the sensing tasks. Some nodes are better performers as compared to the others and this totally depends on their power level. The 3 planes work together in a power efficient way to route data packets to the BS and share resources among themselves. The work examines some protocols in the different layers of the protocol stack. The sensor management protocol (SMP), task assignment and data advertisement protocol (TADAP), sensor query and data dissemination protocol (SQDDP) work in the application layer of the protocol stack. All these protocols are open research issues as explored by the authors in terms of time synchronization, network configuration, mobility of nodes, key distribution, security in data communication etc. The development of transport layer protocols remains a challenge, especially because of hardware constraints like limited power and memory, as a result of which the nodes cannot store large amounts of data like a server. Research to enable communication in this layer needs to be explored upon. It also provides insight into current routing protocols in the network layer like small minimum energy communication network (SMECN), sensor protocol for information via negotiation (SPIN), low-energy adaptive clustering hierarchy (LEACH), sequential assignment routing (SAR) and directed diffusion (DD). In a nutshell, these protocols proposed need to be improved in order to address topology changes, make the network more scalable, and allow easy communication between the network and the external networks i.e. allow internetworking. MAC protocols cannot be adopted into the WSN scenario due to its resource constraints and therefore they should be modified accordingly to suit the need of current state-of-art

applications. Focus needs to be given on providing cross-layer security in the protocol stack, because careful security design in the lower layers can effectively prevent attacks at the application layer. While all the existing solutions can secure the WSN to a certain extent, there is no one solution that can satisfy the security goals completely and guarantee the integrity, authenticity and availability of messages in the presence of adversaries.

The authors in Akkaya et al. have categorized the routing protocols in WSNs on the basis of their modes of operations and have also presented a comparative study on them [2]. Routing techniques are required to send data and communicate between the BS (Base Station) and the sensor nodes. These protocols can be classified as proactive, reactive and hybrid depending upon their modus operandi and their target application. In the proactive category, the nodes switch on their sensors and transmitters, sense the environment and route data packets along pre-defined routes. Example: LEACH (Low Energy Adaptive Clustering Hierarchy). In the 2nd category, nodes react to sudden changes in the environment beyond a pre-determined threshold. Example: TEEN (Threshold Sensitive Energy Efficient Sensor Network). Hybrid protocol incorporates both proactive and reactive concepts. It first computes all routes and then improves the routes at the time of routing. Example: APTEEN (Adaptive Periodic TEEN). Routing protocols can be further categorized as direct, flat and clustering as per the participation style of the sensor nodes. In case of the 1st category, nodes can communicate directly with the BS. When the network grows larger in size, the nodes drain out faster. Example: SPIN. In the case of flat protocols if any node needs to transmit data, it first searches a valid route to the BS and then transmits data. Nodes around the base station may drain out of their energy quickly. Example: Rumor Routing. In the 3rd category, nodes are divided into clusters and each cluster has a CH (cluster-head) and these CHs communicate with the BS. Example: TEEN. Furthermore, depending on the network structure, protocols can be classified as hierarchical, data centric and location based. Hierarchical routing is used for increasing the energy efficiency of the WSNs. The high energy nodes are used for processing and transmitting and the low energy ones for sensing the AOI (Area of Interest). Example: LEACH, TEEN, APTEEN. Data-centric protocols are query-based and depend upon naming the data to query a certain AOI and thereby reduce redundant transmissions. Example: SPIN. Location-based routing protocols need location information of the sensor nodes, which can be obtained either manually or by installing a GPS (Global-Positioning System) in the node. Example: GEAR (Geographic and Energy-Aware Routing). This work has compared the protocols on the basis of parameters like mobility, power management, network lifetime, scalability, resource awareness, data aggregation, query-based and nature of routing. The survey sums up the fact that mobility is limited for DD and GEAR, whereas LEACH, TEEN, APTEEN and PEGASIS use the concept of a fixed BS. Power management is limited for SPIN, DD and GEAR and maximized for LEACH, TEEN, APTEEN and PEGASIS. Network lifetime is maximized for LEACH, TEEN, APTEEN, PEGASIS and RR. Scalability is good for LEACH, TEEN, APTEEN, PEGASIS and RR. All protocols surveyed are aware in terms if resource usage. Only SPIN, DD AND RR are query-based in nature and can therefore exploit this feature to eliminate redundancies while data routing. Routing technique used in SPIN and DD are multi-path in nature and hence these protocols are efficient in terms of energy usage and reliable in terms of data delivery to the destination, though the latter one is not quite applicable for SPIN. This work has done a survey on routing in WSNs and presented 8 different types of protocols in this domain. Future work can concentrate on modifying any of these protocols to suit a specific application in WSN by integrating wireless networks with wired ones, addressing issues of QoS in case of real-time applications, introducing node mobility to handle topology changes in case of critical applications like battle-fields, and also having efficient naming schemes for data-centric protocols.

Taxonomy of routing protocols in WSNs has been developed by Karaki et al. This taxonomy broadly classifies routing protocols according to the network structure and protocol operation. Protocols that fall into the former category are flat, hierarchical and location-based. Protocols that fall into the latter category are negotiation-based, multi-path based, query-based, QOS-based and coherent-based routing [3]. Apart from the traditional routing protocols, this paper provides an insight into protocols based on their operation. For multi-path routing, which was aimed at enhancing the reliability of the network, and hence useful for delivering data in vulnerable environments would increase traffic significantly. A trade-off using a redundancy function eliminating duplicates and conserving energy for the nodes thereby increasing their life time could be incorporated into this category of routing algorithms. This work also motivates us to use braided paths whose costs are comparable with those of the primary paths because of their proximity. In case of query-based routing the BS propagates a query to the other nodes in the network, which respond with matching data. Data aggregation is performed to lower the energy consumption. DD and RR belong to this category. The idea behind negotiation-based routing is to suppress duplicate information and prevent redundant data from being sent to the next sensor or BS by transmitting a series of negotiation messages before the actual data transmission begins. Eg: SPIN. In QoS routing, the network balances energy consumption with data quality to satisfy metrics like delay, energy, bandwidth etc. Eg: SAR. In coherent and non-coherent routing, various data processing techniques are used and sensor nodes cooperate with each other in processing data flooded across the WSN. In the former, nodes forward data to aggregators, which could be CHs after minimum processing, whereas in the

latter, nodes locally process raw data before forwarding to others for further processing. Tiered architectures to maximize network lifetime is a hot area of research along with node deployment in an unpredictable environment to attain adaptive localization and coverage. Time synchronization and self-configuration are other possible future research domains for routing protocols.

While many surveys in existing literature address the issue of security in wireless networks, none focus specifically on the security issue in WSNs. The work in [4] analyzes the threats and security requirements and classifies the attacks as insider vs. outsider, active vs. passive and mote class vs. laptop class. It evaluates attacks in the various layers of the protocol stack and also suggests defense schemes against them. Selecting the most appropriate cryptographic method is vital in WSNs because all security services are ensured by cryptography. Cryptographic methods used in WSNs should meet the constraints of sensor nodes and be evaluated by code size, data size, processing time, and power consumption. These issues have also been addressed in [4]. It highlights some of the open research issues in WSNs like the application of private key operations to sensor nodes, design of efficient and flexible key distribution schemes based on symmetric key cryptography, schemes to ensure security of base stations, new schemes with higher scalability and efficiency for the authenticated broadcast protocols etc. New data aggregation protocols need to be developed to address higher scalability and higher reliability against aggregator and sensor node cheating. Also the proposed protocols on IDS (Intrusion Detection System) address the basic needs on how to filter fraudulent data from the system, can be improved to address the issue of scalability.

The authors in Pal et al. [5] have discussed the architecture of the wireless sensor network. Further, they have categorized the routing protocols according to some factors and summarize on their mode of operation. At the end, they put up a comparative study on these protocols. Routing in sensor networks is a new area of research. Since sensor networks are designed for specific applications, designing efficient routing protocols for sensor networks is very important. Since the sensor networks are application specific, we can't say whether a particular protocol is better than other. We can only compare these protocols with respect to some parameters only as has been done here. Future work can concentrate on modifying any of these protocols to suit a specific application in WSN addressing issues of QoS in case of real-time applications, introducing node mobility to handle topology changes in case of critical applications like battle-fields, and also having efficient naming schemes for data-centric protocols.

Karlof et al. has analyzed the issue of security for routing in WSNs by proposing threat models and security goals, by introducing 2 new types of attacks, viz. sinkhole attacks and HELLO FLOOD attacks and finally crippling attacks and have also suggested counter measures against all of them. A summary of attacks against the protocols have been presented in [6]. Tiny OS beaconing is subjected to selective forwarding, sinkhole, and wormhole and HELLO flood attack. DD is also susceptible to all the above mentioned types of attacks. GEAR suffers from selective forwarding and Sybil attacks, clustering protocols like LEACH, TEEN and PEGASIS suffer from selective forwarding and HELLO flood attacks, and RR is threatened by Sybil and HELLO flood attacks. This work gives a clear idea of security issues in routing in WSNs and aims at ensuring that a secure routing protocol should be able to guarantee the security primitives like integrity, authenticity, and availability of messages in the presence of adversaries. A few common attacks like, spoofing, alteration, replaying of routing information, selective forwarding, sinkhole, Sybil, wormholes, HELLO flood have been extensively studied. By spoofing, altering and replaying routing information, adversaries (ADVs) are able to create routing loops to either attract or repel network traffic to either lure nodes into sending data packets or mislead them from reaching their targets. In case of selective forwarding attacks, ADVs suppress traffic from reaching their destinations by dropping them. Sinkhole attacks work by making a compromised node look attractive in order to lure traffic towards it. In WSNs, all nodes have the same ultimate destination, i.e. the BS, so it becomes easier for the ADV to lure traffic from its neighbors to be route through it and finally provides a single-route to the BS. A malicious node impersonates itself to other nodes in the network and thereby reduces the efficacy of the WSN from being fault-tolerant. This attack is harmful for geographic routing protocols. In case of wormhole attacks, ADV channels packets received in one part of the network to the other and disrupts routing by creating a wormhole. A wormhole is an illusion used to convince two distant nodes that they are within the radio range of one another and thereby force them to communicate by relaying data packets to each other. In case of HELLO flood attacks, nodes broadcast HELLO packets to their neighbors. ADV takes advantage of this and advertises itself in the radio range thereby causing nodes to attempt communication via this route and in the process wreaks havoc in the network. How these attacks affect the functionalities of the protocols by disembarking traffic to cause mayhem has also been stated as a part of the survey. Though countermeasures have also been proposed to combat attacks in these routing protocols, by using link layer encryption, authentication techniques and or cryptography, but they are not enough to defend against all categories of attacks. So this work gives opportunities to design a secure routing protocol which can suffice the demands of current state-of-art applications.

An optimal chain-based solution that is an improvisation over LEACH is PEGASIS (Power Efficient GAthering in Sensor Information Systems) as established by Lindsey et al. The idea is to form a chain of nodes where each node sends and receives from the next neighbour node on the chain. The concept of data fusion is used to combine data from different nodes into one data packet that only one designated node transmits to the BS. Nodes take turns in transmitting to the BS in order to optimize the energy consumption and thus increase the lifetime of the network. The leader that takes turns in transmitting to the BS which is placed at random positions on the chain [7]. This is to ensure that the WSN is robust to failures. The chain formation is done using a greedy algorithm to optimize the utilization of energy and bandwidth and also to outperform the other protocols in this genre.

In [8], a formal model of security for routing protocols in WSNs has been proposed. This new model differs from its previous versions in the sense that it adapts itself to suit the characteristics of the WSN. A major breakthrough of this work is the definition of the output of the model proposed as a function of the routing state of the honest nodes. This can put all categories of routing protocols on the same platform. As a case study this work has considered the Tiny OS beaconing protocol to illustrate how an attack can be formulated using the formal model and also establishes its veracity using the simulation paradigm. How the statistical model can be used to counter the effect of attackers in the other categories of routing protocols established in literature have not been discussed.

Another approach presented in [9], proposes a formal framework for the security analysis of on-demand source routing protocols for wireless ad hoc networks. It gives a formal definition of routing security in terms of indistinguishability of the two models from the point of view of honest parties. The approach is demonstrated by analyzing two secure ad hoc routing protocols, SRP (Secure Routing Protocol) and Ariadne. It proposes a routing protocol that can prove to be secure in this model. A particularly interesting direction for future work is trying to automate the analysis of ad hoc routing protocols using this simulation paradigm.

We have designed a new protocol called secure PEGASIS (or S-PEGASIS) which incorporates security in the hierarchical framework. The model designed has been simulated using NS2 and results obtained compared with existing ones to see how energy efficient and secure our design is.

II. OVERVIEW OF CLASSICAL PEGASIS AND HIERARCHICAL PEGASIS

It is the drawback/s of the first protocol of its kind in this genre of hierarchical routing, eg: LEACH (Low Energy Adaptive Clustering Hierarchy) like single-hop routing that makes it unsuitable for deployment over large areas, dynamic topology adjustment and CH assignment that involves significant overhead that curbs some of the energy gain and complex calculations in each round of data transfer, which requires a perfect random number generator, that a new protocol called PEGASIS (Power Efficient Energy Gathering in Sensor Information Systems) was developed. It is an improvement over LEACH protocol. In LEACH, 5% of nodes acted as cluster heads. Here, only one node communicates with the BS. Each node transmits only to its local neighbor in the data fusion phase.

The key idea in PEGASIS [7] is formation of chains where each node receives from and transmits to a close neighbor. Data travels from node to node, getting fused at each step with the host node's data and is eventually transmitted to the BS by a designated node called leader for that round. Nodes take turns in transmitting to the BS (being the leader) as it is the most energy consuming process (assuming that the BS is far away). This reduces the average energy consumption of each node per round. To have balanced energy dissipation in nodes, the remaining energy level of nodes is also considered as a parameter in addition to transmission-energy (cost) for determination of leader in each round or close neighbor. Long chains in PEGASIS may cause delay for nodes far from leader. To curb this, the concept of hierarchical PEGASIS has been introduced where multiple data transmissions may occur in parallel.

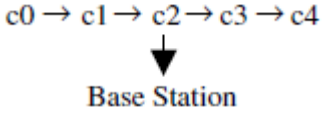

Figure 1: PEGASIS

The first step is the formation of chain of nodes using a greedy approach that works well if the nodes are randomly distributed. If there are N nodes in the network (we assume they are numbered), they become leaders by taking turns. A node may not be allowed to become a leader if its remaining energy level is low or closest neighbor on chain has a distance above a specified threshold. The chain may be constructed by the nodes themselves using greedy algorithm starting from some node or by the BS (and then broadcasted). Each time a node dies, a new chain has to be constructed bypassing it.

We illustrate the data transmission mechanism using an example network with a few nodes. As shown in figure, node c0 passes its data to node c1. Node c1 aggregates node c0's data with its own and then transmits to the leader. After node c2 passes the token to node c4, node c4 transmits its data to node c3. Node c3 aggregates node c4's data with its own and then transmits to the leader. Node c2 waits to receive data from both neighbors and then aggregates its data with its neighbors' data. Finally, node c2 transmits one message to the base station.

However, PEGASIS introduces excessive delay for distant node on the chain. In addition the single leader can become a bottleneck. Hierarchical-PEGASIS is an extension to PEGASIS, which aims at decreasing the delay incurred for packets during transmission to the base station and proposes a solution to the data gathering problem by considering energy delay metric. In order to reduce the delay in PEGASIS, simultaneous transmissions of data messages are pursued. The chain-based protocol with CDMA capable nodes, constructs a chain of nodes, that forms a tree like hierarchy, and each selected node in a particular level transmits data to the node in the upper level of the hierarchy. This method ensures data transmitting in parallel and reduces the delay significantly. Since the tree is balanced, the delay will be in O ($\log_2 N$) where N is the number of nodes.

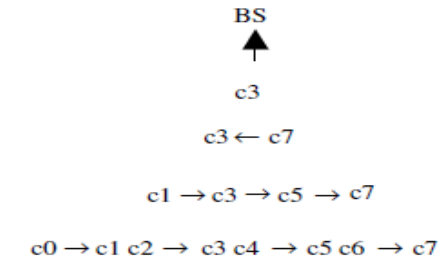

Figure 2: HIERARCHICAL PEGASIS

For example, in the above diagram, node c3 is the designated leader for round 3. Since, node c3 is in position 3 (counting from 0) on the chain, all nodes in an even position will send to their right neighbor. Nodes that are receiving at each level rise to next level in the hierarchy. Now at the next level, node c3 is still in an odd position (1). Again all nodes in an even position will aggregate its data with its received data and send to their right. At the third level, node c3 is not in an odd position, so node c7 will aggregate its data and transmit to c3. Finally, node c3 will combine its current data with that received from c7 and transmit the message to the sink. The non-CDMA based approach creates a three-level hierarchy of the nodes and interference effects are reduced by carefully scheduling simultaneous transmissions. Such chain-based protocol has been shown to perform better than the regular PEGASIS scheme by a factor of about 60.

PEGASIS improves on LEACH by saving energy in several stages [1], [2], [7]. First, in the local gathering, the distances that most of the nodes transmit are much less compared to transmitting to a cluster-head in LEACH. Second, the amount of data for the leader to receive is at most two messages instead of 20 (20 nodes per cluster in LEACH for a 100-node network). Finally, only one node transmits to the BS in each round of communication. However, the PEGASIS still requires dynamic topology adjustment since sensor's energy is not tracked. For example, every sensor needs to be aware of the status of its neighbor so that it knows where to route that data. Such topology adjustment can introduce significant overhead especially for highly utilized networks.

Furthermore, any hierarchical routing protocol is prone to an intrusion attack namely HELLO FLOOD attack which in turn may lead to selective forwarding attack. Routing protocols often use HELLO packet broadcasts by nodes during establishment of clusters. If a node A receives such a packet from another node B, A considers B to be within its normal radio range. Clustering is then done by picking the nearest neighbor in case of PEGASIS chain formation or choosing the CH from which the strongest signal is received in case of LEACH. But if a strong signal emitting adversary is present which broadcasts HELLO packets, the other nodes may mistake it for a legitimate neighbor and add it in the chain/choose it as cluster head. This node can spoof and misinterpret data received from its neighbor nodes/cluster members. It may forward spoofed packets along the route leading to selective forwarding. When this node takes turn and becomes the leader in the chain in case of PEGASIS, it may lead to delivery of entirely misconstrued information to BS and cause serious problems due to delivery of wrong information.

III. DESIGN OF SECURE PEGASIS (S-PEGASIS)

We propose a new protocol called secure PEGASIS which will be able to combat HELLO flood attack in PEGASIS. We chose CDMA based hierarchical PEGASIS as our base protocol as it is energy efficient as compared to other data centric or hierarchical protocols for WSNs. CDMA means code division multiple access method. It is used for parallel communication between multiple pairs of nodes using single communication

medium (here the radio used for data transmission). Each pair uses a different 'code' to encode its data. The combined data from all senders is transmitted over the medium. Any node can receive the data sent by any other node by decoding the data using the sender's code. This way, no multiplexing or time sharing is needed and multiple pairs can communicate with each other simultaneously. The protocol is designed keeping in mind a WSN with the following assumptions:

1. The sensor nodes and BS are stationary.
2. The nodes are capable of communicating with BS but require extra energy for this. For communication within network, much low power radio is used so that energy reserve of nodes is not exhausted quickly.

1.1 Features:

We try to assure the following features in the proposed protocol:

1. Chaining concept of S-PEGASIS:

The nodes will be arranged in a chain with a leader transmitting to the BS and other nodes communicating only with one-hop neighbors. Nodes will be numbered 1 to N (where is the total number of nodes). This number has to be stored in memory. The nodes take turn in becoming leader. In the i^{th} round of communication, the node numbered i mod N becomes leader. The nodes locate themselves and form chains by broadcasting HELLO packets to all neighbors with a signal strength that is approximately equal to that required for communicating with neighbors in normal radio range (not with extra energy like that required for communicating with base station). The chain is formed using a greedy approach. Any node chooses the node from which it first receives HELLO packet as its neighbor along with network key (key negotiation is used for security as explained later). Chain formation has to be done initially when the network is set up or when some node dies. Data transmission process is same as in hierarchical PEGASIS. It is explained below. We assume a chain of 8 nodes c0-c7 arranged linearly in an arbitrary round of data transmission, say round 3. So, c3 is the current leader. The transmission hierarchy looks like the one depicted in Fig. 2.

Since, node c3 is in position 3 (counting from 0) on the chain, all nodes in an even position will send to their right neighbor. The transmissions c0->c1, c2->c3, c4->c5 and c6->c7 occur simultaneously using CDMA. Nodes that are receiving at each level rise to next level in the hierarchy. Now at the next level, node c3 is still in an odd position (1). Again all nodes in an even position will aggregate its data with its received data and send to their right. At this level, the transmissions c1->c3 and c5->c7 occur simultaneously. At the third level, node c3 is not in an odd position, so node c7 will aggregate its data and transmit to c3. Finally, node c3 will combine its current data with that received from c7 and transmit the message to the sink.

Now, in next round, node c4 becomes leader. First, the transmissions c1->c0, c3->c2, c5->c4 and c7->c6 occur simultaneously. The receivers c0, c2, c4 and c6 rise to the next level. Then, the transmissions c2->c0 and c6->c4 occur simultaneously. Then the receivers c0 and c4 rise to the next upper level. Transmission c0->c4 occurs and c4, the leader, sends the aggregated data to the BS. In normal PEGASIS, it would involve eight phases of data transfer in every round as no two pairs communicate simultaneously due to shared communication medium. But here, only 3 phases of data transfer are needed (corresponding to levels in the hierarchy) due to simultaneous data transmissions in the lower levels of hierarchy.

To analyze it mathematically, we consider a network with N nodes where $N = 2^m$ .In the lowest level of hierarchy, there are N nodes, out of which $N/2$ are senders and $N/2$ are receivers. The receivers rise to the next level in hierarchy. So, there are $N/2$ nodes in the 2nd level. Similarly, there are $N/4$ nodes in the next level and so on, till there is only one node, the current leader, in the topmost level.

We assume lowest level to be level 0, the next to be 1 and so on.

No. of nodes in level 0 = $N/2^0$=N, no. of nodes in level 1 =$N/2^1$=$N/2$, no. of nodes in level 2 = $N/2^2$=$N/4$.

Let the topmost level be k^{th} level. As no. of nodes in this level is 1, $N/2^k = 1$.

Therefore, $k = \log_2 N$. As no. of levels = no. of phases in data transfer i.e, the maximum delay a node can have in relaying its data is O(log N).

In normal PEGASIS chain, as nodes are linearly arranged, data is passed from one node to other along the chain with only one node transmitting at an instant. So, delay for the farthest node is O (N). So, we can see that hierarchical chaining decreases delay. Since delay is the biggest factor affecting scalability of PEGASIS, it increases scalability.

2. Scalability:

The number of nodes in the network can be increased without causing much overhead or congestion as only one of them communicates to the base station and each node communicates with only one neighbor in each step

(level of CDMA tree) of every round. The only overhead incurred will be in chain formation. But this is not done frequently, and since a greedy approach is used, it does not consume too much time. If a chain breaks or a node is corrupted by an attacker in such a way that it refuses to pass packets, its expected receiver neighbor will inform the BS about the non-responsiveness of the node after it fails to provide data in a given round. It does so by sending a special alarm packet. The BS will query and authenticate the node to check if the failure is permanent (node dead or corrupt). In this case, the chain will be altered to bypass this node. Otherwise, if it is due to low transmission power, the BS instructs the node to increase transmission power.

3. Static Nodes:

To avoid dynamic topology adjustment problem of LEACH, nodes are static which means that they transmit data to fixed neighbor only once a chain has been formed. Though the leader is changed in every round, it does not affect the transmission mechanism of other nodes. By making the nodes static, we restrict the overall energy consumption of the network.

4. Multi-Hop Communication:

The node receiving a packet from a neighbor aggregates it with its own packet to remove redundancy. There are no redundant packets transmitting in the network as aggregation is done as soon as a packet goes one hop. So, data volume transmitted is minimized and this increases energy efficiency.

5. Security:

We try to combat HELLO flood attacks by introducing key negotiation at the time of chain formation. Each node is supplied with a network key which is globally shared in the network and not known to any outsider. It is also provided with an algorithm to encrypt the key during negotiation.

The algorithm can be any encryption algorithm which is same for all nodes and known by the BS. Suppose, we are using a two byte network key, then the algorithm may be to multiply the lower byte by 7, discard carry and divide the higher byte by 3 to get the encrypted two byte key. Or the algorithm may be encrypting the key using another key. The algorithm is not protocol specific, which means, it may be different for different networks employing this protocol. The network designer chooses this algorithm according to convenience. It should not be known to any outsider (that is, devices excluding the BS, nodes and designer of the network).

The key and algorithm are stored in a special secure memory. In case key-based encryption is used, the algorithm may be stored in normal memory and only the key (used for encrypting the network key) needs to be stored in secure memory. Some secure memories are available for the purpose of storing secret keys and protected software. Their content cannot be accessed by any outsider. Only the device on which they are mounted can read them. One example is the Atmel's crypto memory EEPROM. It can be seamlessly integrated into the node's architecture and accessed just like its own memory. The implementation is done totally in hardware. Secure memories are costlier than normal memory but since we use it to store only the key and its algorithm, we need only a small amount of memory which would not affect the overall cost of nodes much.

While publishing HELLO packets, the nodes also have to supply the key. The key is encrypted so that any attacker cannot obtain it by eavesdropping. It is encrypted by applying the algorithm which is stored along with it in the secure memory.

If receiver finds a match with its own key after encrypting it, then only the sender is added in the chain. Any attacker causing HELLO flood is not expected to know this information and hence will not be added to the chain. During data transmission, the packets should again contain this key to ensure to any receiver node getting data from a neighbor that the sender is a legitimate node. This, along with the alarm raising mechanism in case of failure of a node to transmit data, makes an attack detection system. Sinkhole attacks, wormhole attacks and Sybil attacks are inherently absent in this protocol because attackers are not allowed to be a part of the chain at all. So, they cannot publish any route through them to other nodes. No sinkhole can be created. Attacker detection ensures that even if malicious nodes get some packets of the network and form a wormhole with their invisible band low latency link, the nodes will be detected as attackers as soon as they try to pass the packet to a legitimate neighbor as they cannot get the correct network key. In other words, base station never gets wrong or made up information.

1.2 Detailed Design:

1.2.1 Chain Formation:

The first step in this protocol is the formation of secure chain. The major steps in chain formation are:

- All nodes set their left and right neighbors as null.
- The BS sends a TOKEN packet to any randomly chosen live and non-malicious node.

- A node, on receiving a TOKEN packet, searches for a right neighbor. It broadcasts HELLO packets. To reduce number of packets, HELLO is sent only to live nodes which do not have a left neighbor.
- On receiving a HELLO packet, a node sends neighbor request NREQ packet to the sender in a bid to choose it as left neighbor. A node may send requests to more than one node on receiving HELLO from them.
- Along with the NREQ packet, the public key is also sent. The sender extracts the public key, encrypts the network key with this public key and sends a neighbor accept NACC packet with this encrypted key and its own public key. The network is unique for the network and not known to any outsider.
- When the request sender gets an NACC packet, it extracts the encrypted key, decrypts it with its private key and matches with the stored network key. If there is a match, this means the sender is legitimate. It is chosen as left neighbor and a confirmation packet NCONF is sent. This packet also contains the network key encrypted with the left neighbor's public key so that it can verify the legitimacy of this sender.
- When a node receives the NCONF packet, it verifies the network key. If it is correct, the sender is chosen as right neighbor and the token is passed to it using the TOKEN packet.
- This process repeats till a suitable right neighbor is found for all nodes except the rightmost node. That is, the chain is complete when the count of nodes with right neighbors is one less than the total number of valid nodes.
- After the chain is complete, all nodes are assigned positions (starting with 0 from the left). Positioning is important for the protocol program to work according to the hierarchical CDMA transmission model.

1.2.2 RSA Algorithm:

We have used public key cryptography for communication of network key. The network key, which is exchanged between neighbors during chain formation, is communicated in an encrypted form so that any outsider malicious node may not intercept it. Asymmetric key cryptography is used because it does not incur the overhead of key exchange, which is very costly for sensor network due to constraint on energy. We use RSA algorithm for key generation, encryption and decryption. The algorithm is described as follows:

- All nodes choose a public key and a private key. This is done using the following steps:
- Choose two unequal prime numbers p and q. Find their product n and a quantity ϕ given by (p-1)(q-1).
- The public key e is any number less than ϕ and co-prime to ϕ.
- The private key d is a modular inverse of e mod ϕ, that means, d*e (mod ϕ) =1.
- The public key is taken as e!n and private key as d!n.
- The nodes publish their public keys whereas the private keys are kept securely so that no outsider can know it. It is generally very difficult to guess the private key since finding the product of prime numbers is much easier than factorizing the product. Secondly, the values p and q are randomly chosen and e and d are found based on modular arithmetic.
- In order to send some data (in this case the network key), the sender encrypts it using the receivers' public key. The receiver decrypts is using its private key. It can be correctly decrypted if and only if it was encrypted using the corresponding public key.
- The algorithm used for encryption and decryption are same due to modular arithmetic. Either of the public and private keys may be used for encrypting and the other one can decrypt the encrypted data. This encrypting algorithm is:
- Represent the data in a numeric format.
- If d is the data, and e!n is the receivers' public key, the encrypted data will be d ^ e mod n.
- Similar method is used for decryption. If c is the encrypted data, the original data can be found by c ^ d mod n, where d is the private key of the receiver.

1.2.3 Data Transmission:

Data transmission in this protocol occurs using the hierarchical model described previously. This has been adopted to reduce delay and hence enhance scalability. The time complexity is O (log n) where n is the number of nodes. The major steps in this algorithm are:

- Data transmission occurs in rounds. BS issues the start round commands to the nodes. They transmit the data they have collected from surroundings, on receiving this command. Every round has a different leader, chosen by the formula i mod N, where i is the round number and N is the total number of nodes in the chain.
- Each round consists of phases. The first phase contains all the nodes. The nodes are divided in pairs. One in each pair transmits data and the other receives from it and aggregates it with its own data. The next phase consists of the receivers of first phase and a similar process is followed. These transmissions take place simultaneously using CDMA.

- The direction of data transmission i.e, which node is the sender among a pair and which node is the receiver, is decided by the position of leader among the participating nodes in the current phase. If leader is in odd position, transmission occurs from right to left and if it is in even position, the direction is left to right.
- The number of phases is given by log N where N is the total number of nodes in the chain. In the last phase, only the leader is left with the data aggregated from all the nodes. The leader sends it to the BS.

1.2.4 Energy Modeling:

We have first demonstrated the formation of chain and data transmission without considering the effect of energy on it. Then we have developed an energy model to represent loss of energy at every step. The network uses two types of radio - a low power radio for communication within the network and a high power radio for contention free communication with base station. This is necessary for maintenance of global variables. Since two kinds of channels cannot be simultaneously modeled using ns2, we have shown the low-power radio communication as it occurs (with all packets explicitly shown) whereas the global variable communication is modeled using global tcl variables without showing exact communication with the BS. However, we have incorporated the energy consumption due to updating of global variables. When a node updates a global variable, it is sent to the BS which in turn sends it to every other node.

During the protocol operation, energy is consumed for sending and receiving packets, as well as sensing. Energy required to send a packet is much more than that to receive. The sensing power is very low compared to these.

The nodes are initially set up with energy of 5000 Joules. Then, we have defined constants to represent consumption of energy per byte for various network packets. These, multiplied by the number of bytes in a packet, gives the total energy consumed for various network events like sending a packet to another node, sending a packet to BS, receiving packet from another node, receiving packet from BS, idle (sensing energy consumption every 10 seconds) etc. The number of bytes for various kinds of packets like HELLO, TOKEN, global variables, sensed data etc have also been defined as constants.

When a node sends or receives some packet or updates or receives a global variable, its energy is consumed. If the energy level of a node falls below a certain threshold, it is considered dead. Dead nodes cannot send, receive or sense data. The protocol has features to detect and bypass dead nodes in the network. At regular intervals of time, the nodes check if their neighbors are dead. In this case the next neighbor of the dead neighbor is taken as a neighbor and the global network parameters adjusted accordingly. During data transmission if a node cannot transmit data, it is treated as dead.

If the number of dead nodes exceed a certain percentage (here 10%) of the total number of nodes, the chain is dissolved and a new chain is formed. This is done to ensure that due to interspersed dead nodes, the neighbors do not become far apart.

1.2.5 Error Control Mechanisms:

The network assumed for this protocol is a wireless sensor network with ad-hoc deployment. So, there are frequent instances of packet loss. In order to ensure participation of all nodes in chain formation, we have incorporated some error control mechanisms.

Whenever node broadcasts HELLO packets, it schedules a retransmission after a fixed time interval in case it fails to get a right neighbor. This accounts for loss of HELLO or NCONF packets. NREQ packet loss has not been considered since requests are received from a large number of nodes, and re-sending incurs sending energy cost. Similarly, NACC packet loss is not considered as ultimately, the node being unable to find right neighbor, will re-broadcast HELLO.

If TOKEN packet is lost, it is detected through the maintenance of a global variable indicating the presence of token in the network. In this case, the detecting nodes resend TOKEN packet to their right neighbors. To avoid reception of duplicate token, a node is restricted to respond to a TOKEN packet only if does not have a right neighbor.

Loss of NCONF packet may lead to isolation of the sender, because it has already fixed its left neighbor, so is unable to respond to other nodes' HELLO packets. To avoid this, a node periodically checks if its left neighbor is alive and has right neighbor null till it is selected as the right neighbor of that node. Otherwise, it sets its left neighbor as null.

Data packets may also be lost or arrive out of sequence in which they were sensed. But this is not accounted since detection of lost data may lead to a large overhead.

IV. SIMULATION RESULTS

1.3 NS2 Implementation and Results:

We have implemented our protocol by extending the Agent/MessagePassing class of NS2. Our class name is SPEG. We have added many procedures and overridden the recv and has_data functions of the base class to incorporate the desired functionality.
When a neighbor sensed data, it is modeled through the has_data procedure. In this protocol, the agent attached to each node manages the data and control information stored, manipulated and transformed by the node. Each node has data buffer to hold sensed data. When a node senses new data, the previous contents are replaced by the latest data. Similarly, when it transmits data to a neighbor during transmission phase, its buffer is cleared. When it receives data from a neighbor, it aggregates the data with its own data.
We have used a simple aggregation and fusion model where data is appended to buffer if not present there and it is discarded if already present in the buffer. When a node does not have any data, its buffer is empty and on time o transmission, it will send empty DATA packet.
The recv function has been overridden to represent the course of action when a particular packet is received by the node. The node can respond only if it is not dead. It first decides the type of the packet whether HELLO, DATA etc. and then takes action accordingly.
Besides the basic networking framework, procedures have been added for implementing the RSA algorithm, error control, chain formation and position assignment and scheduling the data transmission timings. The basic working program for the protocol is implemented as an external procedure which schedules the data transmissions after the chain formation is complete.

Nam is a Tcl/Tk based animation tool for viewing network simulation traces and real world packet traces. It supports topology layout, packet level animation, and various data inspection tools. For example when a network with 6 nodes, the visualization tool nam will display a 6 node network.. The location of the nodes could have been chosen at random. If a random location of nodes is chosen and it is not satisfactory, one can chose the "re-layout" button and chose another location. One can also edit the location by clicking at the Edit/View button and then drag in each node to its required location by the help of the mouse. Other things that can be done in nam include coloring nodes, changing shape of the nodes, by default they are round, but they can be changed into square or hexagon etc, coloring links, adding and removing marks, adding labels: a label can appear on screen from a given time onwards, adding text: at the bottom frame of the NAM window, one can make text appear at a given time. This can be used to describe an event at that time. One can add in NAM, a monitoring of the queue file.
Network Animator shows animated results and analyses them in terms of the movement of various packets (TOKEN, HELLO, DATA etc.) in a network environment. Whereas ASCII trace can be used to analyze energy, throughput and various other parameters that determines the efficiency of the network.

1.4 Security and other features:

As the name suggests, the basic aim of this protocol is to add security features to PEGASIS. We have tried to combat various attacks on sensor networks. S-PEGASIS aims to remove all internal and external threats by incorporating only those nodes in the chain which are legitimate and part of the original network. This is done using key negotiation algorithm to combat HELLO flood attacks. As only legitimate nodes form the chain, other kinds of attack such as sinkhole and wormhole attacks are not possible because the path of packets in chain is fixed and cannot be influenced by an outsider malicious node. Sybil attack is also not possible because of unique numbering of nodes by the protocol. An outside node pretending to have a valid number cannot include itself in the chain due to lack of information about the network key. This protocol also ensures reliability in the network and hence especially suitable for critical data sensing networks. This is manifested in inclusion of each deployed node of the network in the transmission chain and immediate neighbor switching when a node is unable to transmit data.

Another important feature of this protocol which has been successfully implemented is the reduction in time complexity of data transmission. In a normal chain like in PEGASIS, time complexity of one round of data transfer (data collected by all nodes aggregated and sent to BS) is O (n), where n is the total number of nodes in the chain. In S-PEGASIS, it becomes O (log n) due to the hierarchical CDMA bases approach in which there are multiple transmissions in each phase of a round.

1.5 Comparative Study:

We have studied some existing hierarchical protocols – mainly LEACH and PEGASIS while developing the concept of S-PEGASIS. We have tried to incorporate the best features of these protocols into our design beside the essential feature of security. Here, in TABLE I, we present a comparative study of these protocols and their features along with our design of S-PEGASIS.

Table I:

Protocol / Parameter	LEACH	PEGASIS	S-PEGASIS
Scalability	It is scalable because of hierarchical data transmission.	It is not very scalable due to transmission time complexity of O (n) which causes large delay if chain is long.	It is scalable. The transmission time complexity is reduced to O (log n).
Energy Efficiency / Bandwidth Consumption	It is highly energy efficient compared to data centric protocols but its efficiency is less than single chain protocols due to a number of cluster heads communicating with the BS.	It is highly energy efficient as a single chain is formed with only one node called leader communicating with the BS and also because other nodes communicate with their neighbors only.	It is highly energy efficient as a single chain is formed with only one node called leader communicating with the BS. Energy consumed while forming the chain is a little higher than PEGASIS but overall efficiency is almost same.
Network Lifetime	Very Good	Very Good	Excellent
Multi-Path Routing	No	No	Yes
Classification	Clustering	Reactive / Clustering	Clustering / Hierarchical
Data Aggregation	No	Yes	Yes
Security	It does not provide security.	It does not provide security.	It has in-built security mechanism. Only legitimate nodes can become a part of the chain.
Reliability	It does not guarantee inclusion of every node in data transmission. If a node fails to respond to cluster head's advertisement, it is left out.	It does not guarantee inclusion of every node. A node relatively farther from other nodes but within radio range may be excluded from chain.	It guarantees inclusion of each live and non-malicious node within radio communication range of others, in the chain.

V. CONCLUSION

Sensor Networks hold a lot of promise in applications where gathering sensing information in remote locations is required. It is an evolving field, which offers scope for a lot of research. Their energy-constrained nature necessitates us to look at more energy efficient design and operation. Protocols, which name the data and query the nodes based on some attributes of the data are categorized as data-centric. Many of the researchers follow this paradigm in order to avoid the overhead of forming clusters, the use of specialized nodes etc.

On the other hand, cluster-based routing protocols group sensor nodes to efficiently relay the sensed data to the sink. The most interesting research issue regarding such protocols is how to form the clusters so that the energy consumption and contemporary communication metrics such as latency are optimized. The factors affecting cluster formation and cluster-head communication are open issues for future research. Moreover, the process of data aggregation and fusion among clusters is also an interesting problem to explore.

Our study of routing protocols was based on SPIN, LEACH and Hierarchical-PEGASIS, as these protocols best handle the issues of energy-awareness, security concerns and resource constraints, eliminating problems of implosion and resource-blindness found in the traditional routing protocols. Then we have developed a new protocol called S-PEGASIS which adds security to the existing PEGASIS hierarchical model.

This paper deals with creating a new protocol called Secure PEGASIS (or S-PEGASIS) for wireless sensor network that will be able to effectively use the limited energy and bandwidth, secure the delivery of data packets among various nodes, counter HELLO flood attacks, and at the same time enhance the scalability and reduce

delay in transmission with the help of hierarchical PEGASIS.

The simulation, however, has certain limitations. For example, the transfer of global variables has been modeled through global variables of tcl. It can be improved to show exact packet transfer using a separate high power channel for communication of nodes with BS. Secondly, the protocol has a chain formation time complexity of O (n^2). As seen from the observation, a 512 node network will take approximately 10 hours to establish the chain. This is a practical limit on the number of nodes. So, there is scope of work in developing a new neighbor searching procedure with less complexity but at the same time ensuring the key negotiation and inclusion of each node on the chain.

We have not provided encryption for data due to large overhead of transmission of encrypted data (since data is huge in amount and asymmetric key cryptography produces cipher texts larger than the original text). Some more efficient encryption technique may be developed to tackle this situation so that the data being passed could not be traced by any outsider. It can be further extended by providing link layer and physical layer security mechanisms so that trusted nodes on chain can never be hacked.

In the generic context, the sensor networks can be made more robust by using solar cells on nodes, incorporating VLSI based memories with low cost and large storage etc. This protocol can be immensely beneficial in sensor network applications in critical area viz. battlefields, disaster management, nuclear radiation etc. where security is and reliability is necessary.

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Performance Analysis of a Grid connected Wind Energy system

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Abstract: - This paper is concerned with the study of a small wind generation system used for battery charging. A topology that aims at the exploitation of maximum energy from the generator, generated at low speed is proposed. The characteristics of the wind turbine and the generator are discussed, providing the overview of the system modeling. Simulation tests of the system are obtained using MATLAB/SIMULINK. We adopt compact permanent magnet type synchronous generator, which doesn't need exciting current, and step- up /down buck-boost chopper to wind power generating system of a few kW output with rotor speed sensor. In addition, we employ rectifier circuit using Diode Bridge instead of AC-DC converter with PWM method and a battery charging system. Using these methods we achieve a simple wind power generation system.

Keyword: - *Wind Generation, Modeling, MATLAB*

I. INTRODUCTION

A wind generation system can be used basically in three distinct applications: isolated systems, Hybrid systems and grid connected systems. Basic characteristics of the systems include a power stage and energy storage capability. Generally, small size isolated systems demand energy storage, by the use of batteries. This paper deals in particular with the study of a wind generation system for battery charging. The complete analysis of the system is presented, and an alternative of optimum control at low speeds so that the extraction of energy occurs in a wide range of wind speedy is also described. Power electronics have an important role for controlling electrical characteristics of wind turbine. For small wind turbine generator in battery charging application DC-DC converter have been used for modifying the electrical load in order to maximize energy generation. Input of DC-DC converter is connected to bridge rectifier and a bulky capacitor (DC bus) and output is connected to battery. Finally the dc power is connected to ac power by inverter and supplied to the local grid. This scheme with proper control algorithm to modify duty cycle of DC-DC converter for maximum energy generation is known as maximum power point tracking. The converter is used to change the apparent DC bus voltage seen by the generator. Thus by controlling the DC converter the terminal voltage of PMSG is adjustable in order to maximize power production. For maximum power transfer in all wind speed the converter must be able to reduce PMSG terminal voltage in low wind speeds. Thus the recommended converter for this type of application must have buck boost voltage characteristics.

II. PROPOSED TOPOLOGY

In this figure 1, we adopt a permanent magnet type synchronous generator, a rectifier circuit for the AC-DC converter. Synchronous generator has many advantages over the induction generator, e.g. no exciting current, high efficiency, etc. Moreover, we use step-up/down buck-boost chopper with smoothing capacitor to control battery charging current. Finally, DC power is converted to AC power by the inverter and step up to required level, and finally supplied to the local grid. Although this chopper is an ordinary one, the load side voltage of chopper keeps constant because battery is connected to the load side. As the generating power, which is kept in the reactor of chopper, is used to charge battery and to supply power to the line, smoothed power supply is achieved. In other case, we can use this battery as power storage unit. For example, we can charge during the night, when small load is demanded, and discharge when required. The advantages of this system are follows:

1. Generated AC power is converted to DC power through simple Diode Bridge rectifier instead of switching devices.
2. As this system has no reverse power flow for step-up/clown buck-boost chopper, many generating units can be in parallel connected to one battery and inverter.
3. As proposed generating unit does not need microprocessor like DSP for the control the system, this unit can be produced in low cost.

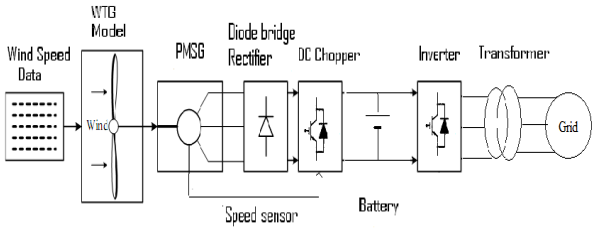

Fig 1 Proposed Block diagram of wind turbine driving permanent magnet synchronous generator with battery storage

III. SYSTEM MODELING

3.1 Generator Characteristics

The electrical machine used in the system is a permanent magnet synchronous generator (PMSG) rated at 1kW, 1000 rpm, 7 pole pairs and axial flux. This type of machine is particularly interesting for applications in wind generation due to its inherent characteristics. Several studies such as those in [2] deal with the characteristics of this machine. The dynamic model of the machine is obtained in [3], described by expressions (1) to (4)

$$T_e = \frac{E_a \cdot I_a + E_b \cdot I_b + E_c \cdot I_c}{\omega_g} \quad (1)$$

$$J \cdot \rho \cdot \varpi_g = T_m - T_e - B \cdot \varpi_g \quad (2)$$

$$\rho \cdot \theta_g = \omega_g \quad (3)$$

$$\rho \cdot \theta_r = P \cdot \omega_g \quad (4)$$

The values considered in the simulation are 0.5 Ω/phase (resistance), 3.35mH (self-inductance) and 3.06mH (mutual inductance).

TABLE 1. SYSTEM CONSTANTS

System constants		
Cd:	22[μF]C	: [2200μF]
Ld:	1[mH],Vb	: 72[V]
Switching	Device	: IGBT
Switching	Frequency	: 4[kHz]

Strategy For Maximum Power Point Tracking

In order to obtain maximum electrical power point, generator characteristics must be considered. Mechanical power produced by wind rotor (Pm) and electrical power produced by PMSG (P_{ca}) verses wm for various speed can be determined by simulation.

The control method of this work is based on the maximum electrical power curve. The aim is to control power generated by PMSG to follow P_{ca} max (wm). The block diagram of maximum power point tracking algorithm is shown. Voltage and current of one phase is measured and modified to determine the instantaneous power. A first low order filter is used to obtain the DC part of power signal which represent the active phase power.

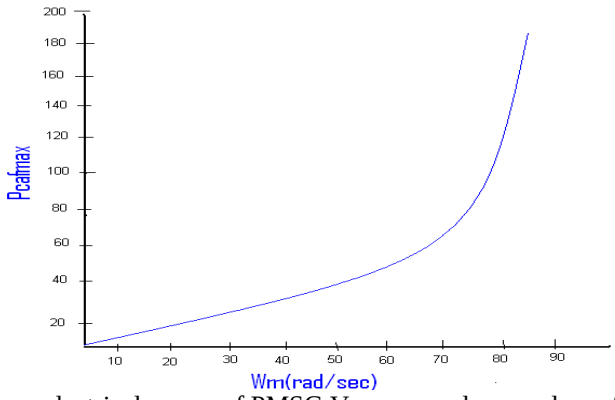

Fig 2.Maximum electrical power of PMSG Versus angular speed wm for one phase

Rotor angular speed (or generator frequency) is measured and used as input parameter of a lookup table containing the maximum power curve of PMSG for one phase. Output parameter of the lookup table is the reference of active power for one phase. Both power signals are subtracted, generating an error signal to PI controller. Control signal modifies the duty cycle the switching device, actively modifying power generated by PMSG

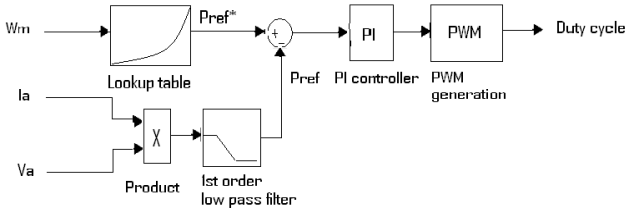

Fig 3. Block diagram of maximum power point tracking control

IV. SYSTEM SIMULATIONS AND RESULT

The system modeling is obtained considering the expressions presented in the previous session. Simulation tests are performed using MATLAB/SIMULINK as shown in Fig.

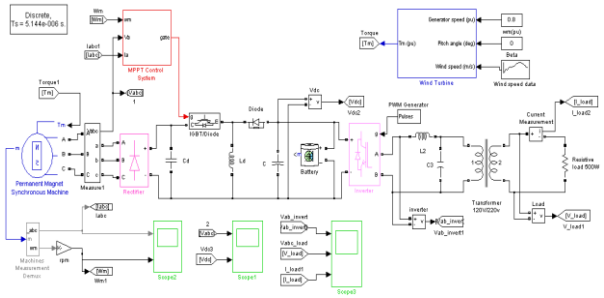

Fig.4 MATLAB/Simulink model wind energy conversion system without MPPT control

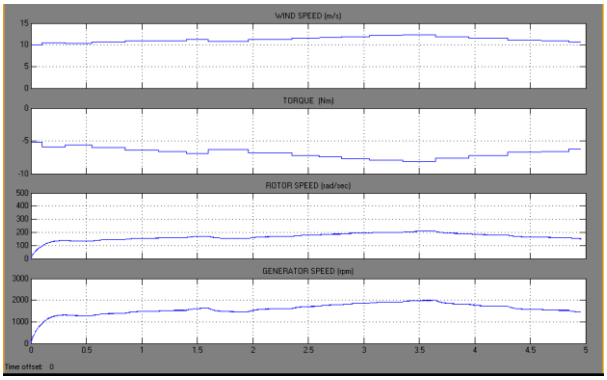

Fig.5 Output waveform at pitch angle β=5 and generator speed ω_m = 1 pu

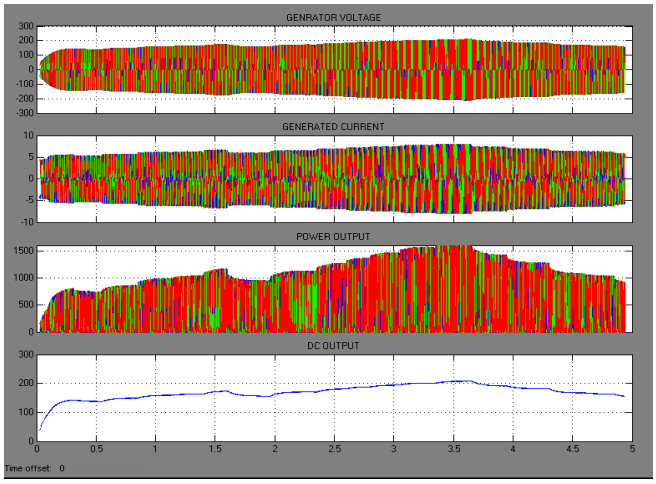

Fig.6 Output waveform at pitch angle β=5 and generator speed ω_m = 1 pu

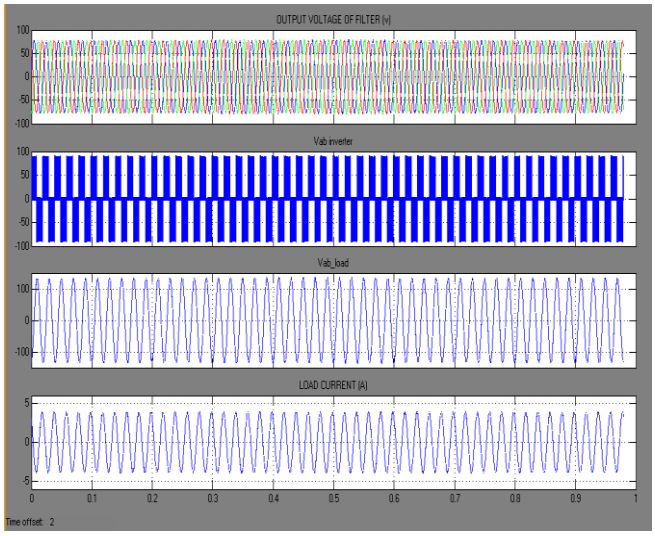

Fig.7 Output waveform at pitch angle β=5 and generator speed ω_m = 1 pu

V. CONCLUSIONS

A simple system and control method for small scaled wind power generating system using permanent magnet type synchronous generator whose output is from 1 to 1.5 kW or so, has been proposed. We consider that we set many generating units (from generator to chopper) in parallel and only one power storage, inverter and total power control unit. The proposed system does not need microprocessor like DSP for the control the system. We expect that use of this type synchronous machine adopted with the proposed simpler control methodology will be able to make an inexpensive alternative for small-scale wind- power generation systems.

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Critical Strength of steel Girder Web

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Abstract: - When a member is subjected to combined action of bending moment, shear and axial force, bending moment & axial force is assumed to resist by whole section and shear is resisted by web only. In such case web shall be designed for combined shear and axial force. The present study determines the strength of web of steel girder under the action of pure shear, pure axial force and combination of it. The classical plate buckling theory is already established to determine the critical buckling strength of web panel of the girder under pure axial compression and pure shear. Using Von Mises yield criteria interaction between axial compression and shear is presented. It has been observed that limit strength of web in combined axial compression and shear is governed by buckling of girder rather buckling of web panel.

Keywords: - *buckling, yielding, limit strength, compression, shear, interaction*

I. INTRODUCTION

Nearly all members in a structure are subjected to bending moment, shear and axial load. Particularly, while designing steel structural member, interactions of these actions need to be considered at limit state. Many literatures, codal provisions are available on interaction of Moment & axial compression (M-P) as well as for moment & shear (M-V). As per the revised Indian codal provisions, in case of sections with web susceptible to shear buckling before yielding, strength of member shall be calculated using one of the considerations as

1 The bending moment and axial force assumed to be resisted by flanges and only shear is resisted by web.
2 The bending moment and axial force acting on the section may be assumed to be resisted by the whole section. In such case web shall be designed for combined action of shear and normal stresses.

It is observed that, the provision of interaction for shear and axial compression (V-P) is less attended. The present study determines the strength of web of steel girder under the action of pure shear, pure axial force and combination of it. For the design of web plate two checks need to be applied, check against buckling and check against local yielding. The classical plate buckling theory is applied to determine the critical buckling strength of web of the girder and Von Mises yield criteria is also used to present interaction between axial compression and shear.

II. BUCKLING OF WEB

Web of rolled steel I section or built up plate girder behaves as a plate subjected to inplane uniform axial compression and shear as shown in Fig 1. Buckling strength of web is affected by web panel dimensions, length to depth ratio – called as aspect ratio (a/b), depth to thickness ratio (d/t) and boundary conditions.

Depending upon whether the web panel is from rolled steel section or from built up plate girder, boundary conditions vary. Web panel of rolled steel section is taken as simply supported alongside ‘b’ and built-in or fixed at the junction of web and flange abbreviated as SFSF, whereas web panel of plate girder is taken as simply supported along all edges abbreviated as SSSS. Elastic buckling strength of such plates is known by classical plate theories.

Classical plate theories are established by various researchers [1,3,4] for elastic buckling of plate under inplane action of pure compression, pure shear and combination of shear and axial compression.

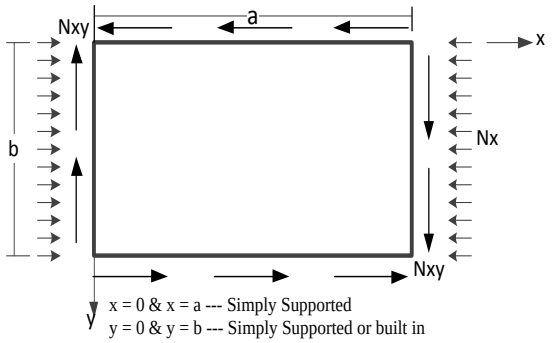

Figure1: Web panel subjected to inplane forces

2.1 Buckling Strength of Web: Classical plate theory approach

2.1.1 Web Panel under Uniform Compression:

When a web panel subjected to uniform compression (Nx) it will buckle in half waves along its longitudinal direction. By gradually increasing Nx and using equilibrium of the compressed plate, critical load at buckling for plate is given by

$$N_{x,cr} = k_a \frac{\pi^2 D}{b^2} \tag{1}$$

Where, D is the flexural rigidity of plate.

The buckling coefficient 'ka' for all edges simply supported, i.e. SSSS plate is given as [1],

$$k_a = \left(\frac{mb}{a} + \frac{a}{mb} \right)^2 \tag{2}$$

Where, 'm' is the number of half waves of buckling.

The buckling coefficient as per aspect ratio and transition of the buckling modes can be seen from Fig. 2

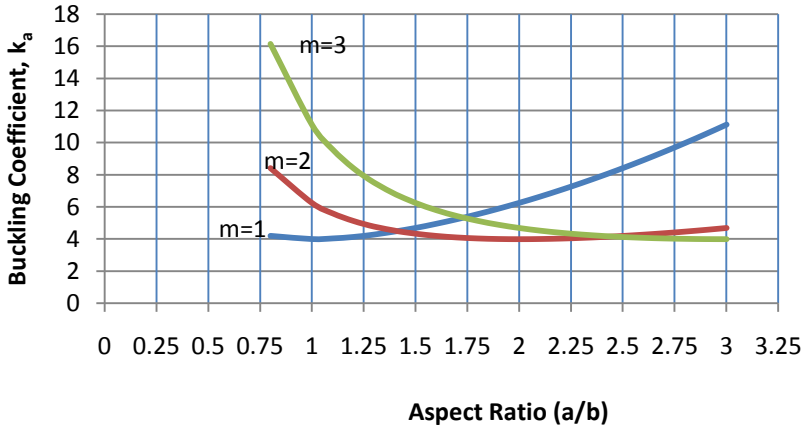

Figure 2: Buckling Coefficient ka as per aspect ratio for SSSS Condition

Rudolph Szilard [3] presented the buckling coefficient 'ka' for SFSF plate

$$k_a = \frac{1}{3}\left[\frac{16}{m}\left(\frac{a}{b} \right)^2 + 3m^2 \left(\frac{b}{a} \right)^2 + 8 \right] \tag{3}$$

The buckling coefficient for this condition as per aspect ratio and transition of the buckling modes can be seen from Fig. 3

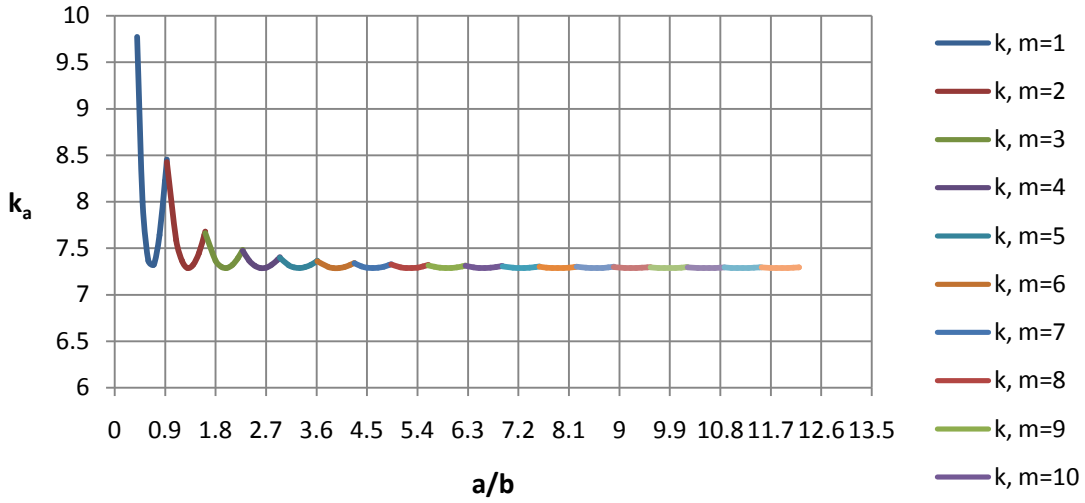

Figure 3: Buckling Coefficient ka as per aspect ratio for SFSF Condition

Considering 't' as the thickness of plate, the critical value of the compressive stress is

$$\sigma_{cr} = \frac{N_{x,cr}}{t} = k_a \frac{\pi^2 E}{12(1-\nu^2)} \frac{t^2}{b^2} \quad (4)$$

2.1.2 Web Panel under Uniform Shear:

When a plate is subjected to the action of shearing forces Nxy uniformly distributed along the edges, the critical value of shearing stress, τcr, at which buckling of the panel occurs is determined using the energy method. [1, 4] Critical shear stress, τcr, at buckling is presented in equation (5)

$$\tau_{cr} = k_v \frac{\pi^2 D}{b^2 t} \quad (5)$$

Where, kv is the shear buckling coefficient and its value with respect to aspect ratio are given in Table 1. [1]

Table 1: Shear Buckling Coefficient

a/b	1.0	1.2	1.4	1.5	1.6	1.8	2.0	2.5	3.0	4.0	∞
K_v , SSSS plate	9.34	8.0	7.34	7.1	7.0	6.8	6.6	6.1	5.9	5.7	-
K_v , SFSF plate	12.28	-	-	11.12	-	-	10.21	9.81	9.61	-	8.99

2.1.3 Web Panel under combined uniaxial compression and Shear:

The interaction equation for determination of buckling strength under combined compression and shear using above plate theories is presented by P S Bulson [4] as under

$$\frac{\sigma_x}{\sigma_{x,cr}} + \left(\frac{\tau}{\tau_{cr}}\right)^2 \leq 1 \quad (6)$$

III. ANALYTICAL VERIFICATION

Verification of results by numerical analysis using ANSYS is carried out. Based on the boundary conditions, two plate models are analyzed using ANSYS for various (a/b) ratios under action of pure compression and pure shear seprately. The boundary conditions considered are SSSS & SFSF.

Following is the data considered for analysis in ANSYS

b = 1.2 m, ν = 0.3, E = 210 GPa, t = 0.01 m

3.1 Web Panel under Uniform Compression

Performing Eigen buckling solution and using element as SHELL93, the plate is checked for buckling resistance in ANSYS. For buckling of SSSS plate under pure axial compression, for minimum buckling load, buckling

coefficient, 'ka' is giving close relation with classical solution as shown in Table 2. The results of SFSF plate are tabulated in Table 3.

3.2 Web Panel under Pure Shear

Similarly, using SHELL63, plate is checked for shear buckling resistance by ANSYS. The results for SSSS condition are tabulated in Table 4. In case of web of rolled steel section i.e. plate of SFSF condition, the results of classical plate theory are directly adopted. It is observed that for larger (a/b) ratio, buckling coefficient kv is almost constant to a value around 9. In practice ratio of (a/b) for rolled steel section is around 10, hence assumed value of kv = 9.00 is reasonably acceptable.

Table 2: Buckling Coefficients k_a for SSSS Condition (ANSYS)

a/b	K_a [1]	Nx,cr [1] N/m	Nx,cr (ANSYS) N/m	% error	K_a ANSYS
1	4	75917	75210	-0.94	3.962749
1.1	4.04	76676.17	75911	-1.01	3.999684
1.2	4.13	78384.3	77822	-0.72	4.100373
1.3	4.28	81231.19	80639	-0.73	4.248798
1.4	4.47	84837.24	84235	-0.71	4.438268
1.41	4.49	85216.83	84633	-0.69	4.459239

Table 3: Buckling Coefficients k_a for SFSF Condition (ANSYS)

a/b	K_a [1]	Nx,cr [1] N/m	Nx,cr (ANSYS) N/m	% error	K_a ANSYS
0.4	9.44	179164.1	169413	5.44	8.93
0.5	7.69	145950.4	135243	7.34	7.13
0.6	7.05	133803.7	122084	8.76	6.43
0.7	7	132854.7	119808	9.82	6.31
0.8	7.29	138358.7	124189	10.24	6.54
0.9	7.83	148607.5	133160	10.39	7.02
1	7.69	145950.4	145370	0.40	7.66
2	-	-	162982	-	8.59
3	-	-	118931	-	6.27
8	-	-	126826	-	6.68
10	-	-	124987	-	6.59
11	-	-	124683	-	6.57
12	-	-	129567	-	6.83

Table 4: Buckling Coefficients k_v for SSSS Condition (ANSYS)

a/b	k_v [1]	Nxy,cr [1] N/m	Nxy,cr (ANSYS) N/m	% error	k_v ANSYS
1	9.34	1231064	1.47E+06	-19.0478	11.11906
1.2	8	1054445	1059000	-0.43199	8.034559
1.4	7.34	967453.2	966471	0.101525	7.332548
1.5	7.1	935819.9	955360	-2.08802	7.24825
1.6	7	922639.3	939040	-1.77759	7.124431

IV. YIELDING OF WEB

Distortion energy theory of failure arrives at expression for equivalent stress (σ_e), which is also referred to as Von Mises stress which considers failure by yielding. A yield criterion defines the limit of elastic behavior under any possible combination of stresses at a point in a given material.

Equation based on the Von Mises yield criterion is expressed as

$$\sigma_e = \sqrt{\frac{(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_1 - \sigma_3)^2}{2}} = f_y \quad (7)$$

Where, σ_1, σ_2, σ_3 are the principal stresses and f_y is the yield stress.
Considering only σ_1, σ_2 the principal stresses acting at a point in the web panel and further web panel under uniaxial compressive stress σ_x and shear stress τ_{xy}, above expression (7) reduces knowing $\sigma_3 = 0$

$$\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 = f_y^2$$

In case of 2D elastic system, σ_1 and σ_2 can be expressed in terms of σ_x & τ_{xy}.

Hence, $\sigma_x^2 + 3\tau_{xy}^2 = f_y^2$

Converting this relation in nondimensional form, equation (8) is arrived as,

$$\frac{\sigma_x^2}{f_y^2} + 3\frac{\tau_{xy}^2}{f_y^2} = 1 \quad (8)$$

V. DESIGN CONSIDERATIONS

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extentions. (10)

5.1 Interaction equation presented by Bulson [4], as per equation (6) is in the form of stress. Modifying the equation (6) in nondimensional form of compression & shear capacities, equation (9) is arrived,

$$\frac{P_w}{P_{cr,w}} + \left(\frac{V}{V_{cr}}\right)^2 \le 1 \quad (9)$$

Where, Pw and V are the actual actions in the web & Pcr,w and Vcr are buckling capacities in axial compression and shear respectively for the web panel.

5.2 Interaction equation based on Von Mises yield criterion defines the limit of elastic behavior under any possible combination of stresses at a point in a given material. Thus the interaction gives the section capacity at a point. Modifying the equation (8) in nondimensional form of compression and shear capacities, equation (10) is arrived,

$$\left(\frac{P_w}{N_{dw}}\right)^2 + \left(\frac{V}{V_d}\right)^2 = 1 \quad (10)$$

Where Pw and V are the actual actions and Ndw & Vdw are the section capacities of the web in axial compression & shear respectively. Section capacity or section strength as governed by material failure by yielding for individual actions as per IS 800:2007 are

1. Member subjected to pure axial compression

$$N_d = A_g f_y / \gamma_{mo}$$

Where, Ag is the gross area of cross section and γmo is the partial safety factor for material.

2. Member subjected to pure Shear

$$V_d = A_v f_y / \sqrt{3}\, \gamma_{mo}$$

Where, Av is the area of the web = b.t

5.3 Indian Standard Codal provisions / Limit state of strength in axial compression is given as under

$$P_{dw} = A_e f_{cd}$$

Where, Ae is the effective cross sectional area of the member and fcd is the stress which accounts for the overall member buckling. In the case of girder subjected to axial compression, overall member buckling stress 'fcd' is based on governing slenderness ratio of the member and relevant buckling class of the section. Using this stress buckling capacity of web is evaluated as

$$P_{dw} = A_v f_{cd}$$

Where, Av is the area of the web = b.t

Thus , interaction equation considering overall buckling of web is

$$\frac{P_w}{P_{dw}} + \left(\frac{V}{V_{cr}}\right)^2 \le 1 \qquad (11)$$

VI. PHILOSOPHY OF INTERACTION EQUATIONS

Above proposed interaction equations (9), (10) & (11) are used for webs of various Indian Standard rolled steel section and plate girder. The critical buckling strength is determined based on plate buckling theory applicable for web panel in equation (9). Taking stiffened web of plate girder, a panel is considered as web portion between two adjacent stiffeners. Using practical spacing of stiffeners, panel aspect ratio (a/b) are taken as 0.9, 1.0, 1.2, 1.4 for plate girder. For unstiffened web of rolled steel beam ratio (a/b) is span to depth of web & it is much larger than that of plate girder. In practice this ratio is around 10 for rolled steel beam. Shear buckling resistance of the web of rolled steel section is determined considering shear buckling coefficient as 9.00 (refer Table 1).

Equation (10) based on Von Mises yield criteria. The strength in denominator is section strength at yielding of section which indicates failure at a point.

The buckling strength determined in equation (11) is based on overall member buckling in case of axial compression and panel dimensions in case of shear.

Fig 4, Fig. 5 & Fig. 6 shows the interaction relationship as expressed by equation (9), (10), (11)

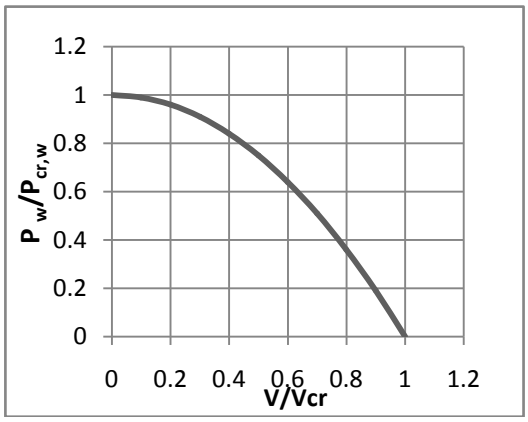

Figure 4: Interaction Curve using Eq (9)

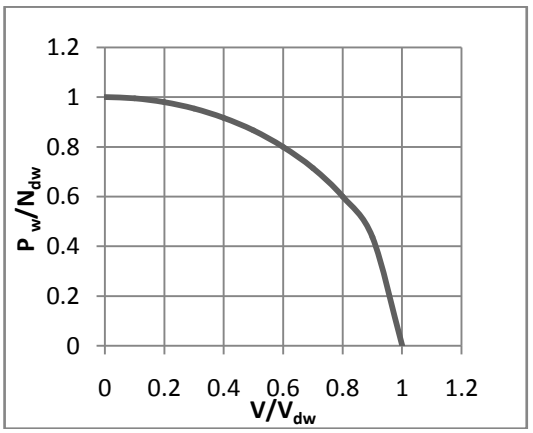

Figure 5: Interaction Curve using eq. (10)

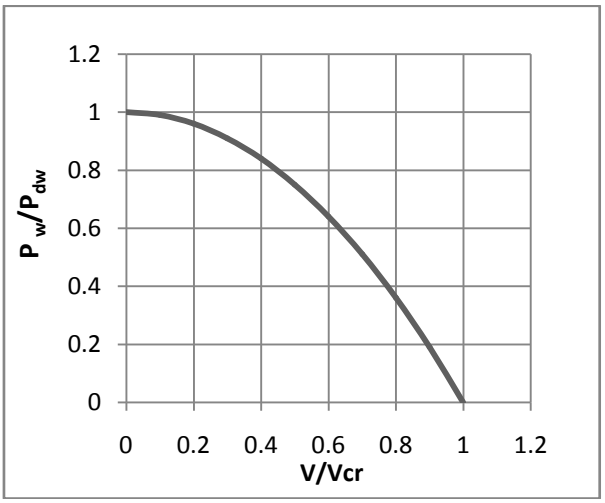

Figure 6: Interaction Curve using Eq (11)

VII. APPLICATION OF INTERACTION EQUATIONS

Some of the cases where the member is subjected to combined action of shear and axial compression are hinged bases of column, hinged bases of arch bridge and at simply supported end of plate girder of railway bridge under longitudinal traction.

The above proposed interaction equations are applied to various configurations of plate girder by varying (a/b) and for the ratio of (Pw/V). Parametric studies are performed based on following data is tabulated here,

Web panel dimensions (a/b) = (1500/1200) = 1.25, thickness of panel = 10 mm, modulus of elasticity = E = 200 GPa, ν = 0.3, fy = 250 MPa

Table 5: Comparison of Interaction Equations

		Axial Compression Capacities			Shaer Capacities		Interaction Equations		
a/b	P_w/V	Pcr	Nd	Pd	Vcr	Vd	Eq. (9)	Eq. (10)	Eq. (11)
1.25	1	527.22	2727.27	407.35	1004.23	1574.59	0.419	0.022	0.588
1.25	2	527.22	2727.27	407.35	1004.23	1574.59	0.389	0.009	0.552
1.25	3	527.22	2727.27	407.35	1004.23	1574.59	0.384	0.007	0.545
1.25	4	527.22	2727.27	407.35	1004.23	1574.59	0.382	0.006	0.543
1.25	5	527.22	2727.27	407.35	1004.23	1574.59	0.381	0.006	0.542

VIII. CONCLUSION

- Interaction equation proposed by P S Bulson [4] for combined action of P & V is linear-quadratic which uses classical plate theory. Buckling strength under individual action of P & V are evaluated on the basis of web panel dimensions and boundary condition of panel edges.
- Von Mises energy distortion theory which is known for yielding at the point of failure, when used for web is not a function of web panel dimensions. The equation basically indicates section strength at yielding rather buckling. The interaction for combined action of P & V is quadratic-quadratic.
- Considering buckling of member subjected to combined action of P & V, the value of P when acting alone & at which member buckles is dependent on Iyy and effective length of the member. Thus, strength under compression is determined based on overall member buckling. However, buckling strength of web under pure shear depends upon web panel dimensions & its boundary condition. Interaction for combined action is linear-quadratic.
- At limit state, interaction of P & V is governed by the limit strength in axial compression on the basis of member strength and that of shear on the basis of panel strength. Interaction values of P & V under three different limit states such as web panel buckling, local yielding, & overall buckling of the member, it is observed that overall buckling of the member governs the limit state.

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Information And Communication Technology (Ict): Catalyst For Enhancing The Intellectual Capacities of Educationists And Closing Observed Skill Gaps of Graduates In Higher Education Institutions In Nigeria.

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Abstract: - This paper highlights the challenges facing the adoption of e-learning and utilization of ICT infrastructure in Nigerian tertiary education. It also looks at the effect of e-learning in tertiary education and the support offered by other ICT infrastructures to the activities of teaching, learning and research.

I. INTRODUCTION

Information and communication technology is fast expanding the highway of knowledge and applications and also provides new ways of exchanging information and transacting business. The world is rapidly moving towards knowledge based economic structures and information societies, which comprises network of individuals, firms and countries, linked electronically in an interdependent and interactive relationship.

Advances in information and communication technology are changing the global economy. Knowledge is becoming increasingly important for production. It is also changing the nature of markets and competition. With the dawn of an age of networked intelligence, the new information technologies are changing the ways we work, learn and communicate with each other. The radical technological changes in information technology and telecommunications have contributed towards a more information and interaction intensive activities for human-computer interaction. This trend which is expected to continue causes a whole new range of social, economic and technological considerations and challenges, regarding the structure and content of societal activities in this information age.

The promises of e-learning for transforming tertiary education and therebyadvancing the knowledge economy have rested on three arguments. E-learning could expand and widen access to tertiary education and training: improve the quality of education and reduce its cost. The paper evaluates these three promises with the sparse existing data and evidence and concludes that the reality has not been to the promises so far in terms of pedagogic innovations, while it has already probably significantly improved the overall learning (and teaching) experience. Reflecting on the ways that would help develop e-learning further, it then identifies a few challenges and highlights open educational resource initiatives as an example of way forward. The first section of the paper recalls some of the promises of e-learning; the second compares these promises and the real achievements to date and suggests that e-learning could be at an early state of its innovation cycle; the third section highlights the challenges for a further and more radically innovative development of e-learning.

Information and Communication Technology (ICT) has become a key tool in acquiring, processing and disseminating knowledge. It has become an imperative tool for measuring development of a nation in the 21st century. The revolutionary impact of ICT on all sphere of the society has not spared the educational sector.
Education is a prerequisite of today's knowledge-based economy. The production and use of new knowledge required a more educated population. ICT is playing a major role in the acquisition and diffusion of knowledge which are fundamental aspects of the education process. It is offering increasing possibilities of codification of knowledge about teaching and for innovation in teaching activities through being able to deliver learning

cognitive activities anywhere at any time (Larsen and Vincent Lancrin, 2005). The availability of the Internet has given rise to an electronic approach to the educational system called e-learning.

Tertiary educational institutions have always being at the forefront of new scientific discoveries and innovations brought about by the activities of teaching, learning and research. E-learning is becoming increasingly prominent in tertiary education. E-learning being delivered on the platform of ICT infrastructure promise to widen access to education and improve quality of education at reduced cost. Apart from electronic learning, ICT infrastructures are being widely use to support teaching, learning and research activities in tertiary education. Such infrastructures include personal computers, specialized software, handheld devices, interactive whiteboard, intranet and visual library.

Information Technology (IT) is radically altering the balance of power between institutions, government, and people by broadly disseminating important information. Power bases dependent on information virtually flows around the globe without restriction. Information technology has altered the way many people do their jobs, and has changed the nature of work in industrialized nations. The practice of management has been greatly affected and aspiring managers must be fluent in new management trends and techniques in order to succeed.

II. CONCEPTUAL FRAMEWORK

Electronic Learning (E-learning) is an electronic delivery and administration of learning opportunities and support via computer network and web-based technology (Akinyemi, et al, 2007). It covers a wide range of systems, from students using e-mail to accessing course work on-line. E-learning can be of different types: Web-supplemented, Web-dependent and mixed mode (OECD, 2005. Application and processes of e-learning include web-bases learning, computer-based learning, virtual classroom, video-conferencing and digital collaboration where contents are delivered via the internet, intranet/extranet, audio/or video tape, satellite TV, CD-Rom. E-learning creates a self-centered approach to learning by relaxing time and space, it enrich learning content and enhance wider access to information resources. When the potential of e-learning is fully harnessed, it could advance knowledge by expanding and widening access, improving the quality of education and reducing cost. When the needs are huge, fully online learning can be crucial and possibly the only realistic means of increase and widen access to tertiary education. Some developing countries like Nigeria have many young people craving for tertiary education and too small an academic workforce to meet the huge demand; training new teachers would take much time and cost, e-learning might be a means for many potential students and learners to study (World Bank, 2003).

Institutions worldwide are adopting Learning Management System (LSM) software developed for administration and teaching in tertiary education. The software enables the treatment of enrolment data electronically, offer electronic access to course materials and carryout assessments as well as offering online interaction between faculty and students (OECD, 2005). Apart from e-learning, other ICT infrastructures are also aiding effective teaching and learning in the traditional classroom setup. Availability of personal computers and its accessories have enhanced the output of teachers and students. Computer Aided Instruction (CAI) software which are tutorial software are widely available to compliment classroom work. These software sometimes have limited capabilities, but very useful in presentation of graphics that aid learning. Handheld devices like mobile not takers are available to aid learning in term of mobility. Interactive White Board is another infrastructure that allows the projection of images generated by computer onto a touch sensitive screen that is of the size of the traditional white board. The Interactive White Board provides instant access to materials form variety of sources and possibility of using pre-prepared lectures that move without apparent from visual to verbal and vise-visa. Intranet is a web-based collaboration among members of the same group. In education system, Intranet aids collaboration among staff and students of the same department, faculty or institution (Obaniyi and Soroyewun, 2007). It serves as a repository of academic materials and knowledge available for use by members of the same academic group. In Intranet, collaboration is faster and cost effective with the removal of cost associated with Internet connectivity. Visual library is another area where ICT is aiding teaching, learning and research. Visual library sites provides access to a large volume of library resources (articles, journals, books, etc) and online reference services via the Internet.

III. LITERATURE REVIEW

Despite the potentials of ICT to enhance the activities of teaching, learning and research, report showed that the application of ICT in Nigerian tertiary institutions is less than five percent (Guardian, 2007). Knowledge, innovation and Information and Communication Technologies (ICT) have had strong repercussions on many economic sectors, e.g the informatics and communication, finance, and transportation sectors (Foray, 2004; Boyer 2002). What about education? The knowledge-based economy sets a new scene for education and new challenges and promises for the education sector. Firstly, education is a prerequisite of the knowledge-based economy: the production and use of new knowledge both require a more (lifelong) educated population and workforce. Secondly, ICTs are a very powerful tool for diffusing knowledge and information, a

fundamental aspect of the education process: in that sense, they can play a pedagogic role that could in principle complement (or even compete with) the traditional practices of the education sector. These are the two challenges for the education sector continue to expand with the help (or under the pressure) of new forms of learning. Thirdly, ICTs sometimes induce innovations in the ways of doing things for example, navigation does not involve the same cognitive processes since the Global Positioning System (GPS) was invented (e.g Hutchins, 1995) scientific research in many fields has also been revolutionized by the new possibilities offered by ICTs, from digitization of information to new recording, simulation and data processing possibilities (Atkins and al. 2003). Could ICTs similarly revolutionize education deals directly with the codification and transmission of knowledge and information-two activities which power has been decupled by the ICT revolution?

The education sector has so far been characterized by rather slow progress in terms of innovation development which impact on teaching activities. Education research and development does not play a strong role as a factor of enabling the direct production of systematic knowledge which translates into ‘’programmes that works’’ in the classroom or lecture hall (OECD 2003). As a matter of fact, education is not a field that lends itself easily to experimentation, partly because experimental approaches in education are often impossible to describe in precisely enough to be sure that they are really being replicated (Nelson, 2000). There is little codified knowledge in the realm of education and only weak developed mechanisms whereby communities of faculty collectively can capture and benefit from the discoveries made by their colleagues. Moreover, learning typically depends on other learning inputs than those received in the class or formal education process the success of learning depends on many social and family aspects that are actually beyond the control of educators.

Information and communication technologies potentially offer increased possibilities for codification of knowledge about teaching and for innovation in teaching activities through being able to deliver learning and cognitive activities anywhere at any time. learning at a distance can furthermore be more learner-centered, self-paced, and problem solving-based than face-to-face teaching. It is also true, however, that many learning activities cannot be coordinated by virtual means only. The emulation and spontaneity generated by physical presence and social groupings often remain crucial. Likewise, face-to-face exchanges are important when they enable other forms of sensory perception to be stimulated apart from these used within the framework of electronic interaction, the influence of distance.

Education is a prerequisite of todays knowledge-based economy. The production and use of new knowledge required a more educated knowledge which are fundamental aspects of the education process. It is offering increasing possibilities of codification of knowledge about teaching and for innovation in teaching activities through being able to deliver learning cognitive activities anywhere at any time (Larsen and Vincent-Lancrin, 2005). The availability of the Internet has given rise to an electronic approach to the educational system called e-learning.

At the heart of this new epoch of economic and technological development is Information Technology (IT). The world as we know it is changing dramatically in terms of the way we see, work, socialize, learn, shop and conduct business due to the widespread and increasing use of IT. The technology will engender what Toffler (1990) refers to as a ‘power shift’ giving rise to an entirely new ‘system for wealth creation’ and the distribution of power. It is for this reason that Frenzel (1996) writes that:

Writers like Toffer (1990), Glastonbury and LaMendola (1992), Frenzel (1996), Naisbitt (1994), and Gates (1995), are also of the opinion that, in the next millennium. IT would determine the countries that would be leaders and those that would be laggards, those that would be rich and those that would be poor, and those that would be powerful as against those that would be weak. Countries that cannot trade using IT would be relegated to the periphery of world commerce and international relations. They would thus become the outcasts of the New World System. Equally, companies that do not have an appropriate IT infrastructure and the promotion of IT use in their operations, management and communication processes would also suffer an existential debacle in the business arena of the new era.

Information Technology comprises computing and telecommunications technologies. It is the merging of the two technologies, especially their organizational and management aspects, that help in fashioning IT for organizational use (Woherem, 1991 and 1993; Frenzel, 1996). In the 1970s and 1980s, the focus is shifting quickly to telecommunications. Now, when commentators and the information superhighway, of which telecommunications is a primary enabling technology.In recent times, researchers working with firm-level data have found significant contributions from IT toward productivity (Lichtenberg 1995: Brynjolfson 1993: Bresnahan 1999: Brynjolfson and Hitt 1995; 1996; 1998; Barua et al, 1991 and Harris and Katz, 1991). Baua et al (1991), Steiner and Teixeira (1991) Strassmam (1995), Hitt and Brynjolfson (1996) and Renkema (2000) all argued that although IT investment have increased productivity, it has not resulted in normal business profitability rather there were some evidences of small or negative impact on profitability.

Information Communication and Technology (ICT) is the modern handling of information by electronic means which involves access to, storage of, processing, transportation or transfer and delivery (Bell 2008) it is acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a micro-electronic based combination of computing and telecommunication (Lucey 2008).

The focus of ICT is on telecommunication and computerization (Lucey 2005) it implies the convergence of computing and communication (Telecommunication) technologies and its uses or application for global internet, Extranet World Wide Web (WWW), Visual reality cyberspace-the New Digital Mentality and culture (Uwaje, 2007). Information Communication and Technology comprises the physical devices and software that link (connect) various computer hardware components and transfer data from one physical location to another (Laudon 2008). Connectivity has facilitated the use of electronic delivery financial transaction.

IV. THE CONCEPT OF UNEMPLOYMENT

Every economy is characterized by both active and inactive populations. The economically active ones arereferred to as the population willing and able to work, andinclude those actively engaged in the production of goodsand services and those who are unemployed. TheInternational Labour Organization (ILO) defines theunemployed as numbers of the economically activepopulation who are without work but available for andseeking work, including people who have lost their jobs and those who have voluntarily left work (World Bank,1998).

According to Fajana (2000), unemployment refersto a situation where people who are willing and capableof working are unable to find suitable paid employment. It is one of the macro-economic problems which everyresponsible government is expected to monitor andregulate. The higher the unemployment rate in aneconomy the higher would be the poverty level andassociated welfare challenges. Fajana (2000), Alao(2005), and Wikipedia (2010) identify the following types

of unemployment.Structural unemployment occurs when there is achange in the structure of an industry or the economicactivities of the country. This may be because people'stastes have changed or it may be because technology has outmoded and the product or service is no longer indemand. It is mostly to be found in the developingcountries of Asia and Africa. This type of unemployment

is due to the deficiency of capital resources in relation totheir demand. In other words, structural unemploymentresults from a mismatch between the demand for labour,and the ability of the workers.

Frictional Unemployment is caused by industrialfriction in which jobs may exist, yet the workers may beunable to fill them either because they do not possess the necessary skill, or because they are not aware of theexistence of such jobs. The employable may remainunemployed on account of shortage of raw materials, or

mechanical defects in the working of plants. Therefore,the better the economy is doing, the lower this type ofunemployment is likely to occur. Seasonal Unemployment is due to seasonalvariations in the activities of particular industries causedby climatic changes, changes in fashions or by the inherent nature of such industries. In the tropical region, pure water companies are less active in rainy season becausedemand for pure water is low. Seasonal oriented industries arebound to give rise to seasonal unemployment

Cyclical Unemployment also known asKeynesian unemployment or the demand deficientunemployment is due to the operation of the businesscycle. This arises at a time when the aggregate effectivecommunity demand becomes deficient in relation to theproductive capacity of the country. In other words, when

the aggregate demand falls below the full employmentlevel, it is not sufficient to purchase the full employmentlevel of output. Cyclical or Keynesian unemployment ischaracterized by an economy wide shortage of jobs and last as long as the cyclical depression lasts. Residual Unemployment is caused by personalfactors such as old age, physical or mental disability,poor work attitudes and inadequate training.

Technological Unemployment is caused bychanges in the techniques of production. Technologicalchanges are taking place constantly, leading to the increased mechanization of the production process. Thisnaturally results in the displacement of labourand finally causing unemployment (Oladele, et al, 2011).

Whatever the type and cause of unemployment,entrepreneurship is its answer.

V. CAUSES OF YOUTH UNEMPLOYMENT IN NIGERIA

In the study of unemployment in Nigeria, Adebayo (1999), Alanana (2003), Echebiri (2005), Ayinde (2008), Morphy (2008 and Awogbenle and Iwuamadi (2010) have identified the main causes of youth unemployment in Nigeria. The first is the rapidly growing urban labour force arising from rural urban migration. Rural-urban migration is usually explained in terms of push-pull factors. The push factors include the pressure resulting from man-land ratio in the rural areas and the existence of serious underemployment arising from the seasonal cycle of climate. The factors are further exacerbated in Nigeria by the lack of infrastructural facilities, which makes the rural life unattractive. Youths move to urban areas with the probability of securing lucrative employment in the industries. In addition to this, there is the concentration of social amenities in the urban centers. This meant that the rural areas are neglected in the allocation of social and economic opportunities. The second is the rapid population growth. Going by the 2006 census in Nigeria, the nation's population was put at 140,431,790 and projections for the future indicate that the population could be over 180 million by the year 2020, given the annual growth rate of 3.2 percent (National Population Commission and ICF Macro, 2009).

With this population, Nigeria is the most populous nation in Africa. It is argued that the high population growth rate has resulted in the rapid growth of the labour force, which is far outstripping the supply of jobs. The accelerated growth of population on Nigeria's unemployment problem is multifaceted. It affects the supply side through a high and rapid increase in the labour force relative to the absorptive capacity of the economy.

The third is the outdated school curricula and lack of employable skills. Some scholars and commentators have argued that as far as the formal sector is concerned, the average Nigeria graduate is not employable and, therefore, does not possess the skills needed by the employers of labor for a formal employment. Afterall employers do not need people to pay or spend their money on but people that will help their organization grow and make more profit as the primary goal of every enterprise is to make profit. Often, this is attributed to the Nigeria's education system, with its liberal bias. The course contents of most tertiary education in Nigeria lack entrepreneurial contents that would have enabled graduates to become job creators rather than job seekers.

The fourth is the rapid expansion of the educational system which directly leads to increase in the supply of educated manpower above the corresponding demand for them. This contributes to the problem of the youth unemployment in Nigeria. For instance, according to Manning and Junankar (1998), the total number of graduates turned out by the higher institutions in Nigeria, which were 73,339 in 1986/1987 which rose to 131,016 in 1996/1997. Presently, with over 97 universities in Nigeria (both federal, state, and private) and the increasing demand for higher education there has been the problem of suitable employment for the varieties of graduates who are turned out by these higher institutions every year. Ordinarily, this should not have been a problem, but the reality is that the Nigerian economy is too weak to absorb this large number of graduates (Utomi, 2011). Further, there is no vibrant manufacturing sector which has the capacity to absorb unemployed youths in Nigeria, as there are over 800 collapsed industries in Nigeria and over 37 factories have closed shops in 2009. About half of the remaining operating firms have been classified as "ailing," a situation that poses a great threat to the survival of manufacturing in the country in the next few years. According to a survey carried out as part of its membership operational audit in January 2010 by the Manufacturers Association of Nigeria (MAN), the 834 figure represents the cumulative aggregate of firms that have shut down their operations in 2009 across the country. The MAN survey usually covers five manufacturing enclaves, into which the country is divided, in terms of manufacturing activities. These include the Lagos, northern, southeast, south-south and southwest mareas. The report of the survey showed that in 2009, a total number of 176 firms became terminally sick and collapsed in the northern area, comprising the Kano and Kaduna states manufacturing axis. In the southeast area, which is comprised of Anambra, Enugu, Imo, and Abia states, a total number of 178 companies closed shop during the period. While in the south-south area, which consisted of Rivers, Cross River, and AkwaIbom states, 46 companies shut down operations before December 2009. According to the survey, the southwest area, which is comprised of Oyo, Ogun, Osun, Ondo, Ekiti, Kogi, and Kwarastates, lost 225 companies during the year. It said that the Lagos area, covering Ikeja, Apapa, Ikorodu, and other industrial divisions in the state, followed closely with 214 manufacturing firms closing shop before the end of 2009 (Okafor, 2008; Oparah, Maiyak, 2010; 2011; Usman, 2011). In a nutshell, Nigeria is a country with numerous business and investment potentials due to the abundant, vibrant and dynamic human and natural resources it possesses. As good as the foregoing sounds, Nigeria continues to experience its share of social, economic and political upheavals which have often stunted its growth and development into the regional economic power that it strives to attain. Nigeria has a relative high rate of violent crimes (Onwubik, 2009). The fact is that the Nigeria is becoming hostile to investment due especially to lack of Nkechi et al. 091 steady and sustainable power supply/ energy crisis in spite of the various attempts are reviving this sector lading to firms depending on generators for their operation whose cost of buying, fueling and maintenance are high, thereby increasing the cost of operation in Nigeria. Besides, high and multiple levies and taxations being paid by these companies, energy crises have combined to make the cost of doing business in Nigeria to be very exorbitant. When the industries and factories closed shops or relocated to a friendlier economic environment, workers were laid off and prospects of recruiting new ones were dashed. All these exacerbated the crisis of youth unemployment in the labor market (Adeloye, 2010; Onifade, 2011). Corruption, which has permeated the entire social structure of Nigeria, has robbed the country of developing a vibrant economic base. Funds meant for development projects have been misappropriated, diverted, or embezzled and stashed away in foreign banks, while some incompetent and corrupt bureaucrats and administrators in the public enterprises and parastatals have liquidated these organizations (Okafor, 2010). The point being made here is that the collaboration of the political elites, local and foreign contractors in the inflation of contract fees have robbed Nigeria of the chances of using more than $500 billion estimated revenue from the oil sale in the last 50 years to develop a vibrant economy that would have created jobs for the youths in various sectors of the economy. The ruling (political) class failed because they replaced the vision, policy, and strategy, which should be the thrust of every leadership with transactions (contract award and other mundane moneyrelated activities), as each successive government took turns to prey on the nation's wealth, by using public power, resources, good will, utilities, instrument of abuse, and personal gains (Okafor, 2005). Thus crippling the economy and engendering and exacerbating unemployment which creates abject poverty, hunger and frustration; killing the zeal and means for entrepreneurship development in the Nigerian

VI. EDUCATIONAL SUCCESS IMPERATIVES OF E-LEARNING

The emergence of ICTs represents high promises for the tertiary education sector (and, more broadly, the post-secondary education sector if one takes into account their impact on non-formal education). ICTs could indeed play a role on three fundamental aspects of education policy access, quality and cost. ICTs could possibly advance knowledge by expanding and widening access to education, by improving the quality of education and reducing its cost. All this would build more capacity for the advancement of knowledge economies. This section summarises the main arguments backing the promises.

E-learning is a promising tool for *expanding and widening access* to tertiary education. Because they relax space and time constraints, ICTs can allow new people to participate in tertiary education by increasing the flexibility of participation compared to the traditional face-to-face model: working students and adults, people living in remote areas (e.g. rural), non-mobile students and even foreign students could now more easily participate in education. Thanks to ICT, learners can indeed study where and/or when they have time to do so-rather than where and/or when classes are planned. While traditional correspondence-based distance learning has long played this role, ICT have enhanced traditional distance education enabled the rise of a continuum of practices between fully campus-based education and fully distance education.

More specifically, fully online learning can allow large numbers of students to access education. The constraints of the face-to-face learning experience, that is, the size of the rooms and buildings and the students/teacher ratio, represents another form of relaxation of space constraints. ICTs indeed allow a very cheap cost of reproduction and communication of a lesson, via different means like the digital recording and its (ulterior or simultaneous) diffusion on TV, radio or the internet. The learning process or content can also be codified, and at least some parts can be standardized in learning objects, for example a multimedia software, that can in principle be used by millions of learners, either in a synchronous or asynchronous way. Although both forms might induce some loss in terms of teachers-learners interactivity compared to face to face teaching, they can reach a scale of participation that would be unfeasible via face-to-face learning.

When the needs are huge, fully online learning can be crucial and possibly the only realistic means to increase and when rapidly access to tertiary education. Some developing countries have huge cohorts of young people and too small an academic workforce to meet their large unmet demand: given training new teacher would take too much time, notwithstanding resources, e-learning might represent for many potential students and learners the only chance to study (rather than an alternative to full face-to-face learning) (World Bank, 2003).

E-learningcan also be seen as a promising way for improving the *quality* of tertiary education and the *effectiveness* of learning. These promises can be derived from different characteristics of ICTs: the increased flexibility of the learning experience it can give to students the enhanced access to information resources for more students; the potential drives innovative and effective ways of learning and/or teaching, including learning tools, easier use of multimedia or simulation tools: finally, the possibility to diffuse these innovations at very low marginal cost among the teachers and learners.

Distance E-learning has not only the virtue to be inclusive for students that cannot participate in tertiary education because of time, space or capacity constraints, as it was shown above. It can also in principle offer to students more personalized to some extent in higher education through the modularity of paths, ICTs allow institutions to give students to choose a wider variety of learning paths than in non-ICT supplemented institutions-not the least because of the administrative burden this would represent in large institutions. This means that students can experiment learning path that best suit them. Moreover, e-learning can potentially allow students to take courses from several institutions e.g. some campus-based and others fully online. This possibly flexibility of individual curricula can be seen as an improvement of the overall student experience, regardless of pedagogical changes. In one word, e-learning could render education more learner-centred compared to the traditional model.

A prestigious university generally has a sizeable library gathering tons of codified information and knowledge. One of the most visible impact of ICTs is to give easier and almost instant access to data and information in a digital form that allows manipulations that are sometimes not otherwise possible. The digitization of information, from academic journals through to books and class notes, can change (and has changed) the life of students by giving them easy access to educational resources, information and knowledge, as well as new data processing possibilities.

But e-learning could also lead to the enhancement of quality in tertiary education by leading to innovative pedagogic methods, new ways of learning and interacting, by the easy sharing of these new practices among learners and teachers communities, as well as by more transparency and easier comparisons and cross-fertilization of teaching materials and methods.

Finally, e-learning can be seen as a promising way to reduce the cost of tertiary education, which is critical for expanding and widening its access worldwide. It might thus represent new opportunities for students having difficulties with this traditional format. Although ICT investments are expensive, they can then generally

be used at near-zero marginal cost. Where would this cost-efficiency come from: the replacement of expensive brick and mortar campuses by virtual campuses: the digitization of library materials that would save the cost of keeping huge paper collections: the improvement of efficiency of institutional management the automation of some of the traditional on-campus activities, including some teaching.

VII. SUCCESS IMPERATIVES OF E-LEARNING

The real impact of e-learning on the quality of education is difficult to measure. E-learning largely embodies two promises: improving education thanks to improved learning and teaching facilities; inventing and sharing new ways of learning thanks to ICTs, that is a new specific pedagogic techniques. While the first promise is by and large becoming a reality, at least in OECD countries, the second appears further from reach. Viewed mainly as an enhancement of on-campus education, and thus matching the reality depicted in the previous section, there is some evidence that e-learning has improved that quality of the educational experience on both faculty and students sides (not to mention enhancement of administrative management). All institutions participating in the CERI survey reported a ''positive impact'' of greater use of e-learning in all its forms on teaching and learning. The quality of education (with or without e-learning) is very difficult to measure, not the least because learning depends on student's motivation, abilities and other conditions (e.g. family, social, economic, health backgrounds) as much as on the quality of teaching. However, the reasons explaining this positive impact on quality largely lives up to the promises of e-learning to offer more flexibility of access to learners, better facilities and resources to study, and new opportunities thanks to the relaxation of space and time constraints. Basically, they do not correspond to a significant change in class pedagogy, but to a change in the overall learning experience. According to the institutions, the main drivers or components of this positive impact come from:

a. *Increased face-to-face sessions,* as the availability of archived lectures online frees up faculty time to focus on difficult points and application and because the introduction of e-learning has sometimes led to a debate on pedagogy
b. *Enhanced communication*between faculty and students and increase in peer learning
c. A*ccess to materials and other resources,* allowing students to revise a particular aspect of a class, giving more access flexibility to part-time students, or giving remote and easy access to the library materials
d. *Access to international faculty/peers,* for example with the possibility of online lectures or joint classes with remote students.

The cost of e-learning

Has e-learning lived up its promises in terms of cost-efficiency? Here again, not if one looks at the most radical promises as noted above, virtual universities have not replaced brick and mortars and saved the cost of expensive building investments and maintenance digital libraries have supplemented rather than replaced physical ones the codification and standardization of teaching in a way that would allow less faculty or less qualified academics has not become the norm, nor have new online learning objects been invented to replace faculty altogether finally, it has become clear that there was no once-for-all ICT investments and that the maintenance and upgrading costs of ICT facilities were actually important, contrary to the marginal cost of then replicating and diffusing information.

Moreover, cost-efficiency has for many universities been a secondary goal compared to the challenge of developing innovative and high quality e-learning courses at many tertiary education institutions. Although the ranking of cost-efficiency has increased between 2002 and 2004 by 16%, 37% of respondents considered ''cutting teaching costs long-term'' as a key rationales in the OBHE survey (OBHE, 2004) a small percentage compared to the two key rationales (over 90% of responses). Again, most universities consider e-learning materials and courses as a supplement to traditional class-room or lecture activities rather than a substitute.

The predominance of web dependent and mixed modes of e-learning makes the assessment of the costs and benefits of e-learning investments more difficult to evaluate as they become part of the on-campus experience. It is striking that the institutions participating in the CERI survey on e-learning has no systematic data on their e-learning costs (OECD, 2005). In this context, and after the burst of the dot.com economy bubble that put out of business many e-learning operations (many never started their operations though), identifying sustainable cost-efficient models for e-learning investments in tertiary education has become critical.

There are examples of cost-efficient models ''outside'' the traditional colleges and universities though. Virtual tertiary education institutions as e.g. the Catalonia Virtual University have a cost advantage as they are developing e-learning materials from scratch and not ''building onto'' a physical camp. The Open University in the UK which is gradually moving from a traditional distance learning courses using books, video cassettes, and CD-ROMs to online courses has reported that their costs per student are one third of the average cost for similar on-campus programmes in UK. Fixed capital costs are lower and it is easier to align.

VIII. E-LEARNING POTENTIAL OF HIGHER EDUCATION INSTITUTION

In most OECD countries the question is no longer whether or not tertiary education institutions should invest in e-learning. Because of the competition between institutions and student demand for easy access to courseware material and flexible learning environments, most tertiary education institutions willing to deliver quality teaching are bound to invest in e-learning. As we have seen, the large majority of institutions are now embracing e-learning adoption cycles one and two, which are basically about providing the students with better access to learning and course material and facilitating the electronic communication between students and teachers. Again, only very few institutions and faculty are however systematically exploring and producing re-usable learning material and objects (third cycle) or have taken full advantage of new ICTs with focus on active learning that combines fact-to-face, virtual, synchronous, and asynchronous interaction and learning in novel ways (fourth cycle). The latter approach would require faculty and students to adopt new roles-with each other and with the technology and support staff.

While ICTs offer powerful new instruments for innovation, tertiary education institutions are generally decentralized institutions where individual faculty often has the sole responsibility for teaching courses and delivering course material. Adoption of the third and especially the fourth e-learning cycle would imply changing to more collaborative ways of organizing and producing teaching material. Faculty members would in many cases have to collaborate with a whole range of new staff as e.g. course managers, web designers, instructional/pedagogical designers, cognitive scientist etc. to produce course material. This could lead to resistance from ‘’traditional’’ faculty arguing that current teaching practices have proved its value for centuries and there is no need to change them to new pedagogical and teaching methods, which have hardly proven their efficiency yet. Moreover, promotion of faculty and funding allocations in universities are often linked to research activities rather than teaching activities, often seen as less prestigious. Faculty members have therefore often relatively few incentives to invest their time in e-learning activities.

The adoption of new ways of teaching and learning at tertiary education institutions through ICTs can therefore create organizational conflicts and tensions. New organizational innovations, new knowledge management practices, and more team working are therefore necessary conditions for tertiary education institutions to be able to move to e-learning adoption has identified a number of lessons learnt by institutions that are in the forefront of e-learning development (OECD, 2005):

- More strategic e-learning planning at the institutional or faculty level and to tie this to the overall goals of the institution is needed
- A paradigm shift in the way academics thinks of university teaching would be necessary, e.g. a shift away from ‘scepticism about the use of technologies in education’ and ‘teacher-centered culture’ towards ‘a role as a facilitator of learning processes’, ‘team worker’, and learner-centered culture’
- Targeted e-learning training relevant for the faculty’s teaching programme as well as ownership of the development process of new e-learning material by academics is also necessary

There is no one-best way or trajectory for e-learning development at tertiary education institutions. But it might prove more difficult to provide the ‘’softer’’ social, organizational and legal changes in tertiary education than provide the technological infrastructures necessary to full embrace the advantages of e-learning (David, 2004). It will depend on a whole range of factors not necessarily related to the development of e-learning including:

- Changes in the funding of tertiary education and in particular e-learning funding
- Student demography
- Regulatory and legal frameworks
- Competition between traditional tertiary education institution themselves and with new private providers
- Internationalization including the possibility of servicing foreign students living abroad and not the least to the extent to which students will want to use the new opportunities for new and flexible ways of learning.

Many tertiary education students would possibly prefer to have some kind of ‘mixed model’ learning choice involving a whole range of different learning opportunities and forms combining face-to-face, virtual, synchronous, and asynchronous interaction and learning.

IX. EDUCATIONAL GAINS OF INFORMATION AND COMMUNICATION TECHNOLOGY

The convergence of telecommunications and computing technologies has profoundly changed the way people acquire and share information. The exponential growth of the Internet and other networks has altered the way we are educated, how we conduct our business, how we enjoy our leisure time, and how we obtain our health care. It is the proliferation of information technology throughout the society that makes the digital information age so significant.

The integration of information technology (IT) into teaching, learning and research is a significant part of both the opportunity and the challenge that higher education faces in the information age. These cultural and technological changes provide us with opportunities to create environments where intellectual capacity, information and knowledge bases, methodologies and other valuables are made available to learners anywhere, anytime. Clearly IT is an important tool in creating access to a learning environment that encourages interaction and collaboration and supports a student's ability to explore individual paths of learning. However, these new opportunities do not come without significant challenges. IT will change teaching and learning profoundly. Information Technology (IT) represents a fundamental change in basic technology of teaching and learning.

X. ECONOMIC GAINS OF INFORMATION AND COMMUNICATION TECHNOLOGY

It is clear that the primary driver of the information age transformation is the integration of historically disparate concepts and approaches into an interrelated environment that offers more value than the sum of its parts. Traditional distinctions and boundaries in technologies-access to information, demand for services, organizational structures and processes are passed. Everything is becoming structurally integrated into networks that exchange information and services among individuals, groups, or institutions on a real-time basis.

Obviously, these technical and cultural changes are affecting how successful organizations compete in this dynamically changing period. Institution must provide their students, employees and entire organization with the environment, experiences and skills for success in a transformed economy and culture. This presents a major challenge in view of the positive empowerment of youths in our society for progressive transformation. IT training, planning and management have moved from independent tactical activities to essential part of an organization's strategic processes. In fact; in the information age, IT system and services are often seen as the factor that distinguishes success from failure in an intensely competitive market place.

Information Technology will increasingly determine the pace of economic growth and the level of human welfare. The prerequisite for the creation of an information-based economy is the existence of an efficient telecommunication structure and technologies. Hence the need for research and advancement in electronic technologies.

XI. SCIENTIFIC RESEARCH

Scientific research is a core activity in tertiary institutions. This activity has been revolutionized by the possibilities offered by ICT; from digitization of information to new recording, simulation and data processing possibilities. Advance ICT infrastructure offers the resources, information and collaboration needed to solve fundamental scientific problems. This has resulted in finding solutions to grand challenges, such as accurate weather forecasting, building more energy efficient automobiles, designing life-saving drugs and lots more (Adedoyin and Akinnuwesi, 2006). Some of the ways in which ICT infrastructures are being used by researchers are high performance computer, software and high-speed networks which allows researchers access to more computational resources. This has resulted in the achievement of grand feats such as accurately modeling earth's climate, design and simulates high-speed civic transport, improve detection of cancer and enhance the recovery of oil and gas from reservoirs. #

XII. CAVEATS OF INFORMATION AND COMMUNICATION TECHNOLOGY

Information system must be protected from attack and therefore new capabilities for effective information operations must be developed. Network centric warfare heavily relies on satellite communication and other forms of space-based technology. With the advent of the digital information age, research and advancements in these areas of supportive electronic technologies are challenges and pertinent for progressive achievement.

Advancement in modern electronic research is vital and fundamental to the changing face of information technology. Advancement in information technology has pushed companies and organization to become computer-based thus becoming vulnerable to external and internal attacks. Coping with the rate at which devices, gadgets, systems and utilities are beamed on the society is itself a positive challenge in view of fear of outdating of previously acquired technology and addiction to the eagerness to stay current in rat race in the digital information age. The key trend in computer hardware is ''smaller, faster and cheaper''. Computers are shrinking in size. Much of this change is being brought about by continuing research into microchip technology that allows more and more electronic elements to be packed into less and less space. Research is currently underway into manipulating molecules to reduce the size of computer elements even further. In addition, recent advances in the field of superconductivity have increased the possibility of using it to dramatically increase the speed of computers. The volume of information is increasing exponentially. Personal computers are making it possible for business to manage that flow effectively. He challenge of the digital

information age is that it is also the age of electronic terrorism. Computer vulnerability has opened the society up to highly motivated and malicious actions by criminals, terrorists and disgruntled employees. Electronic and cyber crimes and terrorism are on the increase. Input crime, process crime, output crime and storage crime are various aspects of computer crimes, which present new dimension of challenges in the information age. In addition to these is the challenge of dealing effectively with computer viruses, Trojan horse, time bomb, logic bomb and worms. A virus is a program attached maliciously to a computer program. When the computer executes the program the virus begin to replicate itself, with potentially harmful result. A Trojan horse program appears on the surface to do one thing but actually does another. A time bomb is a program timed to execute itself on a certain date, while a logic bomb executes whenever a certain command is given. A worm is a program that travels through the computers memory, a wiping out information in the process. Criminals often access a computer through a trapdoor a part of the operating system that will allow access to knowledgeable users.The trend in digital technologies makes it possible for information to be collected, processed, stored and disseminated very efficiently. This trend also makes it more challenging to keep secrets. Secured digital secrecy in the information age is a major challenge because it is desirable, fundamental and pertinent to information and communicating systems, in order to avoid hacking, snooping, sniffing, peeping, tampering and forgoing.

While physical protection of the computer is usually a matter of ensuring that unauthorized person do not gain access to hardware, protecting software and data is an entirely different problem. An organizations data are its most valuable and important assets and maybe irreplaceable. Even if data are not destroyed having them all into competitor's hands can have disastrous implications for private companies, banks and business organizations and even competing political parties.

Most computer based systems are vulnerable to external attacks for malicious and damaging purpose. This presents a major challenge in view of the availability of the new electronic technologies to both positive cyberdevelopers and negative cyber terrorists. It is estimated that more funds have been committed to hacking, cracking and cyber terrorism that cyber development, research and applications.

The dark sides of this information age, which in itself is a challenge, is that information technology like gambling and heroine is addictive. We are driven, forced or conditioned into buying new information and communication gadgets of reasons both real and perceived. The sun never sets in the information age. Subscribers are always plugged into the global matrix of the information domain with incurable addition and constantly awash in a sea of electronic stimuli with resulting attendant challenges. We became further dependent that when something breaks, crashes, or is attacked, our ability to function is reduced or eliminated. Addiction of youth to games and undesirable, destructive, misleading non-educative aspects of the Internet is a major the possibility and consequence of youths graduating into cyber terrorists, cyber fraudsters, hackers, crackers and economic saboteurs, caution is the key theme of information technology.

XIII. INFORMATION SECURITY AND CHALLENGES

Information security is a challenge in technology age. Business espionage is a reality. Business with multiple branches and sensitive information, such as law firms, insurance companies and various industrial establishments are likely to be victims of hacking. To meet the challenges in the digital information age, issues of privacy, secrecy and security are very important and pertinent. All these are very important for an open society in this electronic age. The society establishes a right to privacy. But the information age is challenging society's ability to respect it. The use of information technology poses a major threat to gaining compliance among third parties with respect to privacy rights.

Cryptography is a technology that enables secure communications exchange between systems. Embodied in key industry-standard protocols such as SSL (secure sockets layer). Cryptography plays a key role in providing industry-standard solutions. The leading position of DES (Data encryption standard) and RSA (Rivest, Shamir and Adleman) encryption methods make them very strong encryption processes. The greater the key space, the less susceptible the code to brute force attacks. With RSA's 128 bit key standard, such an attack is nearly impossible hacker or cracker would need over 10 years (several million years) to break the encryption. The digital IDSs, also known as digital certificates or public key certificates are small files carrying information about the subject, the issuer, the validity period and the serial numbers. A certificate along with the corresponding private key serves as the identity of its holder entity. Over network, servers may be configured to grant access only to individuals holding particular certificates. Similarly clients may also be configured to trust servers bearing certain kinds of certificates. Secure socket layer (ssl) is an industry standard protocol that makes use of public key technology. Vast amounts of servers around the public Internet and intranet deploy SSL technology to secure information transmission. SSL delivers three basic levels of security services: message privacy, message integrity, mutual authentication. Message privacy is enabled using a combination of public key and symmetric key encryption. The entire data traffic between the SSL server and SSL client is encrypted using a key and an encryption algorithm negotiated during the SSL handshake. Message integrity ensures that the message content is not tampered by the vandals during tis transmission from clients to server. Using a combination of a shared secret and special mathematical functions called hash functions, the SSL technology provides the essential message integrity services. In the process of mutual authentication the server convince the client of its identity and vice

versa. The relative identities are normally coded in the form of public key certificates, which are exchanged during an SSL handshake.

XIV. THE CHALLENGES FACING ICT UTILIZATION IN NIGERIAN TERTIARY EDUCATION

The challenges facing the adequate utilization of ICT in Nigerian tertiary education can be broadly grouped into four, these are: Inadequate Infrastructure, Inadequate Skilled Manpower, Resistance to Change and Inadequate Funding.

Inadequate Infrastructure

Tertiary institutions in Nigeria lack adequate ICT infrastructure to effectively tap into the opportunities offered by the cyberspace.

Personal computers (PCs) are available in most Nigerian tertiary institutions, but they are not readily accessible to students because of the low computer (PC): student ratio which is averagely put at about 1 to 40. In most cases, the basic software needed for practical works are not available and where they are available, they are not accessible because of the low ratio. There is also the lack of CAI and other specialized software to support some areas of teaching learning and research. Internet connectivity is available in most tertiary institutions in Nigeria, but in most cases the bandwidth subscribed to (which determine speed of access) is too small to support any meaningful academic activity during peak period. Some institutions have subscribed to Virtual Library sites whereby members can access electronic academic materials such as journals. Also some institutions have CD-Rom collections on specialized fields, but the currency of the information on the CDs cannot be guaranteed as no effort is made to update them whereas ICT infrastructures like multimedia projector are available in Nigerian tertiary institutions to support teaching, learning and research, other infrastructures like Interactive White Boards and mobile devices are lacking.

Inadequate Skilled Manpower

Inadequate ICT technical personnel is a major problem in Nigerian tertiary education. The reason for this can be ascribed to the lucrative job opportunities available to ICT professionals outside the academics. The situation has made institutions rely on commercial private ventures to provide support for the few ICT facilities available. The support offered is in most cases are commercial and lack academic content. As a way out of this challenge, some universities like Bells University of Technology, University of Nigeria and NamdiAzikwe University are in partnership with private organizations like AFRIHUB for ICT technical manpower development.

Resistance to Change

There is the concern of faculty members not willing to take the ‘soft’ approach to teaching and learning. Rather, they stick to the traditional hard ‘’approach’’. Report from OECD (2005) gave reasons while faculties resist e-learning.

- That e-learning development, with its standardization aspects, might conflict to some extent with the professional culture of academic based on autonomy and reward system often based on research.
- Concern about intellectual property rights and shared rights between faculty, institutions and technologies.

Funding

This is the major challenge confronting the acquisition and utilization of ICT in Nigerian tertiary education. Most institutions solely rely on their proprietor for funding and the bulk of such fund goes to servicing the overhead cost. Since no clear sustainable business model has yet emerged for commercial provision of e-learning, and failures have been more numerous than success, (OECD, 2005), institutions are not willing to invest the little fund available to them on e-learning project.

Recommendations

The target of tertiary education in Nigerian should be e-learning for Nigerian tertiary education to be effective, the following recommendation are made:

a. there is the urgent need for infrastructural upgrade and funding of research work. Institutions should exploit alternative source of funding’s for ICT infrastructure development. Some of these sources are:

- Collaboration with private organizations for provision of infrastructure and manpower development
- Collaboration on the use of private organizations ICT infrastructures for training of staff and students and for research purposes
- Harnessing the opportunities offer by ICT for commercial purposes.

b. Tertiary institutions should begin to adopt the use of open sources software, which are available for free

c. Encourage the development of in house software for CAI and LMS
d. There is the need for tertiary institutions in Nigeria to recruit a broader range of staff to complement ICT academic staff, such as technologist, instructional designers and learning scientists.
e. Collaboration among institutions. This will enhance sharing of knowledge, technology and personnel. It will also improve the quality of curricula and promote good practices.

With the present situation of tertiary education in Nigeria, where institutions are yet to fully come to term with the reality of e-learning potentials, and that there is no clearly defined sustainability model to support it, there is a case for continued government and its agencies support for ICT acquisition and utilization in the following areas:

- Encouraging the dissemination of good practices to simulate innovation, avoid wasteful duplication of efforts, and scale up successful experiments.
- Encouraging appropriate staff development, in order to ensure progress at institutional level.
- Supporting research and development on learning objects and other promising innovations such as open educational resources or the use of visual simulation tools, and ensuring their relevance to staff and students.
- Promoting collaboration between ICT providers and institutions, and supporting public-private partnerships, in order to keep costs at reasonable level.

XV. CONCLUSIVE REMARKS AND RECOMMENDATION

This paper discovered that the encouraging effect of e-learning on the overall learning experience is a quantum leap in the accurate of e-learning, though it has not significantly transformed the learning and the teaching processes.

The quality of fully online learning is a more controversial question, possibly because online learning was once viewed as possibly become of higher quality than on-campus education (possibly including e-learning as already mentioned). Comparing the quality (or the beliefs about the quality) of fully online learning against traditional distance learning, traditional face-to-face learning or other mixed models of e-learning might not yield the same results; fully online learning is indeed more readily comparable to distance learning than to on-campus education. While institutions having adopted e-learning have generally a positive view of tis possible impact on quality, there is little convincing evidence about the superior or inferior quality of fully online learning compared to other modes of tertiary education.

Another question is whether fully online learning has entailed innovation in pedagogy or just replicated with other means the face-to-face experience. As noted above, ICTs could indeed entail pedagogic innovations and help create a community of knowledge among faculty, students and learning object developers that would codify and capitalize over successful innovation in pedagogy. At this stage, there is no evidence that e-learning has yielded any radical pedagogic innovation. The most successful fully online courses generally replicate virtually the classroom experience via a mix of synchronous classes and asynchronous exchanges. Arguably, they have not represented a dramatic pedagogical change. We will see below that in spite of worthwhile experiments, learning objects and open educational resources are still in their infancy. They hold promises for educational innovation though.

Worldwide, the use of Information and Communication Technology is changing the face of teaching, learning and research. Nigerian educational system cannot afford to take the back seat. Nigerian tertiary education need to fully utilize ICT resources to make education widely available and accessible at reduced cost. The information age presents us with profound opportunities, numerous benefits, daunting challenges, but frightening cautions. Current approach to planning, provision and use of information technology must change in order to respond effectively to the changes that are occurring. The strategic integration of information and technology is fundamental and pertinent to meet the challenges of privacy, secrecy, security and cybe terrorism in the digital information age.

There are many critical issues surroundings e-learning in tertiary education that need to be addressed in order to fulfill objectives such as widening access to educational opportunities enhancing the quality of learning and reducing the cost of tertiary education. E-learning is, in all its forms, a relatively recent phenomenon in tertiary education that has largely not radically transformed teaching and learning practices nor significantly changed the access, costs, and quality of tertiary education. As we have shown, e-learning has grown at a rapid pace and has enhanced the overall learning and teaching experience. While it has not lived up to its most ambitious promises to stem radical innovations in the traditional learning processes. Most institutions are thus currently in the early phase of e-learning adoption, characterized by important enhancements of the learning processes. Most institutions are thus currently in the early phase of e-learning adoption, characterized by important enhancements of the learning process but no radical change in learning and teaching. Like other innovations, they might however live up to their more radical promises in the future and really lead to the inventions of new ways of teaching, learning and interacting within a knowledge community constituted on learners and teachers.In order to head towards these advances innovation cycles, a sustainable innovation and investment model will have to be developed. While a first challenge will be technical, this will also require a broad willingness of tertiary education institutions to search for new combinations of input of faculty, facilities and technology and new ways of organizing their teaching activities. Like for ICT investments in other sectors, the cost-effectiveness of e-learning investments will depend on whether new organizational and knowledge

management practices are adopted. Experiments are already underway that make us aware of these challenges, but also of the opportunities and lasting promises of e-learning in tertiary education.

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Effect Of Strategic Planning On The Growth And Survival Of An Emerging Firm

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Abstract: - The objective of this paper is to examine the impact of strategic planning and engender a better understanding of the importance of the implementation of strategic planning on the survival, growth and income streams of emerging firms. The paper provides a broad overview of what strategic planning is, how it can be formulated commensurate with proper implementation coupled with its importance as a guide for management and as a success imperative for survival, growth and development of an emerging firm.

Keywords: - *Strategy, Strategic Planning, Strategic Management, Emerging firm.*

I. INTRODUCTION

The first major step in the development of a formal planning process was when most companies began developing annual operating budget in the post war era in the late 1950s and early 1960s. Their budges were being extended two or five years into the future.. Furthermore, the need for more comprehensive planning was made pertinent by the rapid changing economic conditions in the early 1960 during this decade the planning horizon was gradually broadened to include projections of size to ten years into the future. In every economic system there are two major producers of goods and services for consumers use, they are the private owners of factors of production and government. The basic task of these producers is to determine what to produce, how to produce and for who should production be targeted.

Business activities in challenging economies faces several major challenges, advance in technology and telecommunication have brought the world's countries together into one global economy. No country today can remain isolated from the world economies if it closes its market to foreign competition its citizens will pay much more for lower quality goods. But if it opens its markets, it will face severe competition and many of its local business will suffer. Around the world, we can see that nations have embraced information and communication technology (ICT) as a means to enrich public and private sector processes, while providing citizens with easier access to these services (Fang, 2002). The emphasis on ICT has also boosted Internet penetration and literacy rates as well as investments in research and developments. The emergence of technological innovations has opened up to new opportunities and challenges to a nation's economic development (Yunos, 2002). It is worth to mention that information technology has becoming an important fact to the business community as it helps improve the business processes.This decade has witnessed remarkable advances in the availability of information, the speed of communication, in raw materials, in electronic marvels and in biogenetics advances and drugs. The most certain thing in life is that change will occur. Yet things generate as much anxiety in managers as impending change. The level of angst included by major change often is such that it leads to breakdown of those culture attributes that hold organizations together. Many businesses have failed because extreme level of distrust engendered by the change process made the communication of shared values, which drive the firm, ineffective. Clearly, the fear of the unknown by human nature can make change highly dysfunctional for organizations, private or public. The challenge of management in a rapidly changing world and challenging economies is therefore to prepare the leaders in governance, captains of industries, entrepreneurs, managers and the citizens to cope with unforeseen change and to manage planned change in such a way that it enhances performances and sharpens the countries and organizations growth and development.

Leaders in governance, captains of industries, entrepreneurs and managers in the private and public sectors of the economy and the entire world over are faced with the dilemma of how to respond to intense competition particularly in a rapidly changing environment. It may sound elementary to ask an obvious question of why make changes corporate wide ? The answer may be that we can see the future and we know that the existing structure simply will no longer work. It could perhaps, also be as a result of change in management or change in corporate focus in which priorities are re-assessed so as to stimulate strategic performance. In reality, for a challenging economy to be consistently relevant, the answer is to continually re-invent and remake their ways of doing things so as to move from where they are to where they want to be. Economically, politically and socially, the world around us has been changing so fast that corporate landscapes of industrialized economies have equally changed drastically. Increase in global competition and liberalization of markets combined with shift in consumer demand and preferences (changes in peoples values and priorities) have prompted the drive for lower cost margins and greater efficiency. As a result of this, countries and corporates have been more or less forced to cut out wasteful and unproductive activities and concentrate resources in their areas of core-competence in order to achieve sustainable competitive advantages. On the other hand, worldwide, recession has affected company structure and practices while global management has brought companies face to face with complex cross-cultural issues and competitions. To survive these unpremeditated turmoil, most organizations embarked on strategic management using a number of business innovations namely: re-engineering, benchmarking, repositioning, restructuring, redesign, re-organization, re-inventing and remaking among other creative innovations to engender competitive edge.. Whether the strategic choice used by strategic managers is total quality management, benchmarking, Re-engineering, paradigm shift or learning organization, the aim is to solve today's problems by improving business processes so as to engender strategic performance. In recent times, the world is experiencing a global depressed economy, Nigeria which is a developing country is no exception, the implication of this is that an organisation has to be sound both strategically and operationally to cover its cost and stay in business.

However, any company that places much emphasis on strategic planning and implement it will have little problem in meeting present, emerging and future business challenges.

II. CONCEPTUAL FRAMEWORK

Strategic Planning framework entails the establishment of necessary structures to ensure that the principles and concept of strategic planning are instituted and practised. The concept is about developing a systematic mental process in which to calibrate today's decisions with the inherent values and objectives of the firm. Strategic planning attracts so much attention from scholars, corporate watchers and stakeholders because it is concerned with the economic health of an organisation.The concept has been viewed from various perspectives and different authors have come up with different definitions that reflect their various perspectives. Simply put, strategic planning determines where an organization is going over the next year or more, how it's going to get there and how it'll know if it got there or not. The focus of a strategic plan is usually on the entire organization, while the focus of a business plan is usually on a particular product, service or program.The way that a strategic plan is developed depends on the nature of the organization's leadership, culture of the organization, complexity of the organization's environment, size of the organization and expertise of planners etc.Strategic planning is asubset of strategic management,The process of strategic planning involves establishing the vision and mission of the company, setting the objectives, developing a strategy and then a detailed set of action steps to implement the ideas.Strategic management is a continual process of making and implementing a particular strategy, and then evaluating performance. It is the mechanism for establishing a learning organization that is proactive. Generally, strategic planning is viewed as the process for determining where an organization is going over the next year or—more typically—3 to 5 years (long term), although some extend their vision to 20 years.

III. LITERATURE REVIEW

A good deal of the early literature on strategic planning was concerned with helping companies to remain profitable and attain competitive edge. In short, the concept of strategic management developed principally among corporations as their tools in the midst of a difficult and fast changing environment. For a policy to be meaningful, there must be some operational strategy that will translate it into action. According to Marks (2007) Growth is a key goal and objective for emerging companies and management must carefully determine the best way to combine the core competencies within a firm's functional departments to provide the firm with the best opportunity for achieving and sustaining a competitive advantage in its chosen environment.

Marks (2007) also posited that strategy is about the forest and the trees. It means taking a long-term view of what you are trying to accomplish, integrating the dynamics specific to a particular company and to its industry, developing a set of initiatives to achieve a particular future position, and then distilling it down into

bite-size activities and actions, that in an appropriate sequence, allow you to meet your objectives. Strategy is the set of decisions defining the activities that positions your company advantageously relative to your rivals. According to *Mintzberg(1990)* Strategy is the determination of the purpose (or mission) and basic long-term objectives of an enterprise, adoption of course of action and collection of resources necessary to achieve their aims. Marks (2007) opined that growth is a key goal and objective for emerging companies and management must carefully determine the best way to combine the core competencies within a firm's functional departments to provide the firm with the best opportunity for achieving and sustaining a competitive advantage in its chosen environment. He also posited that **s**trategy is about the forest and the trees. It's taking a long-term view of what you are trying toaccomplish, integrating the dynamics specific to a particular company and to its industry,developing a set of initiatives to achieve a particular future position, and then distilling itdown into bite-size activities and actions, that in an appropriate sequence, allow you tomeet your objectives. Strategy is the set of decisions defining the activities thatpositions your company advantageously relative to your rivals.
Porter (2008) defines Strategyand his perspective below:
"Competitive strategy is about being different. It means deliberately choosing a different set of activities to deliver a unique mix of value. Given Porter's comments, this paper would like to suggest that strategy for an emerging growth company is generically two pronged:
(1) having a defined plan to address the fundamental issues discussed in the previous section concerning crossing the chasm, and
(2) having a understanding of your market, its needs, and your defined position and activities to perform as good if not better than your competitors.

Strategies must be implemented effectively in order to enhance the key performance indicators organisation-wide. Oluwasanya (2011). According toWheelen and Hunger (2004)strategies "are scheme methods manoeuvres which management hope to deploy in order to move the organization from its present recognizing that during the intervening period in the environment. Empirical evidence suggests that entrepreneurs in emerging firms plan in a way tha is quite different from the standard textbook approaches (McCarthy, 2003). In the multitude of SMEs, not top management teams, but the entrepreneur himself is the enterprise's main strategist and decision maker, developing the vision, mission and strategies, and also implementing them (Analoui&Karami, 2003). Strategic decisions reflects the subjective orientations and attitudes of the entrepreneur.

The role of the entrepreneur and his attitude towards strategies issues are therefore often critical for the implementation of strategy (Kraus, 2007). Likewise, the entrepreneur's personal goals, traits and strategic orientation will have a significant impact on the enterprise's strategy (McKenna, 1996). Many entrepreneurs routinely operate their daily business, but do not believe that strategic management applies to them. However, it has been argued that no business is too small to have a solid strategy (Sandberg, Robinson, & Pearce, 2001). The question of whether or not to use sophisticated strategic management instruments again depends on the entrepreneur's previous experience (Berry, 1998). The market entry of an emerging firm is of major importance because it determines the strategic basis from which the enterprise tries to achieve competitive advantages in the market place (Gruber, 2004). The enterprise's relative position within the market strongly influences its performance. Within the spectrum of the *generic strategies* by Porter (1985), there are (at least) three options:

1. Cost leadership
2. Differentiation
3. Focus on a market niche.

Whether there is a cost advantage or a differentiation potential for the enterprise is the result of the enterprise's ability to cope with the give competitive forces (industry competitors, potential entrants, buyers, substitutes, and suppliers) better than its competitors. Young SMEs can seldom develop cost advantages, as these are often based on economics of scale. For these enterprises, most researchers recommend the *niche strategy*.

Besides, young SMEs can hardly target a market as a whole, but more likely have to target certain narrow market segments which larger competitors ignore (Lee, Lim, Tan, & Wee, 2001). A niche strategy allows an enterprise to target customer needs by focusing the enterprise's limited resources on a narrow segment of the market. This gives time for establishing a market position and developing both the necessary resources to survive (Bamford, Dean, & McDougall, 1997). Numerous empirical studies confirm that the niche strategy is often the most successful initial entry strategy. Ibrahim (1993) made this observation with small enterprises and Bantel (1996) with 166 small technology-based enterprises. Still, the niche strategy leaves several risks for SMEs, since larger enterprises can easily launch an attack on the market niche simply by making the choice to do so.

The *differentiation strategy* is also possible for SMEs. The core of this strategy is to offer the customer a special advantage along dimensions that are highly valued by the customers (Poter, 1985).

For achieving the highest performance, each strategy option needs to be linked with appropriate resources (Borch, Huse, &Senneseth, 1999).

Porter (2008) defines Strategy and his perspective below:

"Competitive strategy is about being different. It means deliberately choosing a different set of activities to deliver a unique mix of value.

Given Porter's comments, this paper would like to suggest that strategy for an emerging firm is generically two pronged:

(1) having a defined plan to address the fundamental issues discussed in the previous section concerning crossing the chasm, and

(2) having a understanding of your market, its needs, and your defined position and activities to perform as good if not better than your competitors.

According to Wheelen and Hunger (2004) strategies "are scheme methods manoeuvres which management hope to deploy in order to move the organization from its present position to a level of niche in the environment.

This paper will like to restate that Strategic planning is asubset of strategic management,

Who Should be Involved in Strategic Planning?

Strategic planning should be conducted by a planning team who among others should note and comply with the following success imperatives:

1. The chief executive and board should be included in the planning group, and should drive development and implementation of the plan.
2. Establish clear guidelines for membership, for example, those directly involved in planning, those who will provide key information to the process, those who will review the plan document, those who will authorize the document, etc.
3. A primary responsibility of a business owner or board of directors is strategic planning to effectively lead the organization. Therefore, insist that the board be strongly involved in planning, often including assigning a planning committee (often, the same as the executive committee).
4. Ask if the board membership is representative of the organization's clientele and community, and if they are not, the organization may want to involve more representation in planning. If the board chair or chief executive balks at including more of the board members in planning, then the chief executive and/or board chair needs to seriously consider how serious the organization is about strategic planning!
5. Always include in the group, at least one person who ultimately has authority to make strategic decisions, for example, to select which goals will be achieved and how.
6. Ensure that as many stakeholders as possible are involved in the planning process.
7. Involve at least those who are responsible for composing and implementing the plan.
8. Involve someone to administrate the process, including arranging meetings, helping to record key information, helping with flipcharts, monitoring status etc.
9. Consider having the above administrator record the major steps in the planning process to help the organization conduct its own planning when the plan is next updated.
10. An organization may be better off to involve board and staff planners as much as possible in all phases of planning. Mixing the board and staff during planning helps board members understand the day-to-day issues of the organization, and helps the staff to understand the top-level issues of the organisation

Strategic Planning Process

With regard to the strategy process, several different *strategic management instruments* can be applied in emerging firms, depending on the respective situation the enterprises are in. for instance any enterprise needs to assess its position within its environment and within the market. (Zahra & Dess, 2001). A common instruments for this is the *SWOT* analysis, which aims at studying internal strengths and weaknesses and matching them with the enterprise's external opportunities and threats (Andrews, 1987).

A SWOT analysis can be used as a basis for developing future strategies as well as for developing the business plan. Another part of the environmental analysis is the *PEST* analysis, which tries to identify political and legal (P), economical (E), socio-cultural (S), and technological (T) factors influencing the enterprise. Finally, the *industry analysis* tries to assess the attractiveness of a specific industry for the enterprise (Analoui & Karami, 2003). The industry analysis again can use sub-instruments, such as market analyses (e.g Wickham, 2001) and Porter's (1985) five forces analysis.

The *product life-cycle (*PLC) concept can be utilized in enhancing the effectiveness of operative instruments and in changing the strategies, especially in emerging firms. The basic idea of the PLC concept corresponds to the law of birth and death of all biological existence. This idea can be transferred to man-made systems, such as products or markets. Even if the forecasting ability of the PLC concept has been deemed rather limited (Levitt, 1965; Cox, 1967), it provides a good overview of marketing decision options, especially in the implementation phase and growth phase of an enterprise (Kraus et al,. 2007).

In tandem with the above the following anaysis should be done to engender smooth strategic focus:

a) Swot Analysis

Among the most useful tools for strategic planning is SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats). The main objective of this tool is to analyze internal strategic factors, strengths and weaknesses attributed to the organization, and external factors beyond control of the organization such as opportunities and threats.

b) Situational Analysis

When developing strategies, analysis of the organization and its environment as it is at the moment and how it may develop in the future, is important. The analysis has to be executed at an internal level as well as an external level to identify all opportunities and threats of the external environment as well as the strengths and weaknesses of the organizations.

There are several factors to assess in the external situation analysis:

1. Markets (customers)
2. Competition
3. Technology
4. Supplier markets
5. Labor markets
6. The economy
7. The regulatory environment

It is rare to find all seven of these factors having critical importance. It is also uncommon to find that the first two - markets and competition - are not of critical importance.

Strategy Formulation

According to Wheelen and Hunger (2004), Strategy formulation is the development of long-range plans for the effective management environment opportunities and threats, in light of corporate strengths and weaknesses. The critical success factors required to adequately implement strategic planning are mission and vision, goals, objectives, programs, budgets, policies and the drivers of these key success factors of strategic planning in an emerging firm, that is, the business owner or management, stakeholders and the employees.

The key components of 'strategic planning' include an understanding of the firm's vision, mission, values and strategies and other success imperatives.

The key components are:

a) Vision: outlines what the organization wants to be, or how it wants the world in which it operates to be. It is a long-term view and concentrates on the future. It can be emotive and is a source of inspiration Wheelen and Hunger (2004).

For example, a charity working with the poor might have a vision statement which reads "A World without Poverty." In the words of Baker“Vision without action is merely a dream Action without vision just passes the time,Vision with action can change the world

b) Mission: Defines the fundamental purpose of an organization or an enterprise, succinctly describing why it exists and what it does to achieve its vision. For example, the charity above might have a mission statement as "providing jobs for the homeless and unemployed"

It is the purpose or reason for the organization’s existence Wheelen and Hunger (2004). It was what the company is providing to society, either a service like housecleaning or a product like automobiles. A well-conceived mission statement defines the fundamental, unique purpose that sets a company apart from other firms of its type and identifies the scope of the company’s operations in terms of products or services offered and markets served. It may also include the firm’s philosophy about how it does business and treats its employees. *It puts into words not only what the company is now, but also what it wants to become management’s strategic vision of the firm’s future.* (Some people like to consider vision and now; a vision statement describes what the organization would like to become.

c) Values: Beliefs that are shared among the stakeholders of an organization. Values drive an organization's culture and priorities and provide a framework in which decisions are made. For example, "Knowledge and skills are the keys to success" or "give a man bread and feed him for a day, but teach him to farm and feed him for life". These example values may set the priorities of self-sufficiency over shelter.

d) Data gathering: Gathering data about the factors, internal and external, that will have an impact on achieving the mission statement.

e) Objectives: Objectives are the end result of any planned activity Wheelen and Hunger (2004). They state what is to be accomplished by when and should be quantified if possible. The achievement of corporate objectives should result in the fulfilment of a corporation's mission. In effect, this is what society gives back to the corporation when the corporation deeds a good job of fulfilling its mission. Objectives must be established at a corporate, divisional and departmental levels depending on structure. Objectives need to be challenging, understandable, clear, reasonable, quantified, specific time limit, prioritized, and consistent across departments. Objectives provide direction and purpose.

f) Goals: Formulating long term goals consistent with the mission statement and the available The term "goal" is often used interchangeably with the term "objective

In contrast to an objective, we consider a goal as an open-ended statement of what one wants to accomplish with no quantification of what is to be achieved and no time criteria for completion. For example, a simple statement of "increased profitability" is thus a goal, not an objective because it does not state how much profit the firm wants to make the next year.

An objective would say something liike, "increase profits 10% over last year."

The goal of strategic planning mechanisms like formal planning is to increase specificity in business operation, especially when long-term and high-stake activities are involved. In an organisational setting, the organization may co-ordinate goals so that they do not conflict with each other. The goals of one part of the organization should mesh compatibly with those of other parts of the organization. Most importantly the goals must be SMART (specific, measurable, related or realistic, time bound).

g) Strategies: Strategy, narrowly defined, means "the art of the general." A combination of the ends (goals) for which the firm is striving and the means (policies) by which it is seeking to get there.

A strategy is sometimes called a roadmap which is the path chosen to plow towards the end vision. The most important part of implementing the strategy is ensuring the company is going in the right direction which is towards the end vision. A strategy of a corporation forms a comprehensive master plan stating how the corporation will achieve its mission and objectives Wheelen and Hunger (2004). It maximizes competitive advantage and minimizes competitive disadvantage. According to Wheelen and Hunger (2004) the typical business firm usually considers three types of strategy: corporate, business, and functional.

1. Corporate strategy describes a company's overall direction in terms of its general attitude toward growth and the management of its various businesses and product lines.

Corporate strategies typically fit within the three main categories of stability, growth, and retrenchment.

2. Business strategy usually occurs at the business unit or product level, and it emphasizes improvement of the competitive position of a corporation's products or services in the specific industry or market segment served by that business unit. Business strategies may fit within the two overall categories of competitive or cooperative strategies.

3. Functional strategy is the approach taken by a functional area to achieve corporate and business unit objectives and strategies by maximizing resource productivity. It is concerned with developing and nurturing a distinctive competence to provide a company or business unit with a competitive advantage. Business firms use all three of strategy simultaneously.

h) Policies: A policy is a broad guideline for decision making that links the formulation of strategy with its implementation Wheelen and Hunger (2004). Companies use policies to make sure that employees throughout the firm make decisions and take actions that support the corporation's mission, objectives, and strategies. For example, consider the following company policies:

- Macdonald's: Macdonald's will not approve any cost reduction proposal if it reduces product quality in any way. This policy supports Macdonald's strategy for Macdonald's brands to compete on quality rather than on price.
- 3M: researchers should spend 15% of their time working on something other than their primary project. (This supports 3M's strong product development strategy.)
- Intel: cannibalize your product line (undercut the sales of your current products) with better products before a competitor does it to you. (This supports Intel's objective of market leadership).
- General Electric: GE must be number one or two wherever it competes. (This supports GE's objective to be number one in market capitalization).
- Microsoft: A "no questions asked" merchandise return policy, because the customer is always right. (This supports Microsoft competitive strategy of differentiation through excellent service

Pre-Implementation Strategic Planning Review

It is clear that the strategic planning process can be time-consuming and requires a substantial amount of managerial resources. Once the mission and strategy statements have been completed, and the goals and objectives have been established, the senior managers of the relevant business unit (or the firm as a whole in the case of corporate-level strategies) will obviously be eager to push forward. Before proceeding, however, it is wise to have an objective, independent group composed of members that have not been involved in the strategy formulation process conduct a final pre-implementation strategy review.

The questions posed by the review group will obviously depend on the particular strategy under consideration; however, questions that probably should be asked in almost every instance include the following:

- Is the strategy realistic and is it likely to produce long-term success for the business unit and/or the firm as a whole?
- Is the strategy constructed in a way that it will withstand public scrutiny and reasonably anticipated turbulence in the relevant business environment?
- Have the developers of the strategy taken past experiences and failures into account in assessing the likelihood of future success for the strategy?
- Does it appear that the members of management hierarchy involved with creating and executing the strategy have had access to all relevant information, including dissenting views?
- Has consideration been given to the impact that the strategy will have on existing businesses?
- Have the strategy developers considered all reasonable options before settling on the specific strategy under consideration?
- Do the advocates of the strategy demonstrate sufficient confidence in its likelihood of success and would they be willing to risk their personal resources on the ultimate outcome of the strategy?

The work of the review group should be respected and the managers associated with the development and execution of the particular strategy should be required to prepare some sort of formal response to the review even if it is ultimately decided to move forward with the strategy in essentially the form it was originally presented for review without significant modification to take into account the findings of the review group

Strategic Planning Implementation

Strategy implementation is the process by which strategies and policies are put into action through the development of programs, budgets, and procedures Wheelen and Hunger (2004). This process might involve changes within the overall culture, structure, and or management system of the entire organization. Sometimes referred to as operational planning, strategy implementation often involves day-to-day decisions in resource allocation except when such drastic corporate-wide changes are needed, however, the review by top management.

Programs

A program is a statement of the activities or steps needed to accomplish a single-use plan. It makes the strategy action oriented. It may involve restructuring the corporation, changing the company's internal culture, or beginning a new research effort Wheelen and Hunger (2004).

Budgets

A budget is a statement of a corporation's programs in terms of dollars. Used in planning and control, a budget lists the detailed cost of each program. Many corporations demand a certain percentage return on investment, often called a "hurdle rate," before management will approve a new program Wheelen and Hunger (2004). This ensures that the new program will significantly add to the corporation's profit performance and thus build shareholder value. The budget thus not only serves as a detailed plan of the new strategy in action, but also specifies through pro-forma financial statements the expected impact on the firm's financial future.

Procedures

Procedures, sometimes termed standard operating procedures (SOP), are a system of sequential steps or techniques that describe in detail how a particular task or job is to be done Wheelen and Hunger (2004). They typically detail the various activities that must be carried out in order to complete the corporation's programs

Evaluation and Control

Evaluation and control information consists of performance data and activity reports. If undesired performance results because the strategic planning processes were inappropriately used, operational managers must know about it so that they can correct the employee activity. Top management need not be involved. If, however, undesired performance results from the processes themselves, top managers, as well as operational managers, must know about it so that they can develop new implementation programes or procedures. Evaluation and control information must be relevant to what is being monitored. One of the obstacles to effective control is the difficulty in developing appropriate measures of important activities and outputs. An application of the control process to strategic planning is depicted. It provides strategic planners with a series of questions to use in evaluating an implemented strategy. Such a strategy review is usually initiated when a gap

appears between a company's financial objectives and the expected results of current activities. After answering the proposed set of questions, a strategicplanner should have a good idea of where the problem originated and what must be done to correct the situation.

Measuring Performance

Performance is the end result of an activity. The measures to select to assess performance depends on the organisational unit to be appraised and the objectives to be achieved. The objectives that were established earlier in the strategy formulation is an integral part of the strategic planning process and should be used to measure corporate performance once the strategies have been implemented.

Limitations or Vitiating Elements of Strategic Planning

Any plan is by its nature static---fixed in time. Circumstances may alter the day after the plan is formulated. Adherence to a plan finalized yesterday, may in fact assure failure tomorrow by virtue of the inflexibility of the approach. Planning, to be effective, must be dynamic. The implementers of a plan must have the authority to alter it as circumstances dictate. Long term goals should remain relatively constant, but strategies and action plans must be fluid.

The best strategy, poorly implemented, is of little value and a flawed strategy executed well will fail. A strategy needs not be brilliant, as long as it is sound, is well conceived, and avoids the obvious errors. The key is not to make the really dumb mistakes. Below is a list of seven common traps in strategic planning to be used as a reality checklist as you contemplate your plan (4) :

1. Failing to recognize and understand events and changing conditions in the competitive environment.
2. Basing strategies on a flawed set of assumptions.
3. Pursuing a one-dimensional strategy that fails to create or sustain a long-term competitive advantage.
4. Diversifying for all the wrong reasons. Ill-considered diversification strategies based on growth for its own sake or portfolio-management strategies often create negative synergy and a loss of shareholder value.
5. Failing to structure and implement mechanisms to ensure the coordination and integration of core processes and key functions across organizational boundaries.
6. Setting arbitrary and inflexible goals and implementing a system of controls that fail to achieve a balance among culture, rewards, and boundaries.
7. Failing to provide the leadership essential to the successful implementation to strategic change.

A primary issue that surfaces in failed strategy and planning is the lack of fact based decisions with validated assumptions. Many growth company CEO's have grandplans but fail to put the resources and human capital in place to execute and implement.

IV. CONCLUSIVE REMARKS AND RECOMENDATIONS

The objective of this paper was to create a better understanding of the intersection of the academic fields of entrepreneurship and strategic planning and management. The paper was based on an aggregation of the extant literature in these two fields. It has been shown that there are intersections between both of these fields of studies, and this is pointed out by Mintzberg's *school of strategy.* Obvious intersections are strategy content and processes within emerging firms in the development of strategic management instruments. The niche strategy has been shown to be a most successful market entry strategy for emerging firms, whereas the differentiation strategy can also gain important once the enterprise grows. Success for any enterprise-regardless of its size or age- is highly dependend upon its ability to find a valuable strategic position (Thompson, 1999). Nonetheless, some authors have questioned the overall value of strategic management in emerging firms (Bhide, 1994), and argued that it does not work in a dynamic environment where flexibility and responsiveness are key conditions for survical (Mintzberg, Quinn, & Ghoshal, 1995). This paper has a different opinion about this becase of the fact that most strategic planning and management instruments which have originally been developed for large enterprises, such as the SWOT analysis, can be important for emerging firms as well, but need to be adapted according to their peculiarities and pertinence. Since emerging firms considerably differ from large enterprises in their amount of resources, it is doubtful that 'standard' strategic planning instruments work in the same manner in emerging firms as in large enterprises. The instruments therefore need to be aligned with the personnel as well as the cultural, organizational, and financial conditions of the specific enterprise in order to be successful. Since many strategic instruments are simply not known or applied in emerging firms, a consciousness regardling the virtue of the use of proper strategic instruments needs to be raised. This is where politics and education have to take over. They both need to use their respective channels for generating a greater strategic awareness, starting with emerging firms, especially the young ones.

Most importantly, the integration of entrepreneurial (opportunity-seeking) and strategic (advantage-seeking) perspectives seems to be a promising approach for contemporary management, and is probably even a necessary approach for coping with the effects of the new competitive landscape. Both perspectives can be

regarded as essential for value creation, although neither is sufficient on its own (McGrath & MacMillian, 2000; Ireland et al, 2001). Strategic planning therefore without any doubt become more entrepreneurial, and shift from the traditional administrative approach to a *strategic entrepreneurship* approach. This would characterize a new management philosophy that promotes strategic agility, flexibility, creativity, and continuous innovation. It can also be used in transforming administrative-oriented employees into intrpreneurs.
From the foregoing, this paper can rightly assert that strategic planning is a panacea to the profitability and sustenance of emerging firms, the researcher can say that strategic planning has been the success factor and antidote used by emerging firms to engender competitive edge and enhanced bottomline.

Recomendations
The planning process occurs repeatedly on the continuum of progress in a
company's growth. Below are some recomended activities for successful implementation and execution of strategic planning by emerging firms:
• Build an organization capable and willing of carrying out the strategy and plan.
• Develop budgets that steer resources into those internal activities critical to strategic success.
• Establish strategy-supportive policies.
• Motivate people in ways that induce them to pursue the target objectives energetically and, if need be, modify their duties and job behavior to better fit the requirements of successful strategy execution.
• Monitor progress daily.
• Tie the reward structure to the achievement of targeted results.
• Create a company culture and work climate conducive to successful strategy implementation.
• Install internal support systems that enable company personnel to carry out their strategic roles effectively day to day.
• Institute best practices and programs for continuous improvement.
• Exert the internal leadership needed to drive implementation forward and to keep improving on how the strategy is being executed.
• Repeatedly use the planning pyramid as the basis for future decision.
• Walk the talk with your stakeholders.

In order to solve the problem concerning strategic planning in an emerging firm formulation and implementation matters, the following recommendations are suggested for consideration:
1. The board of directors should approve the funds for the implementation of formulated strategy if such funds are within the capacity of the company.
2. Workers who have spent a considerable number of years within the organization should be involved in strategic policy formulation and implementation. This development would benefit the company in terms of ideas generation and as motivating factors to the works.
3. Companies, he especially case study, should find the means of surviving the present economic hardship, which can hinder the time of implementation of the formulated strategies.
4. Over emphasis in operating decision should be reduced by the management.
5. The welfare of those who are to implement
6. Strategy planning is important and as such all factors that would motivate workers should be considered and put in place.

Strategic planning is therefore recommended to emerging firms in view of the fact that Strategic planning has been successfully used by emerging and existing firms for future survival, growth and increased productivity and efficiency country-wide and organisation-wide.

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Blind Source Separation Using Artificial immune system

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Abstract: - Independent component analysis is a computational method to solve blind source separation. Blind source separation is defined as the separation of source signals from received signals without any prior knowledge of the source signals. Independent Component Analysis looks for the component that are statistically independent and nongaussian. The most traditional algorithm used is FASTICA algorithm. It is the algorithm which uses Newtonian Iteration approximation .Independent component analysis based on FASTICA algorithm faced two main disadvantages.One is that the order of the independent components is difficult to be determined and the suitable source signals are not isolated.In order to overcome these disadvantages, an improved ICA algorithm based on Artificial Immune System is used.AIS is an attractive technique and it is advantageous over other techniques such as it can be easily implemented and has great capability of escaping local optimal solutions. It has the great capability of providing better signal separation when compared to FASTICA algorithm.The goal of the proposed AIS-ICA algorithm is to use AIS to determine the separating matrix of ICA by means of which order of independent component analysis is determined and suitable source signals are isolated. The Artificial immune system is based on natural immune system principles and it can offer strong and robust information processing capabilities for solving complex problems. Artificial immune system is based on clonal selection principle that can be used to optimise functions. The steps involved in CLONALG are initialisation, cloning, mutation and selection. In case of initialisation, initialise the population randomly and select the function to maximise. In the second step, the best antibody being cloned the most. In case of mutation, the worst antibodies are mutated higher.The final step is selection in which antibodies are selected for next iteration. It describes the basic principles of immune response to an antigenic stimulus. It is population based algorithm and its only variation operator is mutation.

Keywords: - *Independent component analysis, artificial immune system, signal separation, heuristic algorithm*

I. INTRODUCTION

Blind source separation (BSS) is to separate the source from the received signals without any prior knowledge of the source signal. Problems related to BSS have become an active research area in the fields of statistical signal processing and unsupervised neural learning. Independent component analysis (ICA) is one of the most used methods for BSS. The goal of ICA is to recover independent sources when given only sensor observations that are unknown linear mixtures of the unobserved independent source signals. It has been investigated extensively in image processing, financial time series data and statistical process control. For ICA, many effective algorithms have been proposed, the most used traditional algorithm is FastICA algorithm that uses the approximate Newtonian iteration algorithm. But in practical application, it often leads to local minimum solution and the suitable source signals are not isolated. Moreover, the order of the independent components (ICs) is difficult to be determined. These two problems are the main drawbacks of FastICA algorithm. To overcome these disadvantages, an improved ICA algorithm based on artificial immune system (AIS) (called AIS-ICA) is presented. They are one among many types of algorithm inspired by biological systems, including evolutionary algorithms, swarm intelligence, neural networks and membrane computing. AIS are bio-inspired algorithms that take their inspiration from the human immune system. Within AIS, there are many different types of algorithm, and research to date has focused primarily on the theories of immune networks, clonal selection and negative selection. It is based on natural immune system principles, and it can offer strong and robust information processing

capabilities for solving complex problems. There are various applications of AIS, and they include data analysis, scheduling, classification, fault detection and security of information systems. Since AIS has many advantages over other heuristic techniques such as it can be easily implemented and has great capability of escaping local optimal solutions, it is used in this study to develop the AIS-ICA algorithm.

II. METHODOLOGY

I.ICA

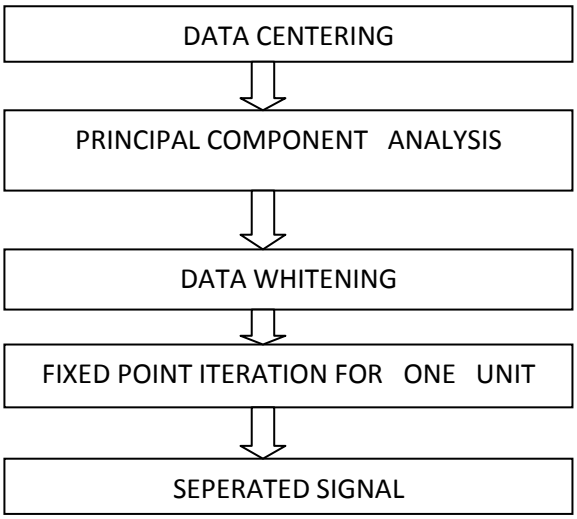

Fig 1: block diagram of existing work

DATA CENTERING

The input data X is centered by computing the mean of every component of X and subtracting that mean. The data centering can be defined as the difference between data vector(X) and mean(X) and it is given by

$$X_c=X-E\{X\}(1)$$

PRINCIPAL COMPONENT ANALYSIS

It is one of the pre processing tool for ICA. It is used to find the eigen values and the eigen vectors in order to whiten the given data. The drawback is that the concept of correlation is used.

DATA WHITENING

The main goal of whitening is to transform the data vector linearly as result of which newly obtained data vector is white i.e. the components are uncorrelated and the variance equal to unity or the covariance matrix equal to identity matrix. Whitening can be done using Eigen value decomposition which can be defined as follows

$E*D*E^T$

Where E is the Eigen Vector, D is the Eigen value, E^T is the transpose matrix of Eigen vectors

Since eigen values are single component wise operation the above equation can be written as

$Z=E*D^{-1/2}*E^T$

FASTICA ALGORITHM FOR ONE UNIT

The FASTICA algorithm for one unit estimates one row of demixing matrix that is extremum of contrast functions. It is an algorithm which maximises the non gaussianity of statistical independence. Non gaussianity can be measured by two methods namely Kurtosis contrast function and negentropy. Kurtosis can be classically dehined as follows

$$Kurt(b) = E(b^4) – 3(E(b^2))^2(2)$$

If variable b is assumed to be zero mean and unit variance, the right hand side simplifies to $E(b^4) – 3$. This shows that kurtosis is simply a normalised version of the fourth moment $E(b^4)$. For a Gaussian b, the fouth moment equals $3(E(b^2))^2$. Thus, kurtosis is zero for a Gaussian random variable and non zero for most non Gaussian random variables.

Unlike kurtosis,negentropy is determined according to the information quantity of differential entropy. Entropy is a measure of the average uncertainity in a random variable. The differential entropy H of random variable b with density f(b) is defined as H(b)=- $\int p(b) \log p(b) db$. According to a fundamental result of

information theory, a Gaussian variable will have the highest entropy value among a set of random variables with equal variance. For obtaining a measure of non-Gaussianity, the negentropy J is defined as follows:

$J(b) = H(b_{gauss}) - H(b)$

The negentropy is always non negative and is zero if and only if b has Gaussian distribution. Since negentropy is very difficult to compute, an approximation of negentropy is proposed as follows:

$$J(b) \sim [E\{G(b)\} - E\{G(0)\}]^2 \quad (3)$$

Where 0 is a Gaussian variable of zero mean and unit variance , and b is a random variable with zero mean and unit variance. G is a non quadratic function , and is given by $G(b) = b^4$.

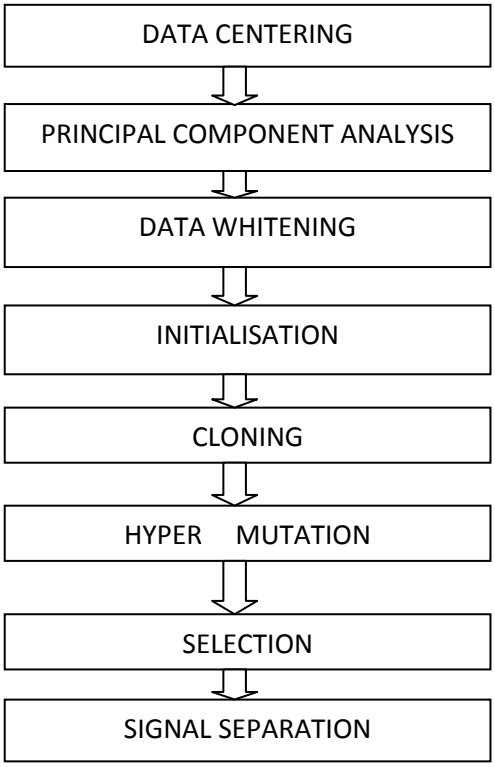

Fig 2:Block diagram of proposed work

DATA CENTERING

The input data X is centered by computing the mean of every component of X and subtracting that mean. The data centering can be defined as the difference between data vector(X) and mean(X) and it is given by

$X_c = X - E\{X\}$

PRINCIPAL COMPONENT ANALYSIS

It is one of the pre processing tool for ICA. It is used to find the eigen values and the eigen vectors in order to whiten the given data. The drawback is that the concept of correlation is used.

DATA WHITENING

The main goal of whitening is to transform the data vector linearly as result of which newly obtained data vector is white i.e. the components are uncorrelated and the variance equal to unity or the covariance matrix equal to identity matrix. Whitening can be done using Eigen value decomposition which can be defined as follows

$$E*D*E^T \quad (4)$$

Where E is the Eigen Vector, D is the Eigen value, E^T is the transpose matrix of Eigen vectors

Since eigen values are single component wise operation the above equation can be written as

$$Z = E*D^{-1/2}*E^T \quad (5)$$

INITIALISATION

It is the process in which variables are assigned. The function that is to be maximsed or minimized should be selected.Initialise the population randomly.

CLONING

Antibody's affinity corresponds to the evaluation of the objective function given by the antigen.The antibodies are cloned; the best antibody being cloned the most and worst being cloned the least number of times.

HYPER MUTATION

The clones are mutated in inverse proportion to their affinity. The best antibody's clones are mutated lesser and worst antibody's clones are mutated most.The mutation can be uniform, gaussian or exponential.

SELECTION

It is the final step involved in CLONALG algorithm. It is the process in which best antibodies are selected for next iteration.

III. SIMULATION RESULTS

The input signal is then passed through the mixing matrix as a result of which mixed signals will be produced. The proposed AIS ICA and FASTICA algorithm will be used to separate the original signal. The artificially generated mixtures are used to evaluate the effectiveness of the proposed AIS ICA algorithm compared with that of FASTICA algorithm. Six simulated signals are used as input source signals which are as follows:

a. Modulated sinusoid:

*P(t)= 2*sin(t/149)*cos(t/8)+0.2*rand()*

b. Square wave:

*Q(t)= sign(sin(12*t + 9*cos(2/29))) + 0.1 *rand()*

c. Sawtooth:

*R(t)= (rem(t, 79)-17)/23+0.1*rand()*

d. Impulsive curve:

*S(t)= ((rem(t,23)-11)/9)^5) + 0.1*rand()*

e. Exponential:

*U(t)= 5*exp(-t/121)*cos(37*t) + 0.1*rand()*

where the rem function returns a result that is between 0 and sign(e)*abs(z). If z is a zero,rem returns NaN(not a number). The rand function generates a set of uniformly distributed pseudo random numbers.

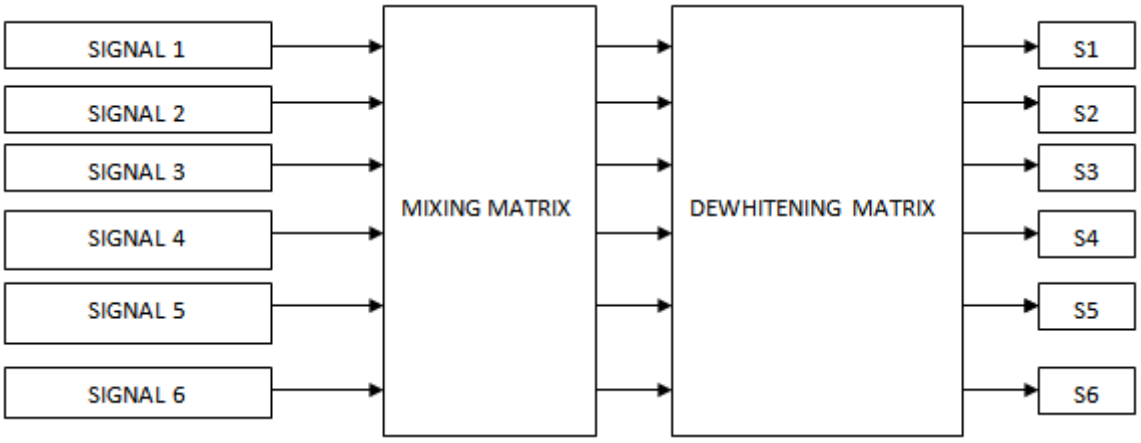

Fig 3:Block diagram of separating six signals

Where s1,s2,s3,s4,s5,s6 represents separated signals

The input signals waveforms are given below as follows

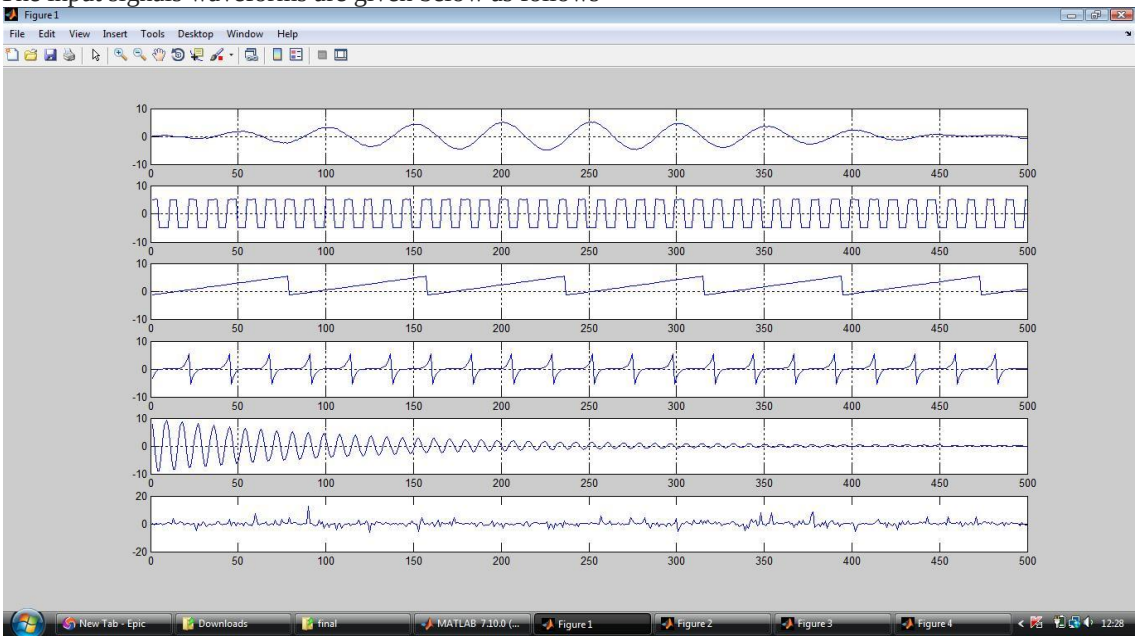

Fig 6:Input signals

The first to sixth I/p represent modulated sinusoid, square wave,sawtooth wave, impulsive wave, exponential and spiky noise respectively.The input signals are passed through the 6×6 mixing matrix as a result of which the mixed signals are generated. The mixed signals are passed through FASTICA and AIS-ICA algorithm by means of which signals will be separated. The mixed signal wave forms are as follows

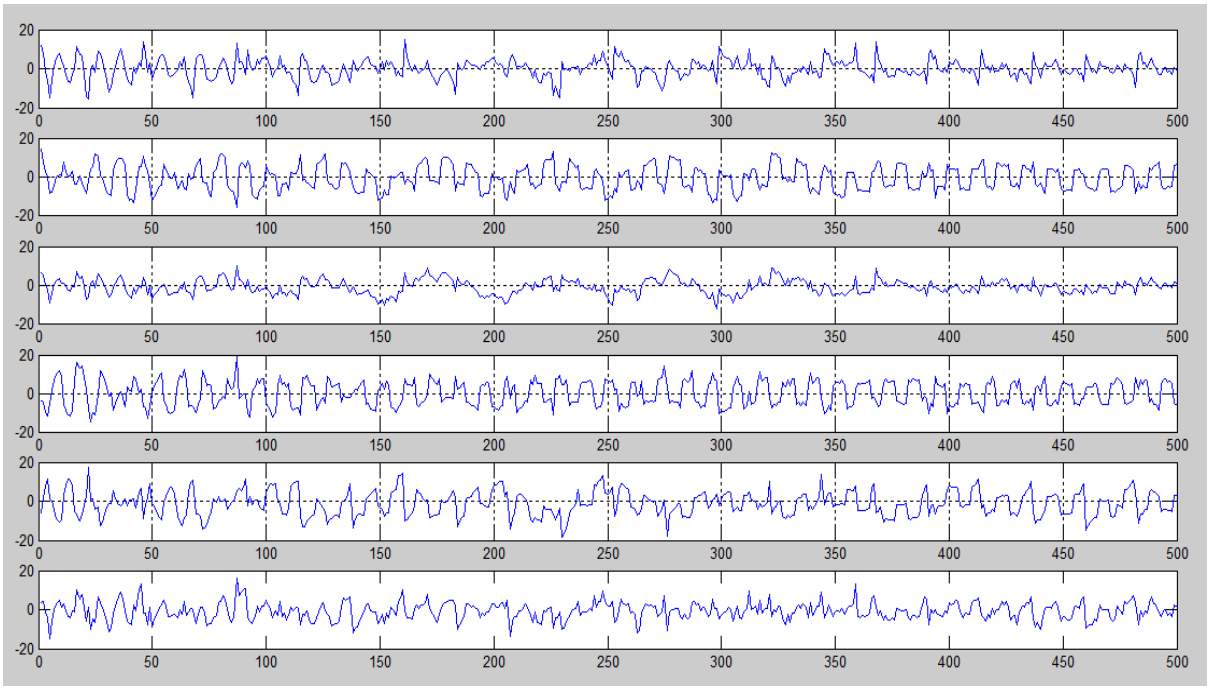

Fig 7: Mixed signals

The separated signals of FASTICA and AIS-ICA are as follows:

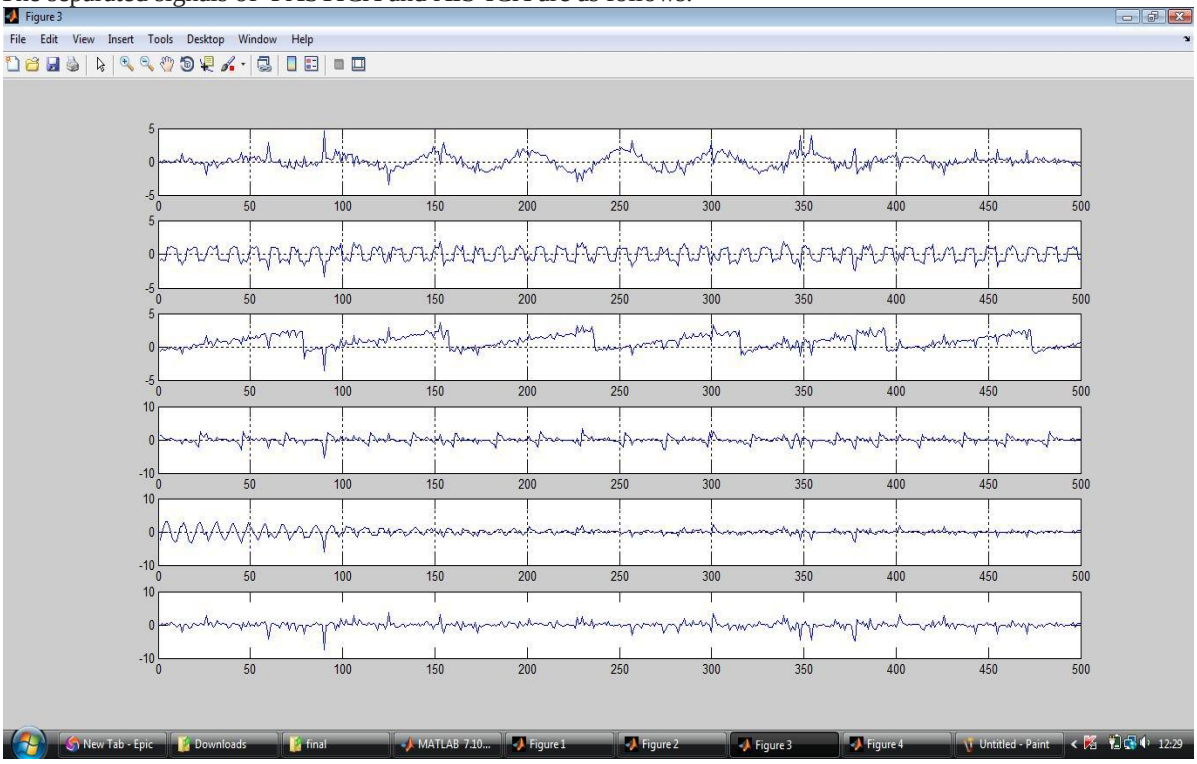

Figure 8: FASTICA

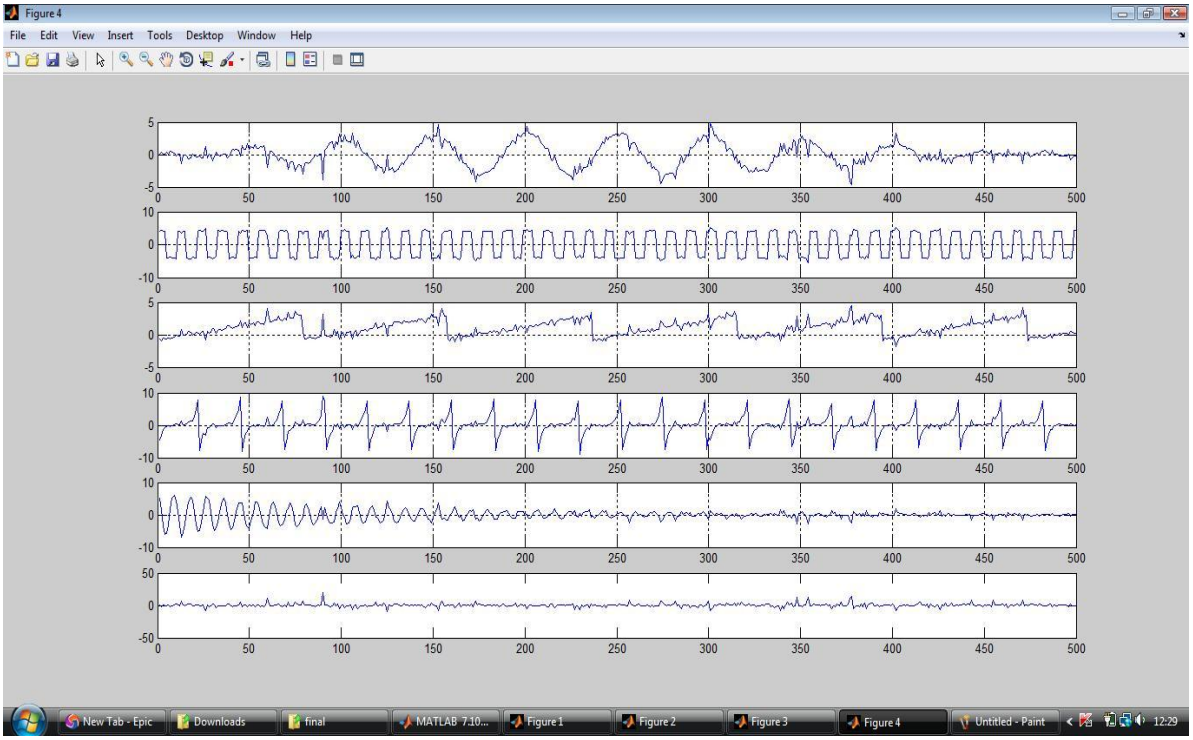

Figure 9 AIS-ICA

It can be seen that FastICA couldn't separate the independent components clearly, whereas the proposed AIS-ICA separates them clearly. That is, it can be seen that the source signals separated by the AIS-ICA algorithm are more accurate than those separated by the FastICA algorithm.

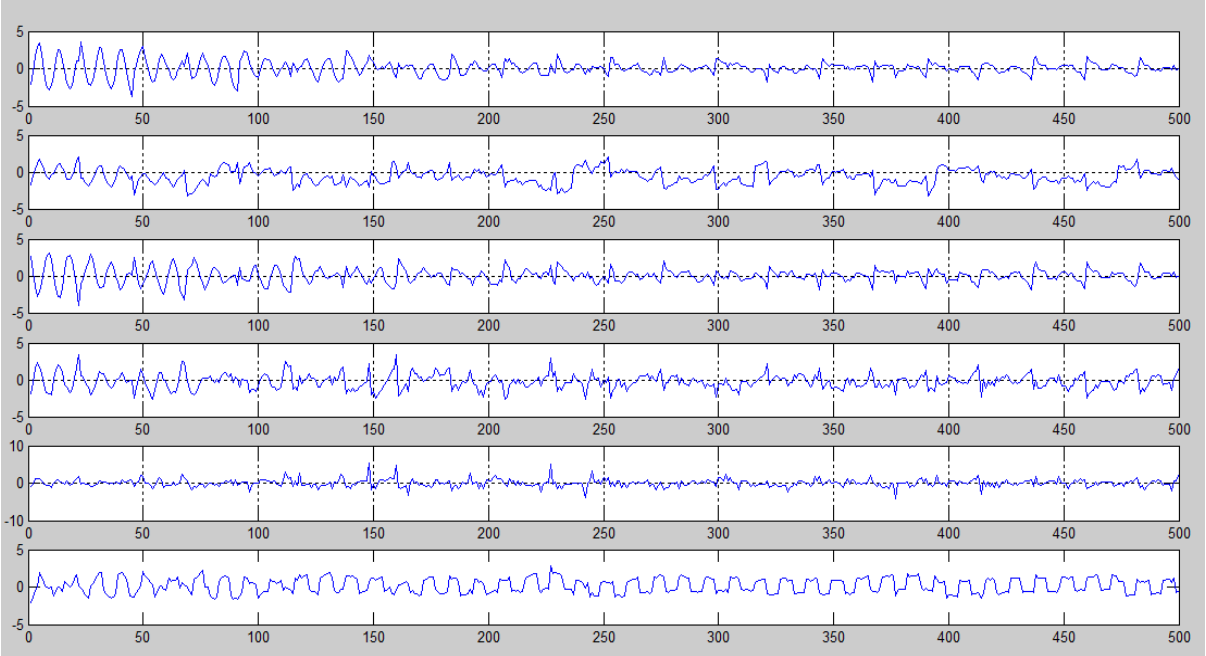

Figure11:FASTICA by 1st round

AIS-ICA

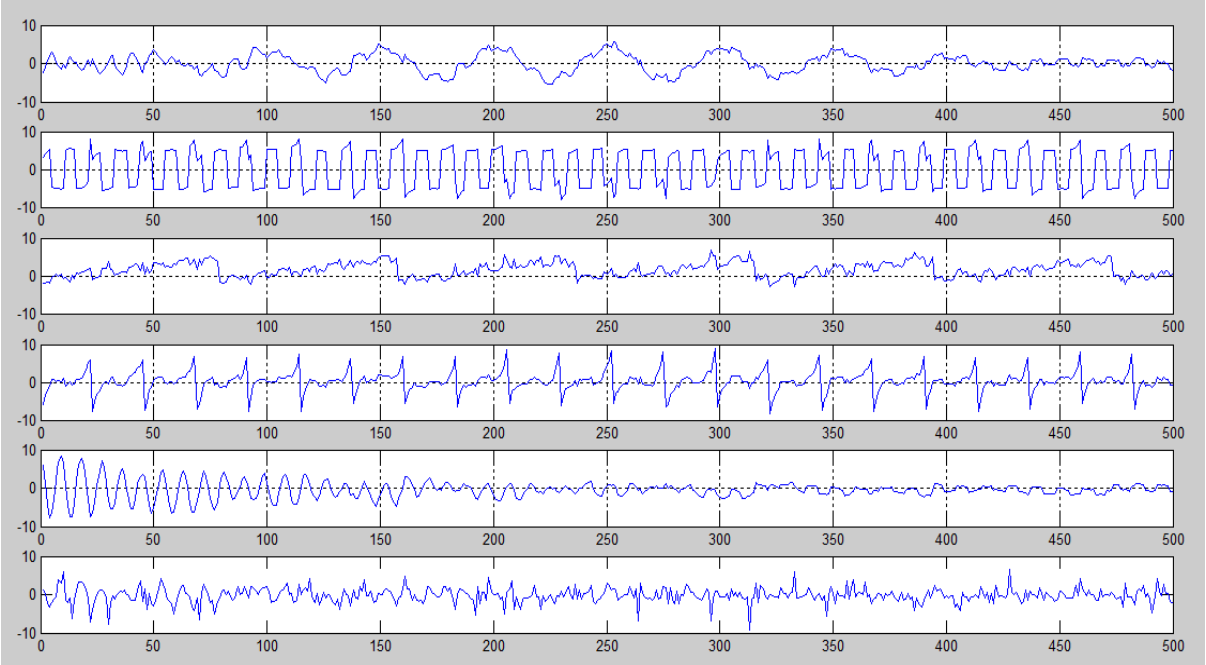

Fig 9(a): AIS-ICA by 1st round

From the above rounds of FASTICA and AIS ICA, the following information can be inferred:

- AIS-ICA provides better separating results compared to that of FAST-ICA.
- The order of IC can be easily determined by AIS-ICA

IV. CONCLUSION AND FUTURE WORKS

Independent component analysis separates mixed signals blindly without any information of the mixing system. FASTICA is the most popular gradient based ICA algorithm, but it has two disadvantages order of the ICs is difficult to be determined and easy to obtain local minimum. In order to overcome these two disadvantages, an improved ICA algorithm based on AIS is used. In the proposed AIS-ICA algorithm, it is used to determine the de mixing matrix of ICA. Simulation results from the artificial signal data showed that the AIS-ICA algorithms provides better separating results than that of FASTICA algorithm. The order of ICs can be determined by the proposed AIS-ICA algorithm. The future work indicates AIS ICA has to applications aiding problems involved in claasification,fault detection and security of informational systems.

4.1 FUTURE WORKS

The future work indicates AIS ICA has found to be in many involved in claasification,fault detection and security of informational systems. It also aids the problems involved in control of growing of memory cells and also the mutation and cloning are taken randomly. So a new classifier called as proposed particle swam optimisation is used to attain an optimal value. The future works aids to be applied in EEG signal classification by means of which normal and abnormal signals can be easily classified with high accuracy.

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Hydrological characterization of twelve water catchments in Nigeria

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Abstract: - Twelve water catchments (WCs) in Ogbomosho, south west of Nigeria were evaluated for their hydrological characterization with respect to domestic and irrigation activities. Both physiochemical and biological parameters (limnological properties) were determined which include pH, total alkalinity (TA), CO_3^{2-}, HCO_3^-, NO_3^-N, SO_4^{2-}, N, P, K, Na, Ca, Mg, dissolved oxygen (DO), electrical conductivity (ECw), biochemical oxygen demand (BOD), total solids (TS), total dissolved solids (TDS), chlorophyll a,b,c and phaeophytin. Temperature fluctuation of the water catchments was measured in-situ to avoid samples coming into contact with the surrounding air using mercury in glass thermometer. Soil samples collected from the bottom of the water catchments were determined for chemical properties such as N, P, K, Na, Ca, Mg, and SO_4^{-2} following recommended procedures. These parameters were investigated based on the perceived research consent of their efficacy in characterizing water catchments hydrologically along safety and pollution divides. The limnological properties were configured into ranking compared with standards to evaluate the degree of contamination or suitability of the WCs for domestic and irrigation purposes. Results obtained indicated pH values of the catchments ranging from 5.8 to 7.4 with corresponding TA between 0 and 296 mgL^{-1} suggesting high level of dissolved carbon dioxide (DCO_2) and traces of untreated wastewater in most of the catchments. Based on ranking of the limnological properties of the WCs, WC4, WC5, WC6 recorded indices between 65 and 95 signifying that cumulatively these three WCs were more prone to pollution and could affect human health at consumption while WC2, WC3, WC 7 and , WC 10, aligned between 95 and 120 indicating mild to medium pollution and WC1, WC 11, and WC 12 oscillated between 120 to 145 picturing WCs approaching standards (132) while WC8 ranged between 145 and 170 revealing WC 8 as catchment with little or no tendency for hazards at drinking. Similarly, WC2, WC8, recorded soil reference (SR) between 50 and 60 suggesting possible interference of organic decomposition between the soil stratum and water in the catchment, however, WC1, WC4, WC5, WC6, WC7 and WC 12 recorded SR between 40 and 50 showing possible adjustment of the soils in the WCs of various salinity levels and WC 3, WC9, WC 11 revolving between 30 and 40 projecting the WCs with minimal pollution. Moreover, WC 10 only recorded value between 20 and 30, an inference of the soil stratum void of absolute contamination. Generally, WC2, WC8, appeared polluted both in limnological properties and basic soil conditions while WC9, WC10, WC11, and WC3 reflected high scale of ranking on limnological properties with low scale of SR possibly indicating little or no interaction between the soil base and the water in the catchments. Contrary wise, WC6 was high in SR but low in limnological properties. This trend suggests the presence of oxygen saturation in some of the WCs. Overall results indicated that WC4, WC5, WC6 require major water treatment prior to its usage for irrigation to avoid salt deposition at the crop root base, while WC2, WC3, WC7, WC9 and WC10 were considered relatively safe for drinking. WC1, WC11, WC2 requires some measure of precaution before drinking, however, WC12, and WC 8 could be consumed with little or no fear of infection.

Keywords: *- Hydrology, limnology, water quality, Nigeria, domestic, irrigation*

I. INTRODUCTION

Nigeria exhibits such demographic features that call for a holistic approach to forestall future crises while catering for the basic water needs of the populace. The agricultural labour force of the country stands at 70

% with population growth of 3.5 %, death rate of 105/1000 births, net migration of 27/1000, HIV/Aids infection at 5.4 % coupled with inflation monster of 12.5%. In addition to the features evident in Nigeria, the country is also susceptible to high risk of mortality arising from poor resource management viz-a-viz air, surface and water pollution. Consequently, extensive research studies are therefore indispensable to ensure that various water catchments especially shallow wells used for domestic and agricultural purposes are less vulnerable to environmental hazards. This will prevent large scale loss of human life, economic crisis, social and ecosystem collapse.

Water is one of the most indispensable resources given to humanity as a gift. Humanity either survives or collapses by the quality of water available, assessable and consumable. Water quality therefore becomes an important focal point that requires holistic evaluation in view of its importance to human existence. Howard et al., (1985) reported that generally water in nature is pure especially in its evaporation state. However, during condensation and the liquid water flowing through the hydrologic circle contacts are made made with materials beneath the surface of the earth thereby accumulating impurities and contaminants. These contaminants are aggravated by human activities due to the use of agricultural chemicals, pesticides and burning of fuels. Usually, drinking water is expected to be free of suspended solids, turbidity with moderate quantity of dissolved inorganic solids, but completely free of organics, toxic substances and pathogens (Howard et al., 1985), while water for irrigation is much below that of drinking water.

Qualitatively therefore, information on water quality, pollution or contamination can only be validated through physiochemical and biological properties (limnological). Contaminants involving turbidity and hydrogen sulfide easily detect by smell (Self, 2010) while limnological tests are conducted to determine bacteriological concentration as it affects human nutrition and physiochemical properties that identify impurities and other dissolved substances affecting water for domestic purposes. As a rule of the thumb, water with pH values lower than 5 results in pipe corrosion because most metals become more soluble in low pH, while pH greater than 8.5 suggests a significant amount of bicarbonates of Na, CA or Mg has thereby caused hardness (Romano, 2007). Edhira and Vasil (2008) further expatiated that high $C0_3^{2-}$ cause Ca and Mg ions to form insoluble minerals, leaving sodium as the dominant ion in solution thus raising the pH level to about 8.5. This scenario results in soil particle dispersion, crusting with attendant water infiltration and permeability problems and eventual crop failure. Moreover, the most damaging effects of poor quality irrigation water as reported by Edhira and Vasil (2008) are an excessive accumulation of soluble salt, thereby leading to the flotation of clay and humus particles and eventual plugging up of large silos. Invariably, plugging action reduces water movement into and through the soil, thus crop roots cannot assess water from the soil even though pool of water may be observed on the soil surface. Although, salts may harm plant growth physically (Wilcox, 1955), however, specific limits of permissible salt concentrations for irrigation water may be difficult to be stated because of the wide variation in salinity tolerance among different plants, therefore field-plots studies of crops on soils prone to salinity levels would provide valuable information relating to specific crop dynamics to salt tolerance (Todd, 1980; Richard, 1954).

Water quality for domestic and human consumption goes side by side with irrigation water standards. For example, environmental hypoxia (insufficient oxygen) occurring in water catchments such as ponds, wells and rivers suppress the presence of aerobic organisms and by extension, such water when applied to crops could end up contaminating the soil from which nutrients are transported through the roots of the plants. In addition, nitrates in drinking water are capable of infecting young children with "blue baby syndrome" although can be an N - source for soil fertility (Bander, et al., 2007). Moreover, poor quality water either for domestic or irrigation has an effect on human and crop health, while environmental sustainability is in jeopardy. Therefore the knowledge of water quality for domestic and agricultural activities is indispensable and critical to water management issues. In view of the uniqueness of quality water to human health, issues relating to water management are indispensable. For example, water containing impurities such as CH_4 to just between 1 to 2 mgL^{-1} could result in an explosion in wells and storage tanks (Heath, 1964). Likewise, temperature fluctuations need to be stabilized to avoid exposure of soluble materials arising from organic decomposition (Black and Handshaw, 1966) thereby rendering the water catchments unsafe for consumption. Moreover, increasing demand in the existing water supply necessitates sustainable studies on alternative water sources like wells. This study aims at hydrological characterization of twelve water catchments along domestic and irrigation water divides.

II. MATERIALS AND METHODS

Twelve water catchments (WCs) (wells) distributed uniformly across Ogbomosho metropolis of the south west, Nigeria was investigated and characterized based on their suitability for domestic and irrigation activities in 2009/2010 rainfall season. Six of the WCs were located at the town centre, prone to effluents as stadium east (WC1), General East (WC2), High Court (WC3), Stadium West (WC4), Kuye (WC5), General West (WC6), while six others were positioned within Ladoke Akintola University of Technology, (LAUTECH)

at Chemical Engineering Departmental Laboratory (WC7), Faculty of Agricultural Engineering Research Field (WC10), Nursery/Primary of LAUTECH (WC1), and Department of Pure and Applied Mathematics (WC12).

Twenty physiochemical and limnological properties which include acidity/alkalinity (pH), total (TA), carbonate (CO_3^{2-}), bicarbonate (HCO_3^-) nitrates (NO_3-N), sulphates (SO_4^{2-}), phosphorus (P), sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), dissolved oxygen (DO), electrical conductivity (ECw), biochemical oxygen demand (BOD), total solid (TS), total dissolved solids (TDS), chlorophyll (a,b,c), and pheophytin were determined according to standard laboratory procedures. Conductivity was measured within the period recommended by WHO (1996) to prevent chemical adulteration of samples with storage time, while DO, BOD and other sensitive properties were measured within 24hrs of sampling (Miroclav, 1999). The temperature of the WCs was measured in situ at 10:00am and 2:00pm respectively to avoid the water samples coming into equilibrium with the surrounding air using a glass thermometer mercury-filled with 0.1^0C graduations (WHO, 1996).Soil samples obtained from the bottom of the WCs were analyzed for chemical properties. These include nitrogen (N), phosphorus (P), potassium (K), sodium (Na), calcium (Ca), magnesium (Mg) and sulphates (SO_4^{2-}) following standard methods. Three types of chlorophyll (a, b, c) found in phytoplankton were measured using spectrophotometer methods (WHO, 1996) to assess the ecological status of the water catchments.

In view of the difficulties encountered in interpreting analysis of the chemical quality of groundwater and soil conditions due to numerous elements involved, the result of the analysis of the twelve WCs and the corresponding soil environments was subjected to ranking (Tables 3&4). The lowest number was assigned to the results of the analysis with the highest tendency for contamination while the highest number of results with the lowest possibility of contamination to ensure uniform comparability and resolve the complexities involved in the response of individual elements in the laboratory work in conformity with WHO standards.

III. RESULTS

The average temperature of WCs ranged from 26.2^0C (10:00am) to 27^0C (2:00pm), 26.3^0C (10:00am) to 27.1^0C (2:00pm), 26.5^0C (10:00am) to 26.9^0C (2:00pm), 25.3^0C (10:00am) to 26.5^0C (2:00pm), 25.5^0C (10:00am) to 26.7^0C (2:00pm), 25.6^0C (10:00am) to 26.8^0C (2:00pm), 26.4^0C (10:00am) to 26.5^0C (2:00pm), 26.5^0C (10:00am) to 27.7^0C (2:00pm), 26.5^0C (10:00am) to 29.5^0C (2:00pm), 26.4^0C (10:00am) to 27.2^0C (2:00pm), 26.5^0C (10:00am) to 26.8^0C (2:00pm), 26.6^0C (10:00am) to 27.8^0C (2:00pm), for WC1 to W12 respectively. Physiochemical and limnological properties of the twelve WCs are presented in Table I. Average pH values ranged from 5.8 (WC2) to 7.4 (WC7). Three WCs (WC2, WC8 and WC1) recorded pH values below the normal range for irrigation and domestic activities estimated at between 6.5 to 8.5 (Edlira and Vasil, 2008). Total alkalinity, primarily considered as a function of hydroxide, carbonate and bicarbonate concentrations was highest for WC4. Seven of the WCs showed concentrations of alkalinity above 150 MgL^{-1}. However, six were within the recommended limit for drinking water of 400mgL^{-1} (Gordon and Hamlin, 2009) (Table 3). The most influential water quality guideline on crop productivity was attributed to salinity hazard as measured by electrical conductivity (Bandar et al., 2007), WC2 and WC4 recorded values above 500mgL^{-1} compared to others. The results of DO and BOD of the WCs are presented in Table 1. Besides, WC4, WC5, WC7, recording DO above the threshold limit, WC1, WC6, WC8, WC9, WC10, WC11, WC12 fall within the recommended value for drinking water at 5mgL^{-1}, while WC2, WC3 slightly exceeded the standard limit. Chlorophyll a, b, c of the WCs followed a similar trend with DO and BOD. The highest values of chlorophyll a, b, c were obtained from WC11 (12, 23, 24.5) and the least from WC4 (4, 9, 10).

IV. DISCUSSIONS

The trend observed in the temperature dynamics reveals the extent to which temperature characterizes the biological species present and their corresponding rates of activity (Howard, 1985). WC4 exhibits the average lowest temperature at 10:00am followed by WC5, and WC12, the highest. This scenario suggests possible aggravated growth of algae in WC12 thereby generating tasting, odor problems, and decreasing viscosity, (Howard et al., 1985) undesirable in drinking water. Similarly, at 2:00pm. WC9 recorded the highest temperature at 29.5^0C closely followed by WC8 and WC3, WC4, the least showing preference of WC3 and WC4 to others as evident in accelerated dissolution of solids typical of increased temperature beyond the normal (Howard et al., 1985) inimical to human health. Physiochemical and limnological properties obtained suggested WC2, WC8 and WC1 unsuitable for domestic activities, although, in the light of shortage of irrigation water, WC2, WC8 and WC1 could be mildly treated with gypsum for re-use of agricultural purposes. However, for drinking water, pH values above 8.3 are not desirable because of the presence of carbonates and hydroxide concentration in addition to bicarbonates (WHO, 1996). The phenomenon observed in total alkalinity possibly indicated that the application of water from these water catchments for crop production may cripple the plant ability to compete with ions in the soil solution for water with possibility of physiological drought (Bandar, et al., 2007). In a similar trend, WC1, WC2, WC3, WC4 and WC6, recorded sodium concentration above 30mgL^{-1} while others ranged from 10.53 mgL^{-1} to 29.2 mgL^{-1}. This observation is possibly due to the greater proportion

of sodium ion (Na^+) compared to Ca^{2+} and Mg^{2+} in water, thereby causing low permeability within the soil stratum, limited aeration with corresponding reduction in crop growth (www.derm.qld.gov.au, 2009). .Nitrates concentration of the WCs were within the threshold values, although WC1, WC3, WC5, WC6 and WC7 exhibited values suggestive of possible metabolism to ammonia with evolution of nitrite capable of oxidizing iron atoms in haemoglobin to ferric ion Fe^{3+} and resulting into methemoglobinomia in infants other wise known as blue baby syndrome (Kim-Shapiro et al., 2005; Romano and Zheng, 2007). Likewise nitrates in drinking water at levels above the standard poses an immediate threat to young children, but can be significant N sources credited towards soil fertility and crop production (Edhira et al., 2008; Addiscott and Benjamin, 2004; Kim-Shapiro et al.,2005). The marginal increase shown in DO and BOD should not however be dismissed with a wave of the hand in view of the fact that an insignificant amount of poison in solution is dangerous as the concentrated one with a similar solution, both are deadly. Moreover, the average BOD values ranged from 5.8 (WC12) to 12 (WC2) with 10 out of the WCs described as being very polluted respect to domestic activities according to Miroslav (1999).

The results recorded for chlorophyll a, b, c appeared divergent from the conventional trend, however WC4 was above the limit in most of the parameters measured. An overall result obtained indicated that WC2, WC8, WC1, and WC5 exhibited parameters that rendered them safe for drinking while WC3, 4, 7, 8, 9, 10, 11 and 12 could be considered for irrigation.

V. CONCLUSION

In marked contrast to the large seasonal variation of surface water temperature typical of temperate climates as opposed to tropical regions, ground water temperature tends to remain relatively constant, an important advantage for drinking water and industrial uses (Todd, 1980). Although saline groundwater has traditionally been regarded as an undesirable resource, modern technological advances had reversed this role. Advances in desalination techniques suggest that saline groundwater is a potentially important water supply source where shortages are imminent. (Todd, 1980). Consequent on the above information and the available modern technology, the twelve water catchments could be treated for both domestic and irrigation activities.

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Table 1: Physiochemical and Limnological Properties of Twelve Water Bodies in Ogbomosho, South West, Nigeria

S/N	Properties	Symbols	Units	WB1	WB2	WB3	WB4	WB5	WB6	WB7	WB8	WB9	WB10	WB11	WB12
1	Acidity/Alkalinity	pH		6.3	5.8	6.8	7.2	6.9	7.4	6.5	6.2	6.6	6.9	7.3	6.7
2	Total alkalinity	TA	mg L^{-1}	64	0	104	552	72	296	168	16	256	160	208	216
3	Carbonate	$CO3^{2-}$	mg L^{-1}	0	0	0	552	0	296	0	0	0	0	0	0
4	Bicarbonate	HCO_3^{2-}	mg L^{-1}	64	0	104	0	72	0	168	16	256	160	208	216
5	Nitrates	NO_2^{-N}	mg L^{-1}	0.81	0.07	0.42	0.1	0.47	0.47	0.37	0.11	0.17	0.07	0.11	0.03
6	Sulphate	SO_4^{2-}	mg L^{-1}	10.3	2.53	8.81	18	10.2	10.7	3.09	2.63	10.5	7.11	7.73	2.24
7	Phosphorus	p	mg L^{-1}	0.28	0.19	0.1	0.1	0.02	0.28	0.35	0.19	2.15	0.5	1.66	0.17
8	Sodium	Na	mg L^{-1}	35.6	33.21	38.1	39	29.2	39.7	17	12.2	9.72	10.53	16.2	19.44
9	Potassium	K	mg L^{-1}	9.72	11.34	7.02	12	4.68	14.8	3.9	4.68	3.12	10.53	4.68	4.68
10	Calcium	Ca	mg L^{-1}	28.5	27.5	19.3	66	32.3	48.8	1.75	14.3	2.75		17.75	12
11	Magnesium	Mg	mg L^{-1}	11	10.5	8.25	13	10.1	11.8	6.93	6.73	4.15	3.9	5.5	5.73
12	Dis.Oxy.	DO	mg L^{-1}	4.5	6	5.8	9.5	8	5	8	4	5	14	4.5	5
13	Conductivity	ECw	µScm $^{-1}$	385	510	420	505	420	370	420	380	440	4.5	380	405
14	Bio Ch Ox De.	BOD	mg L^{-1}	8.5	12	10.5	13	10	7	8	10	6	400	6	5.8
15	Total Solid	TS	mg L^{-1}	220	420	320	440	370	250	350	240	350	9	210	420
16	Tot.Dis. Sol.	TDS	mg L^{-1}	140	220	230	340	280	180	250	190	280	305	110	150
17	Chlorophyll	a	µg L^{-1}	5	5	7	4	8	9	7	10	6	200	12	8
18	Chlorophyll	b	µg L^{-1}	9	14	11.5	9	16.5	16.5	16.5	16	12.5	10	23	16.5
19	Chlorophyll	c	µg L^{-1}	10	16	12	10	17	17.5	17	16.5	13	21	24.5	17.5
20	Pheophytin		µg L^{-1}	11.6	17.2	14.4	12.4	17.8	18.4	18.8	17.8	14.2	24	25	18

Table 2: Basic Soil Information of Twelve Water Catchments in Ogbomosho, Nigeria

Properties	Symbols	Units	WC1	WC2	WC3	WC4	WC5	WC6	WC7	WC8	WC9	WC10	WC11	WC12
Nitrogen	N	mg L^{-1}	175	319	661	593	236	866	441	258	988	752	988	494
Phosphorus	P	mgkg-1	102.5	122.5	133.58	102.5	102.5	112.5	92.5	92.5	112.5	830	103	123
Potassium	K	mgkg-1	19.50	19.5	253.5	58.5	19.5	19.5	19.5	58.5	58.5	546	58.5	19.5
Sodium	Na	mgkg-1	20.25	20.25	202.5	162	40.5	20.25	20.25	20.25	40.25	384.75	40.5	20.25
Calcium	Ca	mgkg-1	219.75	31.75	nd	12	129	16.25	5.75	25.50	25.50	198.75	nd	3.25
Magnesium	Mg	mgkg-1	457.2	133.75	394.38	360.63	333.13	70.63	685.62	66.25	202.5	369.38	737.50	146.88
Sulphates	SO42-	mgkg-1	140	131.88	191.87	83.75	56.25	156.25	143.75	231.87	231.87	236.25	171.87	296.25

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Chemical reaction effect on MHD Free Convection and Mass Transfer Flow past a Vertical Flat Plate with porous medium

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Abstract: - The two dimensional free convection and mass transfer flow of an incompressible, viscous and electrically conducting fluid past a continuously moving vertical flat plate through porous medium in the presence of heat source, thermal diffusion, large suction, Chemical reaction and the influence of uniform magnetic field applied normal to the flow has been studied. Usual similarity transformations are introduced to solve the momentum, energy and concentration equations. To obtain the solutions of the problem, the ordinary differential equations are solved by using perturbation technique. The expressions for velocity field, temperature field, concentration field, skin friction, rate of heat and mass transfer have been obtained. The results are discussed in detailed with the help of graphs and tables to observe the effect of different parameters.

Keywords: - *MHD, Free convection, Flate plate, Heat Transfer, Mass transfer and Variable Temperature, Porous medium, chemical reaction.*

I. INTRODUCTION

Magneto-hydrodynamic (MHD) is the branch of continuum mechanics which deals with the flow of electrically conducting fluids in electric and magnetic fields. Many natural phenomena and engineering problems are worth being subjected to an MHD analysis. Furthermore, Magneto-hydrodynamic (MHD) has attracted the attention of a large number of scholars due to its diverse application to geophysics, astrophysics and many engineering problems, such as cooling of nuclear reactors, the boundary layer control in aerodynamics, cooling towers, MHD pumps, MHD bearings etc.

Convection in porous media has applications in geothermal energy recovery, oil extraction, thermal energy storage and flow through filtering devices. The phenomena of mass transfer are also very common in theory of stellar structure and observable effects are detectable, at least on the solar surface. The study of effects of magnetic field on free convection flow is important in liquid-metal, electrolytes and ionized gases. The thermal physics of hydro-magnetic problems with mass transfer is of interest in power engineering and metallurgy. The study of flows through porous media became of great interest due to its wide application in many scientific and engineering problems. Such type of flows can be observed in the movement of underground water resources, for filtration and water purification processes, the motion of natural gases and oil through oil reservoirs in petroleum engineering and so on. A large amount of research work has been done in the field of chemical reaction, heat and mass transfer. The study of heat and mass transfer with chemical reaction is of great practical importance to engineers and scientists because of its almost universal occurrence in many braches of science and engineering.

An extensive contribution on heat and mass transfer flow has been made by Gebhart [1] to highlight the insight on the phenomena. Gebhart and Pera [2] studied heat and mass transfer flow under various flow situations. Therefore several authors, viz. Raptis and Soundalgekar [3], Agrawal et. al. [4], Jha and Singh [5], Jha and Prasad [6] have paid attention to the study of MHD free convection and mass transfer flows. Abdusattar [7] and Soundalgekar et. al. [8] also analyzed about MHD free convection through an infinite vertical plate. A numerical solution of unsteady free convection and mass transfer flow is presented by Alam and Rahman [9] when a viscous, incompressible fluid flows along an infinite vertical porous plate embedded in a porous medium is considered.Senapati and Dhal [10] have studied magnetic effect on mass and heat transfer of a hydrodynamic flow past a vertical oscillating plate in presence of chemical reaction. Senapati et al.[11] have discussed the

mass transfer effects on MHD unsteady free convective Walter's memory flow with constant suction and heat sink .

It is proposed to study the Chemical reaction effect on MHD Free Convection and Mass Transfer Flow past a Vertical Flat Plate with porous medium.

II. FORMULATION OF PROBLEM

Consider a two dimensional steady free convection heat and mass transfer flow of an incompressible, electrically conducting and viscous fluid past an electrically non-conducting continuously moving vertical flat plate through porous medium in presence chemically reaction species . Introducing a Cartesian co-ordinate system, *x*-axis is chosen along the plate in the direction of flow and *y*-axis normal to it. A uniform magnetic field $B_0(x)$ is applied normally to the flow region. The plate is maintained at a constant temperature T_w and the concentration is maintained at a constant value C_w. The temperature of ambient flow is T_∞ and the concentration of uniform flow is C_∞. Considering the magnetic Reynold's number to be very small, the induced magnetic field is assumed to be negligible, Considering the Joule heating and viscous dissipation terms to negligible and that the magnetic field is not enough to cause Joule heating, the term due to electrical dissipation is neglected in the energy equation. The density is considered a linear function of temperature and species concentration so that by usual Boussinesq's approximation, the steady flow is governed by the following equations:

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0 \tag{1}$$

$$u\frac{\partial u}{\partial x}+v\frac{\partial v}{\partial y}=\nu\frac{\partial^2 u}{\partial y^2}+g\beta(T-T_\infty)+g\beta_c(C-C_\infty)-\frac{\sigma B_0^2 u}{\rho}-\frac{u}{K'} \tag{2}$$

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\frac{K}{\rho C_p}\frac{\partial^2 T}{\partial y^2}+Q(T-T_\infty) \tag{3}$$

$$u\frac{\partial C}{\partial x}+v\frac{\partial C}{\partial y}=D_M\frac{\partial^2 T}{\partial y^2}+D_T\frac{\partial^2 T}{\partial y^2}-R'(C-C_\infty) \tag{4}$$

with boundary conditions

$$\left.\begin{array}{l} u=U_0\ ,v=V_0(x).\ \mathrm{T}=\mathrm{T}_w\ ,C=C_w\ \text{ at y=0} \\ u=0\ ,v=0\ ,T=T_\infty\ ,C=C_\infty\ as\ y\to\infty \end{array}\right\} \tag{5}$$

where u and v are velocity components along x-axis and y-axis respectively, g is acceleration due to gravity, T is the temperature. k is thermal conductivity, σ is the electrical conductivity, D_M is the molecular diffusivity,U_0 is the uniform velocity, C is the concentration of species, $B_0(x)$ is the uniform magnetic field, C_P is the specific heat at constant pressure, Q is the constant heat source(absorption type), D_T is the thermal diffusivity, C(x) is variable concentration at the plate, $V_0(x)$ is the suction velocity, ρ is the density, ν is the kinematic viscosity, β is the volumetric coefficient of thermal expansion and β_c is the volumetric coefficient of thermal expansion with concentration and the other symbols have their usual meaning. For similarity solution, the plate concentration C(x) is considered to be $C(x)=C_\infty+(C_w-C_\infty)x$.

Let us introduce the following local similarity variables in equation

$$\left.\begin{array}{l} \psi=\sqrt{2\nu x U_0}\ f(\eta)\ ,\eta=y\sqrt{\frac{U_0}{2\nu x}}\ ,\theta=\frac{T-T_\infty}{T_w-T_\infty}\ ,\phi=\frac{C-C_\infty}{C_w-C_\infty} \\ Pr=\frac{\mu C_p}{k}\ ,Gr=\frac{2xg\beta(T_w-T_\infty)}{U_0^2}\ ,Gm=\frac{2xg\beta_c(C_w-C_\infty)}{U_0^2}\ ,Sc=\frac{\nu}{D_M y}\ ,M=\frac{2x\sigma B_0^2}{U_0\rho} \\ \frac{1}{K}=\frac{2x}{U_0K'}\ ,S=\frac{2xQ}{U_0}\ ,R=\frac{2x\nu R'}{U_0}\ ,S_0=\frac{(T_w-T_\infty)}{(C_w-C_\infty)}\ ,f_w=V_0(x)\sqrt{\frac{2x}{\nu U_0}} \end{array}\right\} \tag{6}$$

In equations (2) to (4) with boundary conditions (5) ,we get

$$f'''+ff''-\left(M+\frac{1}{K}\right)f'+Gr\theta+Gm\phi=0 \tag{7}$$

$$\theta''+Prf\theta'-SPr\theta=0 \tag{8}$$

$$\phi''+Scf\phi'-(2Scf'-R)\phi+S_0Sc\theta''=0 \tag{9}$$

with boundary conditions

$$\left.\begin{array}{l} f=f_w, f'=1, \theta=1, \phi=1 \quad at\ \ \eta=0 \\ f'=0\ , \theta=0, \phi=0\ as\ \eta\to\infty \end{array}\right\} \tag{10}$$

where Gr is Grashof number, Gm modified Grashof number, M is magnetic number, Pr is prandtl number, Sc is Schmidt number, K permeability parameter porous medium ,S is heat source parameter ,S_0 is the Soret number, R chemical reaction parameter and f_w is the suction parameter.

III. METHOD OF SOLUTION

To introduce the new variable ξ in place of η ,let us substitute the following

$$\xi = \eta f_w \, , f(\eta) = f_w X(\xi), \theta(\eta) = f_w^2 Y(\xi) \; \phi(\eta) = f_w^2 Z(\xi) \tag{11}$$

In equations (7) – (9) with boundary condition (10),We get

$$X'''(\xi) + X''(\xi)X(\xi) = \epsilon\left(\left(M + \frac{1}{K}\right)X'(\xi) - GrY(\xi) - GmZ(\xi)\right) \tag{12}$$

$$Y''(\xi) + PrX(\xi)Y'(\xi) = \epsilon SPrY \tag{13}$$

$$Z''(\xi) + ScX(\xi)Z'(\xi) - 2ScX'(\xi)Z(\xi) + ScS_0Y''(\xi) = -\epsilon RZ(\xi) \tag{14}$$

with boundary conditions

$$\left.\begin{aligned} &X = 0, X' = \epsilon, Y = \epsilon, Z = \epsilon \;\; at \; \xi = 0 \\ &X' = 0 \, , Y = 0, Z = 0 \qquad as \;\; \xi \to \infty \end{aligned}\right\} \tag{15}$$

where $\epsilon = \frac{1}{f_w^2}$ is very small as suction is very large.

let us substitute the following series in equations (12) to(14) with boundary condition(15)

$$\left.\begin{aligned} &X = 1 + \epsilon X_1 + \epsilon^2 X_2 + \epsilon^3 X_3 + \cdots. \\ &Y = \epsilon Y_1 + \epsilon^2 Y_2 + \epsilon^3 Y_3 + \cdots. \\ &Z = \epsilon Z_1 + \epsilon^2 Z_2 + \epsilon^3 Z_3 + \cdots. \end{aligned}\right\} \tag{16}$$

and by comparing the co-efficient of ϵ , ϵ^2 and ϵ^3 ,we get

First order equations

$$\left.\begin{aligned} &X_1''' + X_1'' = 0 \\ &Y_1'' + prY_1' = 0 \\ &Z_1'' + ScZ_1' + ScS_0 \; Y_1'' = 0 \end{aligned}\right\} \tag{17}$$

with boundry conditions

$$\left.\begin{aligned} &X_1 = 0, X_1' = 1, Y_1 = 1, Z_1 = 1 \text{ at } \xi = 0 \\ &X_1' = 0, Y_1 = 0, Z_1 = 0 \;\; as \; \xi \to \infty \end{aligned}\right\} \tag{18}$$

Second order equations

$$\left.\begin{aligned} &X_2''' + X_2'' + X_1X_1'' = \left(M + \frac{1}{K}\right)X_1' - GrY_1 - GmZ_1 \\ &Y_2'' + Pr(Y_2' + X_1Y_1') = SPrY_1 \\ &Z_2'' + Sc(Z_2' + X_1Z_1') - 2ScX_1' \, Z_1 + ScS_0X_2'' = -RZ_1 \end{aligned}\right\} \tag{19}$$

with boundry conditions

$$\left.\begin{aligned} &X_2 = 0, X_2' = 0, Y_2 = 0, Z_2 = 0 \text{ at } \xi = 0 \\ &X_2' = 0, Y_2 = 0, Z_2 = 0 \;\; as \; \xi \to \infty \end{aligned}\right\} \tag{20}$$

Third order equations

$$\left.\begin{aligned} &X_3''' + X_3'' + X_1X_2'' + X_1''X_2 = \left(M + \frac{1}{K}\right)X_2' - GrY_2 - GmZ_2 \\ &Y_3'' + +Pr(X_2Y_1' + Y_2'X_1 + Y_3') = SPrY_2 \\ &Z_3'' + Sc(Z_3' + Z_2'X_1 + Z_1'X_2) - 2Sc(Z_2X_1' + Z_1X_2') + ScS_0Y_3'' = -RZ_2 \end{aligned}\right\} \tag{21}$$

with boundry conditions

$$\left.\begin{aligned} &X_3 = 0, X_3' = 0, Y_3 = 0, Z_3 = 0 \text{ at } \xi = 0 \\ &X_3' = 0, Y_3 = 0, Z_3 = 0 \;\; as \; \xi \to \infty \end{aligned}\right\} \tag{22}$$

By solving (17) with boundary condition (18) we get

$$\left.\begin{aligned} &X_1 = 1 - e^{-\xi} \\ &Y_1 = e^{-Pr\xi} \\ &Z_1 = (1 - A_1)e^{-Sc\xi} + A_1e^{-Pr\xi} \end{aligned}\right\} \tag{23}$$

By solving (19) with boundary condition (20) we get

$$X_2 = A_5 + (A_4 + \xi A_6)e^{-\xi} + \frac{e^{-2\xi}}{4} + A_2 e^{-Sc\xi} + A_3 e^{-Pr\xi}$$
$$Y_2 = (A_6 + \xi A_7)e^{-Pr\xi} + A_8 e^{-(1+Pr)\xi}$$
$$Z_2 = B_8 e^{-Sc\xi} + B_1 \xi e^{-Sc\xi} + B_2 e^{-Pr\xi} + B_3 e^{-(Sc+1)\xi} + B_4 e^{-(Pr+1)\xi} + B_5 e^{-2\xi} + B_6 e^{-\xi} + B_7 \xi e^{-\xi} \quad (24)$$

By solving (21) with boundary condition (22) we get

$$X_3 = A_{17} + A_{16}e^{-\xi} + A_9 e^{-(Pr+1)\xi} + A_{10}e^{-(Sc+1)\xi} + A_{11}e^{-Pr\xi} + A_{12}e^{-Sc\xi} + \frac{2}{45}e^{-3\xi} + A_{13}e^{-2\xi} + A_{14}\xi e^{-\xi} + A_{15}\xi^2 e^{-\xi}$$

$$Y_3 = A_{18}e^{-Pr\xi} + A_{19}e^{-(Sr+Pr)\xi} + A_{20}e^{-(2+Pr)\xi} + \frac{A_3}{2}e^{-2Pr\xi} + A_{21}e^{-(1+Pr)\xi} + A_{22}\xi e^{-Pr\xi} + A_{23}\xi^2 e^{-Pr\xi} + A_{24}\xi e^{-(1+Pr)\xi}$$

$$Z_3 = B_9 \xi e^{-Sc\xi} + B_{10}e^{-Pr\xi} + B_{11}e^{-(1+Sc)\xi} + B_{12}e^{-(1+Pr)\xi} + B_{13}e^{-(Pr+Sc)\xi} + B_{14}e^{-(2+Pr)\xi} + B_{15}e^{-(2+Sc)\xi} + B_{16}e^{-2Pr\xi} + B_{17}e^{-2\xi Sc} + B_{18}e^{-2\xi} + B_{20}e^{-\xi} + B_{21}\xi e^{-\xi} + B_{22}\xi e^{-2\xi} + B_{23}\xi^2 e^{-Sc\xi} + B_{24}\xi e^{-Pr\xi} + B_{25}\xi e^{-(1+Sc)\xi} + B_{26}\xi e^{-(1+Pr)\xi} + B_{27}\xi^2 e^{-Pr\xi} + B_{28}\xi e^{-Pr\xi} + B_{29}e^{-Sc\xi} \quad (25)$$

Using equations (16) in equation (11) with the help of equations (23) to (25) we have obtained the velocity, the temperature and concentration fields as follows

Velocity Distribution

$$u = U_0 f'(\eta) = U_0 f_w^2 X'(\xi) = U_0[X_1'(\xi) + \epsilon X_2'(\xi) + \epsilon^2 X_3'(\xi)] \quad (26)$$

Temperature Distribution

$$\theta = f_w^2 Y(\xi) = Y_1(\xi) + \epsilon Y_2(\xi) + \epsilon^2 Y_3(\xi) \quad (27)$$

and mass concentration Distribution

$$\phi = f_w^2 Z(\xi) = Z_1(\xi) + \epsilon Z_2(\xi) + \epsilon^2 Z_3(\xi) \quad (28)$$

The main quantities of physical interest are the local skin-friction, local Nusselt number and the local Sherwood number. The equation defining the wall skin-friction as

$$\mu\left(\frac{\partial u}{\partial y}\right)_{y=0}$$

So the dimensionless skin friction is

$$\tau = 1 + \epsilon\left(A_6 - A_4 - PrA_3 - ScA_2 - \frac{1}{2}\right) + \epsilon^2\left(A_{17} - A_{16} - (Pr+1)A_9 - (Sc+1)A_{10} - PrA_{11} - ScA_{12} - 2A_{13} + A_{14} - \frac{2}{15}\right)$$

The local Nusselt number is defined as $-\left(\frac{\partial T}{\partial y}\right)_{y=0}$

So the dimensionless Nusselt Number is

$$Nu = -Pr + \epsilon\big((-A_6 Pr + A_7) - (1+Pr)A_8\big) + \epsilon^2(-PrA_{18} - (Sr+Pr)A_{19} - (2+Pr)A_{20} - 2PrA_3 - (1+Pr)A_{21} + A_{22} + A_{24})$$

The local Sherwood number is defined as $-\left(\frac{\partial C}{\partial y}\right)_{y=0}$

So the dimensionless Sherwood number

$$Sh = -Sc(1-A_1) - PrA_1 + \epsilon(-ScB_8 + B_1 - PrB_2 - (Sc+1)B_3 - (Pr+1)B_4 - 2B_5 - B_6 + B_7) + \epsilon^2(B_9 - PrB_{10} - (1+Sc)B_{11} - (1+Pr)B_{12} - (Pr+Sc)B_{13} - (2+Pr)B_{14} - (2+Sc)B_{15} - 2PrB_{16} - 2ScB_{17} - 2B_{18} - B_{20} + B_{21} + B_{22} + B_{24} + B_{25} + B_{26} + B_{28} - ScB_{29})$$

where

$$A_1 = \frac{ScS_0Pr^2}{ScPr - Pr^2}, A_2 = \frac{Gm(1-A_1)}{Sc^3 - Sc^2}, A_3 = \frac{Gr + GmA_1}{Pr^3 - Pr^2}, A_4 = \frac{1}{2} + M + \frac{1}{K} - PrA_2 - ScA_1,$$
$$A_5 = -\left(A_4 + A_2 + A_3 + \frac{1}{4}\right), A_6 = \frac{Pr^2}{(1+Pr)}, A_7 = \frac{Pr^2 + SPr}{Pr}, A_8 = -\frac{Pr^2}{(1+Pr)}$$

$$,A_9 = \frac{A_3+A_8Gr+GmB_9-A_3Pr^2}{(Pr+1)^3-(Pr+1)^2}, A_{10} = \frac{A_2+GmB_3-A_2Sc^2}{(Sc+1)^3-(Sc+1)^2}, A_{11} = \frac{A_3Pr^2+Gr\ A_6+GmB_2+\left(M+\frac{1}{K}\right)PrA_3}{Pr^3-Pr^2},$$

$$A_{12} = \frac{A_2Sc^2+Sc\left(M+\frac{1}{K}\right)A_2+GmA_8}{Sc^3-Sc^2}, A_{13} = \frac{-2A_6+1+GmB_5+\left(M+\frac{1}{K}\right)/2}{4},$$

$$A_{14} = -\left(A_5 + A_4 + 2A_6 + GmB_6 - \left(M+\frac{1}{K}\right)A_6A_4\right) - 2\left(A_6 + GmB_1 + A_6\left(M+\frac{1}{K}\right)\right),$$

$$A_{15} = \frac{\left(A_6+GmB_1+A_6\left(M+\frac{1}{K}\right)\right)}{-2},$$

$$A_{16} = -A_9(Pr+1) - A_1(Sc+1) - PrA_{11} - ScA_{12} - 2A_{13} + A_{14} + 2A_{15} - \frac{2}{15},$$

$$A_{17} = -\left(A_{16} + A_9 + A_{10} + A_{11} + A_{12} + A_{13} + \frac{2}{45}\right)$$

$$A_{19} = \frac{Pr^2A_2}{(Sc+Pr)^2-Pr(Sc+Pr)}, A_{20} = \frac{Pr^2-4PrA_8(Pr+1)}{4((2+Pr)^2-Pr(2+Pr))},$$

$$A_{21} = \frac{SPrA_8+Pr^2A_9+PrA_8(1+Pr)-Pr^2A_6+PrA_7}{(1+Pr)^2-Pr(1+Pr)} + \frac{Pr^2A_6-Pr^2A_7}{(1+Pr)},$$

$$A_{22} = \frac{SPrA_6+Pr^2A_5+Pr^2A_6-PrA_7}{-Pr} + \frac{SPrA_7+Pr^2A_7}{-Pr^2},$$

$$A_{23} = \frac{SPrA_7+Pr^2A_7}{2}, A_{24} = \frac{Pr^2(A_6-A_7)}{1+Pr}, A_{18} = -\left(A_{19} + A_{20} + A_{21} + \frac{A_3}{2}\right)$$

$$B_1 = \left(Sc(A_1-1) + A_2Sc^2 + \frac{R(1-A_1)}{Sc}\right), B_2 = \frac{ScPrA_1-ScS_0A_3Pr^2-RA_1}{Pr^2-PrSc},$$

$$B_3 = \frac{2Sc(1-A_1)+Sc^2(A_1-1)}{(Sc+1)^2-Sc(Sc+1)}, B_4 = \frac{2ScA_1-ScPrA_1}{(Pr+1)^2-Sc(Pr+1)}, B_5 = \frac{ScS_0}{4-2Sc},$$

$$B_6 = \frac{2A_6ScS_0-ScS_0A_6}{1-Sc} + \frac{ScS_0A_6(Sc-2)}{(1-Sc)^2}, B_7 = -\frac{ScS_0A_6}{1-Sc},$$

$$B_8 = -(B_2 + B_3 + B_4 + B_5 + B_6)$$

$$B_9 = \frac{-RB_8+Sc^2B_8+Sc^2(1-A_1)A_5}{-Sc} + \frac{-RB_1+Sc^2B_1}{-Sc^2},$$

$$B_{10} = \frac{-RB_2-ScS_0A_{18}Pr^2+2PrScS_0A_{22}-2ScS_0A_{23}+PrScA_1A_5+ScPrB_2}{Pr^2-ScPr} + \frac{(2Pr-Sc)(2A_{23}PrScS_0-ScS_0A_{22}Pr^2)}{Pr^2(Pr-Sc)^2} + \frac{-ScS_0A_{23}}{(Pr+Sc)^2}$$

$$B_{11} = \frac{(2+3Sc)(2ScB_1-Sc^2B_1-Sc^2(A_1-1)A_6-2Sc(1-A_1)A_6)}{(1+Sc)^2(1+2Sc)^2} + \frac{-RB_3+2ScB_8+2Sc(1-A_1)(A_6-A_4)-A_4Sc^2(A_1-1-B_8)+Sc(Sc+1)B_3}{(Sc+1)^2-Sc(Sc+1)}$$

$$B_{12} = \frac{-RB_4-(ScS_0A_{21}+ScS_0A_{24})(1+Pr)^2+ScB_4(Pr+1)-ScPr(B_2-A_4A_1)+2Sc(B_2+A_6-A_4)}{(Pr+1)^2-Sc(Pr+1)} + \frac{(2+2Pr+Sc)(ScA_1A_6(Pr-2)-2ScS_0A_{24}(Pr+1))}{(1+Pr)(1+Pr+Sc)^2}$$

$$B_{13} = \frac{-ScS_0A_{19}(Sc+Pr)^2+(Sc-2Pr)ScA_3(1-A_1)+ScA_1A_2(Pr-2Sc)}{(Pr+Sc)^2-Sc(Pr+Sc)}$$

$$B_{14} = \frac{-ScS_0A_{20}(2+Pr)^2+2ScB_4-Sc(1+Pr)B_4-ScA_1+\left(\frac{ScPrA_1}{4}\right)}{(Pr+2)^2-Sc(Pr+2)}$$

$$B_{15} = \frac{ScB_3(1-Sc)+(1-A_1)\left(\frac{Sc^2}{4}-Sc\right)}{(Sc+2)^2-Sc(Sc+2)}, B_{16} = \frac{-2ScS_0Pr^2A_3-ScPrA_1A_3}{4Pr^2-2PrSc},$$

$$B_{17} = \frac{A_2(A_1-1)}{2}, B_{18} = \frac{-RB_5+Sc(B_6+2B_5+B_7)}{4-2Sc} + \frac{ScB_7(4-Sc)}{4(2-Sc)^2}$$

$$B_{20} = \frac{-RB_6+Sc(B_6-B_7)}{1-Sc} + \frac{(2+Sc)(-RB_7+3ScB_7)}{(1+Sc)^2}$$

$$B_{21} = \frac{B_7(Sc-R)}{1+Sc}, B_{22} = \frac{ScB_7}{2(2-Sc)}, B_{23} = \frac{B_1(Sc^2-R)}{-2Sc},$$

$$B_{24} = \frac{2PrScS_0A_{23}-ScS_0Pr^2A_{22}}{Pr(Pr-Sc)}, B_{25} = \frac{(2Sc-Sc^2)(B_1+A_6(A_1-1))}{(1+Sc)(1+2Sc)}$$

$$B_{26} = \frac{-ScS_0A_{24}(Pr+1)+(ScPr-2Sc)A_6A_1}{(1+pr)(1+Pr+Sc)}, B_{27} = \frac{-ScS_0A_{23}Pr^2}{Pr(Pr+Sc)}$$

$$B_{28} = \frac{-ScS_0A_{23}Pr^2(4Pr+2Sc)}{Pr^2(Pr+Sc)^2}$$

$$B_{29} = -(B_{10} + B_{11} + B_{12} + B_{13} + B_{14} + B_{15} + B_{16} + B_{17} + B_{18} + B_{20})$$

IV. RESULTS AND DISCUSSION

In this paper we have studied the Chemical reaction effect on MHD Free Convection and Mass Transfer Flow past a Vertical Flat Plate with porous medium. The effect of the parameters Gr, Gm, M, K, R, Pr, S,So,fw, and Sc on flow characteristics have been studied and shown by means of graphs and tables. In order to

have physical correlations, we choose suitable values of flow parameters. The graphs of velocities, heat and mass concentration are taken w.r.t. η and the values of Skin friction, Nusselt number and Sherwood Number are shown in the table for different values of flow parameters

Velocity profiles: The velocity profiles are depicted in Figs 1-4. Figure-(1) shows the effect of the parameters Gr and Gm on velocity at any point of the fluid, when Sc=0.22,Pr=0.71,M=2,K=2,R=2 ,So=0.5 ,S=0.5 and fw=0.5.It is noticed that the velocity decreases with the increase Grashof number (Gr), where as increases with the increase of Modified Grashof number (Gm).

Figure-(2) shows the effect of the parameters M,K and R on velocity at any point of the fluid , when Sc=0.22,Pr=0.71, Gm=15,Gr=10 ,So=0.5 ,S=0.5 and fw=0.5. . It is noticed that the velocity increases with the increase of permeability of porous medium (K) and Chemical reaction parameter (R),where as decreases with the increase of magnetic parameter (M).

Figure-(3) shows the effect of the parameters So,Sc and fw on velocity at any point of the fluid, when Pr=0.71,M=2,K=2,R=2 ,Gr=10 and Gm=15 .It is noticed that the velocity decreases with the increase of Soret number (So) where as increases with Schmidt number (Sc) and suction parameter (fw).

Figure-(4) shows the effect of the parameters S and Pr on velocity at any point of the fluid, when Sc=0.22,Gr=10,M=2,K=2,R=2 ,So=0.5 ,Gm=15 and fw=0.5.It is noticed that the velocity decreases with the increase of source parameter (S),where as increases with Prandtl number (Pr)

Heat Profile: Figure-(5) shows the effect of the parameters fw, Pr and So on Heat profile at any point of the fluid ,when Sc=0.22,Gr=10,M=2,K=2,R=2 and Gm=15 . It is noticed that the temperature falls in the increase of Prandtl number (Pr) and suction parameter (fw) , whereas temperature rises with Soret number (So).

Mass concentration profile: Figure-(6) shows the effect of the parameters Scand R on mass concentration profile at any point of the fluid, when Gr=10,M=2,K=2,S=2 ,So=2 ,Gm=15 and fw=0.5.It is noticed that the mass concentration increases with the increase of Schmidt number (Sc) and chemical reaction parameter(R) .

Figure-(7) shows the effect of the parameters So , S and fw on mass concentration profile at any point of the fluid ,when Pr=0.71, Sc=0.22,Gr=10,M=2,K=2,R=2 , Gm=15 .It is noticed that the mass concentration increases with the increase of suction parameter (fw) and Soret number (So),whereas decreases with the increase of source parameter (S).

Figure-(8) shows the effect of the parameters Pr and M on mass concentration profile at any point of the fluid when Gr=10,K=2,S=2 ,So=2 ,Gm=15 ,Sc=0.22 and fw=0.5 .It is noticed that the mass concentration decreases with the increase of Prandtl number (Pr) and magnetic parameter (M).

Skin friction: The numerical values of skin-friction (τ) at the plate due to variation in Grashof number (Gr), modified Grashof number (Gm), heat source parameter (S), Soret number (So), magnetic parameter (M), Schmit number (Sc), suction parameter (fw), and Prandtl number (Pr) for externally cooled plate is given in Table-1. It is observed that both the presence of So in the fluid flow decrease the skin-friction .The increase of M, Gr and Gm decreases the skin-friction while an increase in Pr, Sc,fw and R increase the skin-friction.

Table-2 represents the skin-friction for heating of the plate and in this table it is clear that Gm,Sc,So,M and K play the reverses phenomena of the Table-(1) are happened.

Nusselt Number: Table-(3) illustrates the effect of the parameters Pr ,S and fw on Nusselt number at plate, It is observed that Nusselt number increases at the plate with the increase of prandtl number (Pr) ,whereas increases with the increase of source parameter (S) and suction parameter (fw).

Sherwood Number: Table-(4), illustrates the effect of the parameters of Sc, S, So, fw, Pr and R on Sherwood Number at plate. It is noticed that Sherwood Number at plate increases with the increase of Schmidt number (Sc) , reaction parameter (R) and Soret number (So), whereas decreases with the increase of source parameter (S), Prandtl number (Pr) and suction parameter (fw).

Table-1: Numerical values of Skin-Friction (τ) due to cooling of the plate.

Sl.No	Gm	Gr	Pr	Sc	S	So	R	fw	M	K	Skin Friction(τ)
1	10	10	0.71	0.22	2	2	2	0.5	2	2	-164220
2	12	10	0.71	0.22	2	2	2	0.5	2	2	-167189
3	15	10	0.71	0.22	2	2	2	0.5	2	2	-171643
4	10	12	0.71	0.22	2	2	2	0.5	2	2	-211390
5	10	15	0.71	0.22	2	2	2	0.5	2	2	-291833
6	10	10	0.71	0.3	2	2	2	0.5	2	2	-137359
7	10	10	0.8	0.22	2	2	2	0.5	2	2	-150937
8	10	10	0.71	0.22	2	2	2	0.5	4	2	-275392
9	10	10	0.71	0.22	2	2	2	0.5	5	2	-330965
10	10	10	0.71	0.22	2	2	2	0.5	2	4	-150321

11	10	10	0.71	0.22	2	2	2	0.5	2	5	-147541
12	10	10	0.71	0.22	2	2	3	0.5	2	2	-141856
13	10	10	0.71	0.22	2	2	4	0.5	2	2	-101270
14	10	10	0.71	0.22	2	3	2	0.5	2	2	-195444
15	10	10	0.71	0.22	2	4	2	0.5	2	2	-223418
16	10	10	0.71	0.22	2	2	2	0.7	2	2	-42991
17	10	10	0.71	0.22	2	2	2	0.8	2	2	-25290

Table-2: Numerical values of Skin-Friction (τ) due to heating of the plate.

Sl.No	Gm	Gr	Sc	Pr	S	So	R	fw	M	K	Skin Friction(τ)
01	-10	-10	0.22	0.71	2	2	2	0.5	2	2	17342
02	-10	-15	0.22	0.71	2	2	2	0.5	2	2	15876
03	-10	-20	0.22	0.71	2	2	2	0.5	2	2	14410
04	-15	-10	0.22	0.71	2	2	2	0.5	2	2	-25545
05	-20	-10	0.22	0.71	2	2	2	0.5	2	2	-10055
06	-10	-10	0.22	0.71	2	2	2	0.5	3	2	73030
07	-10	-10	0.22	0.71	2	2	2	0.5	4	2	128727
08	-10	-10	0.22	0.71	2	2	2	0.5	2	3	8062
09	-10	-10	0.22	0.71	2	2	2	0.5	2	4	4322
10	-10	-10	0.22	0.71	2	2	3	0.5	2	2	-62253
11	-10	-10	0.22	0.71	2	2	4	0.5	2	2	-16007
12	-10	-10	0.22	0.71	2	3	2	0.5	2	2	23021
13	-10	-10	0.22	0.71	2	4	2	0.5	2	2	31947
14	-10	-10	0.22	0.71	3	2	2	0.5	2	2	17342
15	-10	-10	0.22	0.8	2	2	2	0.5	2	2	23868
16	-10	-10	0.3	0.71	2	2	2	0.5	2	2	8085

Table-3: Numerical values of the Rate of Heat Transfer (Nu)

Sl.No	S	Pr	fw	Nu
01	2	0.71	0.5	7304
02	2	0.8	0.5	8333
03	2	0.9	0.5	9534
04	3	0.71	0.5	7173
05	4	0.71	0.5	6996
06	2	0.71	0.8	741
07	2	0.71	0.9	361

Table-4: Numerical values of the Rate of Mass Transfer (Sh)

Sl.No	S	So	Sc	Pr	fw	R	Sh
01	2	2	0.22	0.71	0.5	2	-8388
02	3	2	0.22	0.71	0.5	2	-8423
03	4	2	0.22	0.71	0.5	2	-8463
04	2	3	0.22	0.71	0.5	2	-6891
05	2	4	0.22	0.71	0.5	2	1296
06	2	2	0.22	0.8	0.5	2	-8639
07	2	2	0.22	0.9	0.5	2	-10683
08	2	2	0.3	0.71	0.5	2	-6358
09	2	2	0.4	0.71	0.5	2	11542
10	2	2	0.22	0.71	0.5	3	-382
11	2	2	0.22	0.71	0.5	4	16398
12	2	2	0.22	0.71	0.6	2	-4059
13	2	2	0.22	0.71	0.7	2	-2200

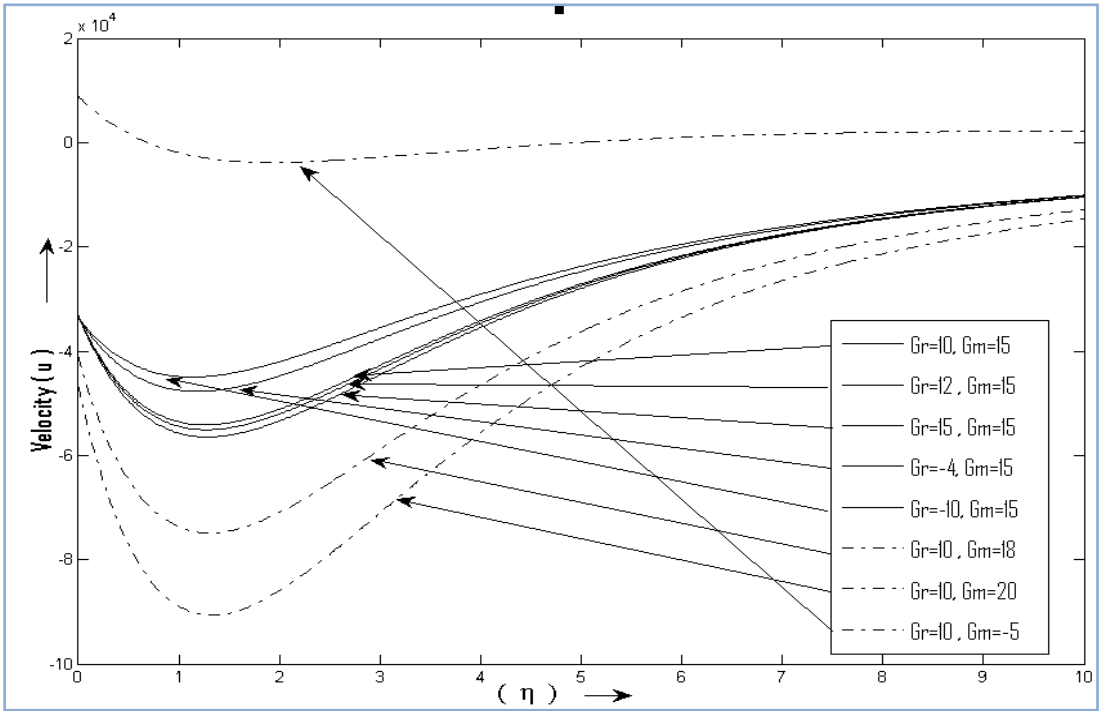

Fig-(1) Effect of Gr and Gm on velocity profile when Sc=0.22,Pr=0.71,M=2,K=2,R=2 ,So=0.5 ,S=0.5 and fw=0.5.

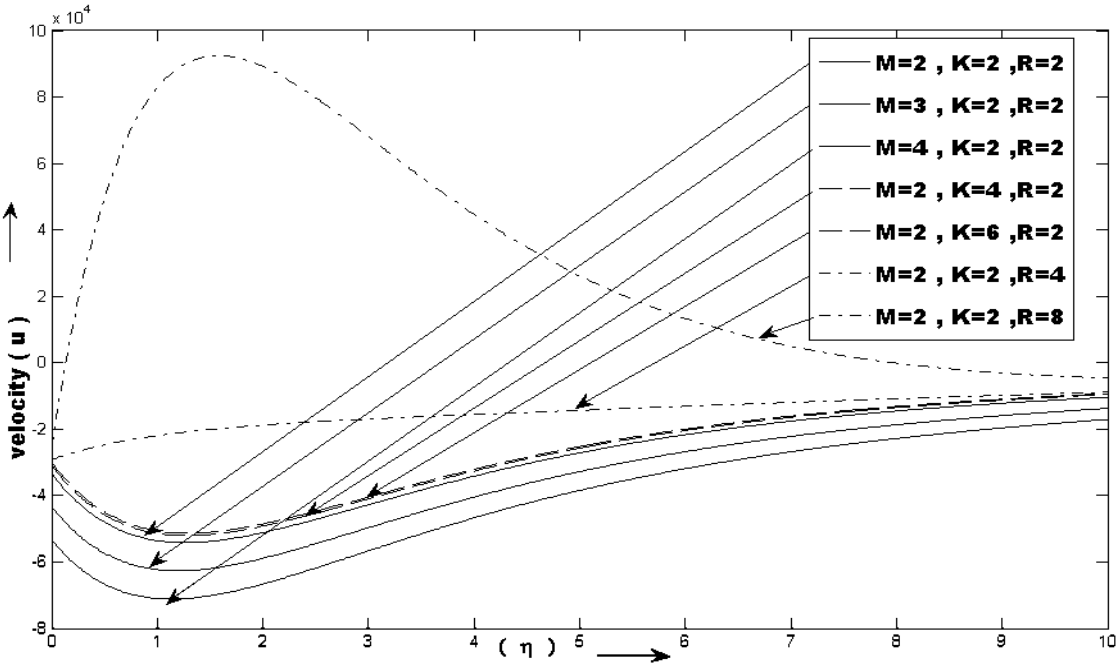

Fig-(2) Effect of M,K and R on velocity profile when Sc=0.22,Pr=0.71, Gm=15,Gr=10 ,So=0.5 ,S=0.5 and fw=0.5.

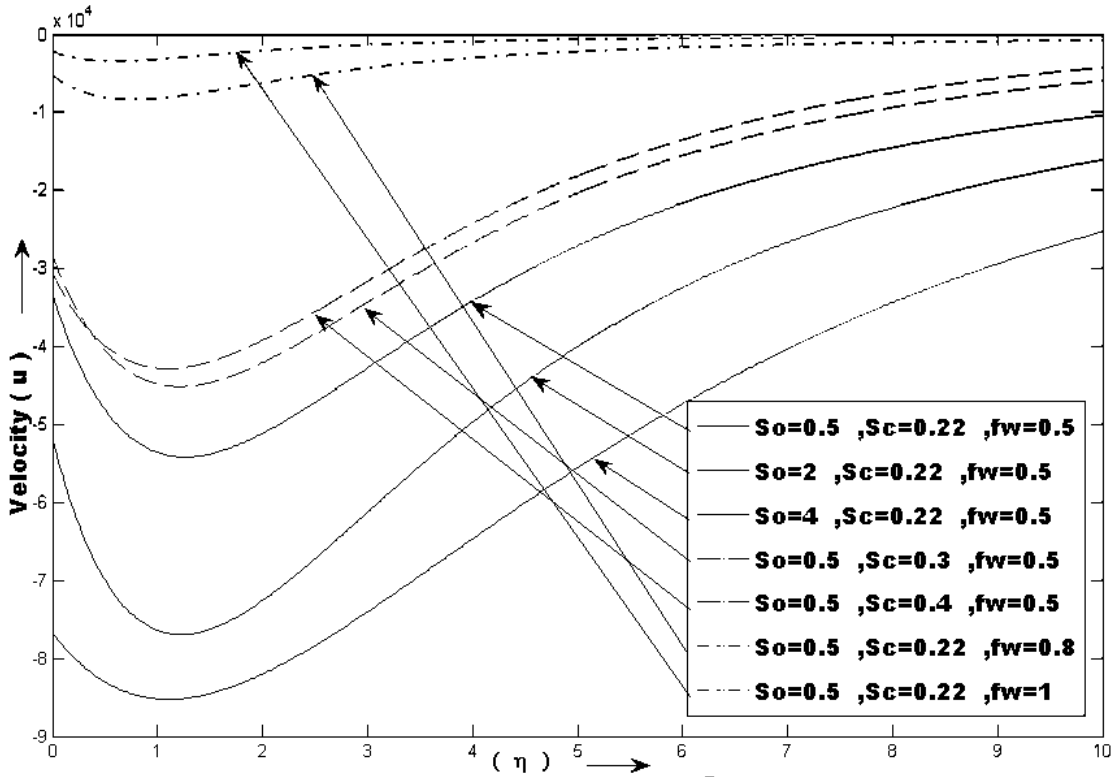

Fig-(3) Effect of So ,Sc and fw on velocity profile when Pr=0.71,M=2,K=2,R=2 ,Gr=10 and Gm=15 .

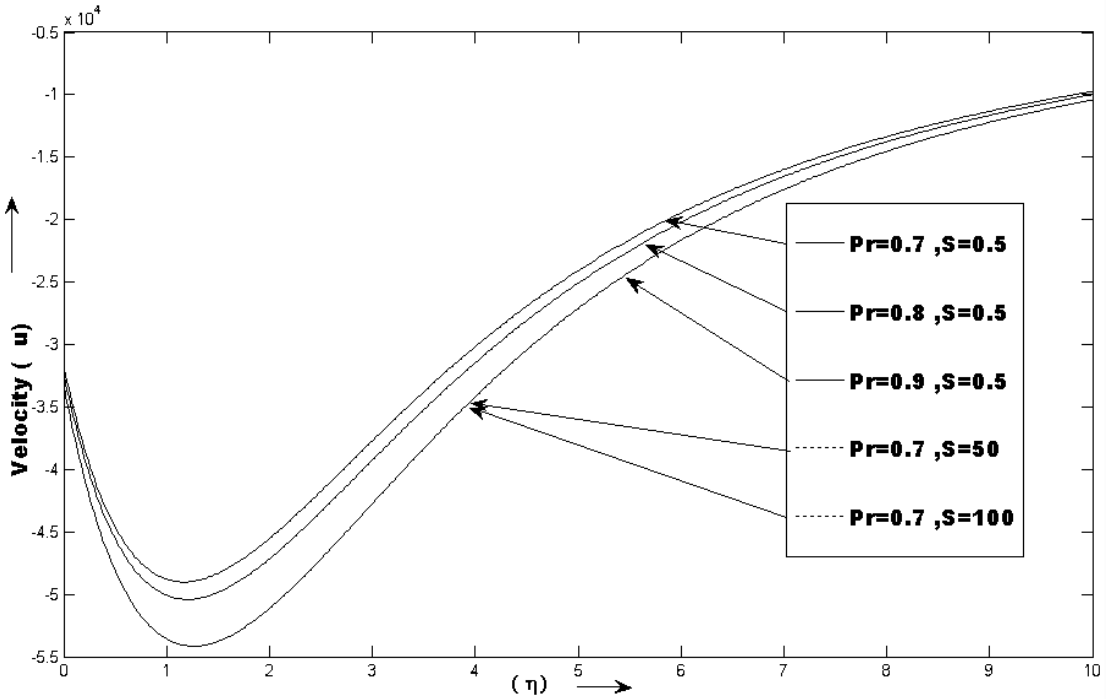

Fig-(4) Effect of Pr and S on velocity profile when Sc=0.22,Gr=10,M=2,K=2,R=2 ,So=0.5 ,Gm=15 and fw=0.5.

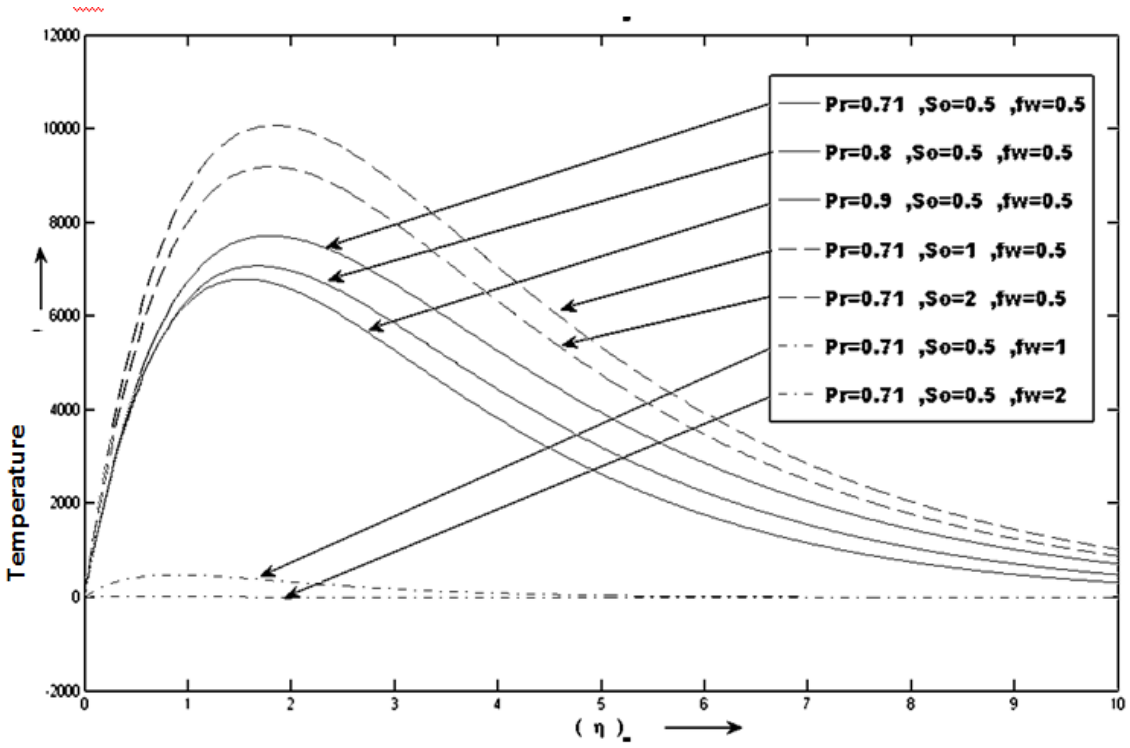

Fig-(5) Effect of fw,Pr and So on Temperature profile when Sc=0.22,Gr=10,M=2,K=2,R=2 and Gm=15

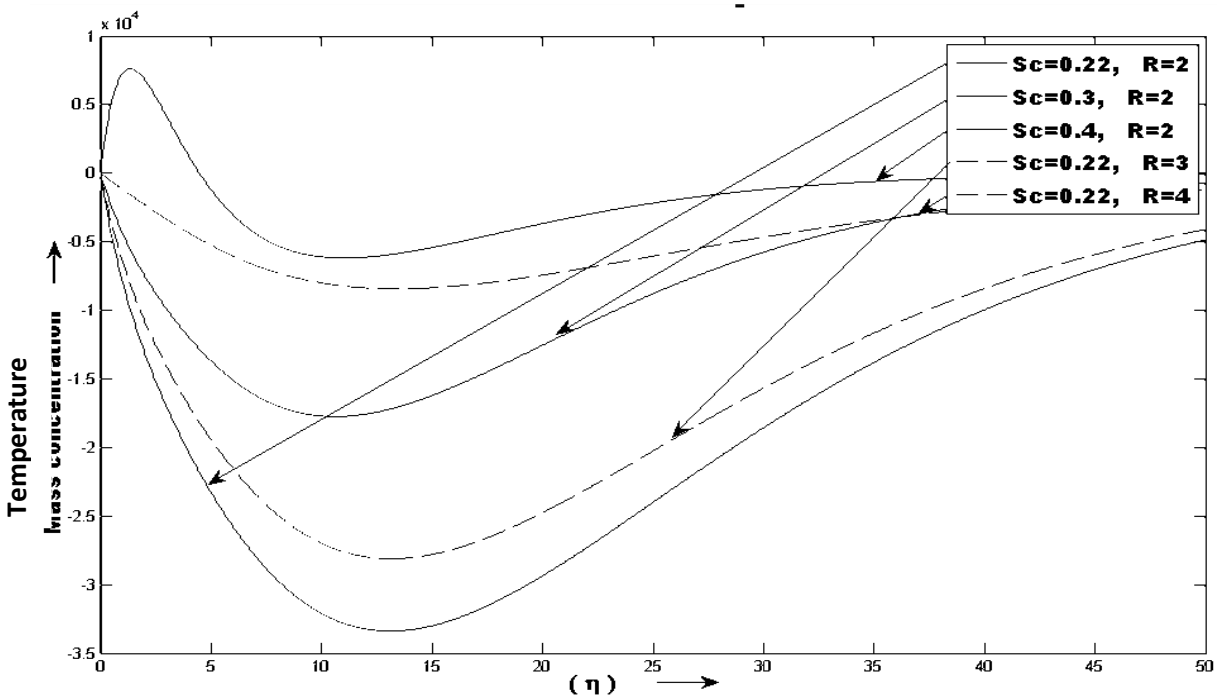

Fig-(6) Effect of R and Sc on mass concentration profile when Gr=10,M=2,K=2,S=2 ,So=2 ,Gm=15 and fw=0.5.

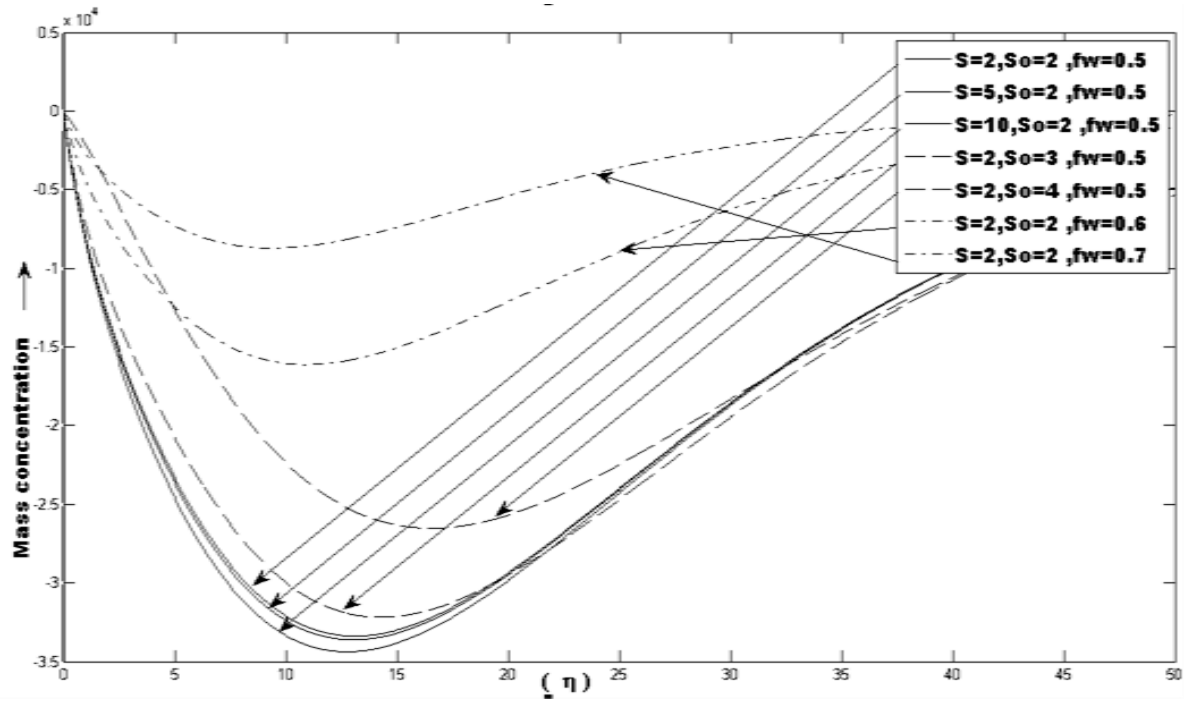

Fig-(7) Effect of S.So and fw on mass concentration profile when Pr=0.71, Sc=0.22,Gr=10,M=2, K=2,R=2 , Gm=15 .

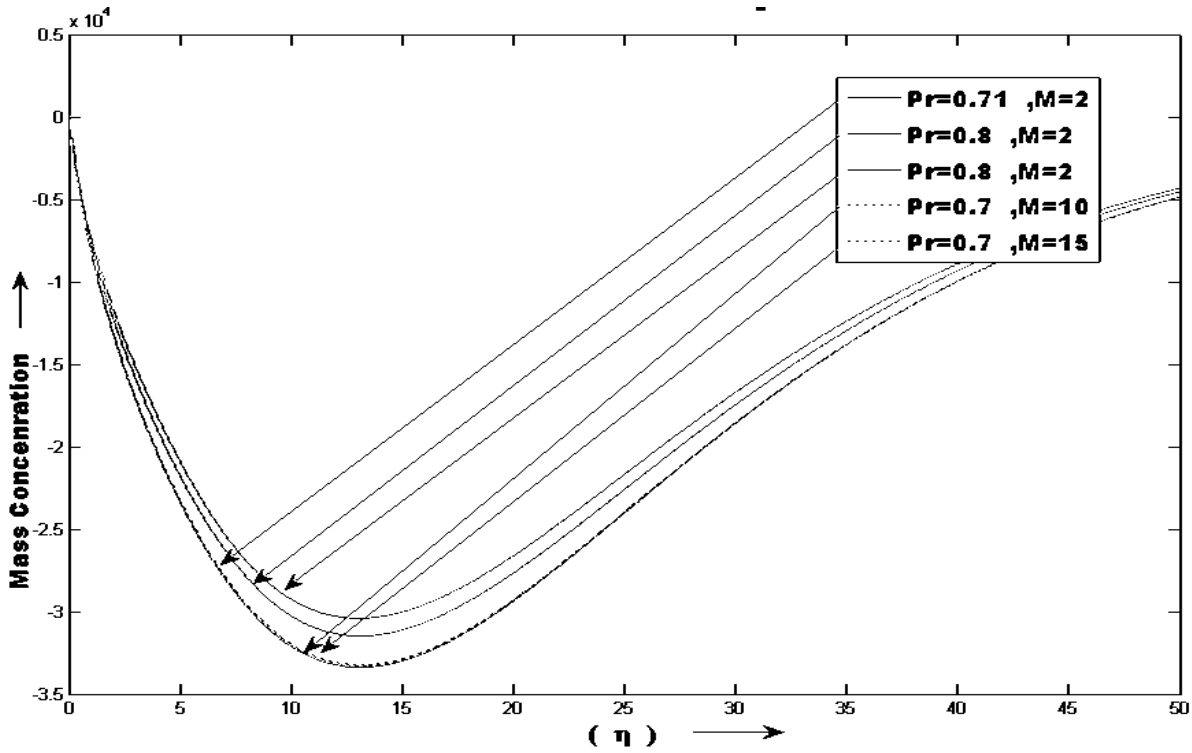

Fig-(8) Effect of Pr and M on mass concentration profile when Gr=10,K=2,S=2 ,So=2 ,Gm=15 ,Sc=0.22 and fw=0.5.

V. CONCLUSION

In this study, the following conclusions Chemical reaction effect on MHD Free Convection and Mass Transfer Flow past a Vertical Flat Plate with porous medium are set out:

i. The velocity increases with the increase in K, R,Sc,fw, and Pr, whereas decreases with the increase in of M,Gr, Gm ,So and S .

ii. The mass concentration of fluid increases with the increase of R,So,Sc and fw ,whereas decreases with increase of M,S,and Pr.

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Analysis of Temperature and Rainfall Trends in Vaal-Harts Irrigation Scheme, South Africa

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Abstract: - Agriculture is crucially dependent on the timely availability of adequate amount of water and a conducive climate. Temperature and rainfall patterns impact the availability of water for agricultural uses. Therefore, temperature and rainfall are twin important environmental factors in agricultural activities such as tillage, planting, irrigation and mechanization. The characteristics of the Vaal-Harts temperature data for year 1996 to 2010 and rainfall data for year 1983 to 2010 were examined in this study using statistical techniques. Basic statistical properties of the data were determined using the mean, variance, coefficient of variation and Pearson's correlation coefficient. Temperature and rainfall observations with the average of about 17.44 were used. The minimum and maximum temperatures recorded were 9.72^0C and 23.52^0C. The Coefficient of variation (CV) was found to be about 29.59. Variance is a measure of how far a set of numbers is spread out; and the variance of this set of observations is 26.625. The average yearly temperature increases insignificantly by a constant of about 0.117 ($p = 0.163$; 95% CI: -0.054 – 0.288), while rainfall shows decreasing trend annually which means that the dry season will be drier. The involvement of non-zero values in the serial correlation indicated the significance of the deterministic component in the data. The results of this analysis enhance our understanding of the characteristics of air temperature and rainfall in the study area for effective planning of farming operations.

Keywords: - *Environment, temperature, rainfall, Vaal Harts*

I. INTRODUCTION

Farming activities and operations like tillage, planting, plant growth, irrigation and mechanization depend on the temperature and rainfall of the prevailing environment. Adequate analysis and prediction of environmental factors like air temperature and rainfall can enhance the effectiveness of these activities for increased agricultural production. Temperature is a measure of the quantity of heat energy possessed by a body or medium as a result of heat transfer. Air temperature is a consequence of radiation heat transfer (thermal radiation) from the sun. Air temperature is an important atmospheric factor in agricultural production and it influences the rate of evapotranspiration which is a significant component of the hydrologic cycle (Ogunlela 1997). Rainfall is also an important climatic variable because of the critical role it plays in agricultural processes indirectly resulting into water logging and salinity (Ojo *et al* 2009).

Statistical analysis has proven to be an efficient tool for analysing and predicting the effects of environmental factors such as air temperature (Ogunlela 1997). A time series statistical analysis is a set of observations generated sequentially over time. The technique can allow the interdependence of successive observations to be taken into account in employing standard statistical tests that assume the independence of observations; and they could also be used in predicting future events. A stationary time series is one whose properties do not change with time. Usually, a stationary time series can be usefully described by its mean, variance and autocorrelation function or spectral density function. Spectral analysis is the method of estimating the spectral density function or spectrum of a given time series (Chatfield 1989). The spectral density function helps in determining which frequencies explain the variance of the series. Some theoretical insights into the spectral analysis technique were given by Wei (1990), which can be used in analyzing hydrologic and meteorological events or other phenomena where periodicities may be present. The application of the spectral analysis technique for the analysis of soil surface roughness under simulated rainfall was also done and it was found to be effective (Ogunlela 1997). Pearson's correlation coefficient is a measure of the correlation (linear

dependence) between two variables *X* and *Y*, giving a value between +1 and −1 inclusive to give the covariance of the two variables divided by the product of their standard deviations. It is used to measure the strength of linear dependence between two variables (Rodgers and Nicewander 1988; Stigler 1989). Since farming and other related activities can be enhanced by accurate analysis of environmental factors like air temperature and rainfall, the focus of this work therefore is to conduct analysis of air temperature and rainfall data for the Vaal Harts irrigation scheme (VHS), South Africa in order to better understand their effect as key environmental factors influencing irrigation system.

II. MATERIALS AND METHODS

The Vaal Harts Irrigation Scheme (VHS) is located in a summer rainfall area of South Africa. This area battles with low, seasonal and irregular rainfall with an average rainfall of 442 mm per year (Jager 1994). The average precipitation in the summer months, October to February varies between 9.1 and 9.6 mm/day while in July precipitation is only 3.6 mm/day. The rainy season in the area is usually from October to March. In the winter months, almost no rainfall occurs. The average rainfall in Jan Kempdrop and in Taung weather stations (close to the study area) is 477 mm and 450 mm respectively (AGIS 2009). The average temperature of the spring and summer months is above 30°C and with the highest in the month of February. The median annual simulated runoff in the area is in the range of 20 to 41 mm, with the lowest 10-year recording at 4.8 to 9.3 mm (Schmidt, and Karnieli 2002).

Rainfall data from 1983 to 2010 and air temperature data from 1996 to 2010 were obtained from the South African Weather Service. For each of these years; the values of the two variables for each month of the year were computed. Basic statistics of mean, variance, standard deviation and coefficient of variation including Pearson's correlation coefficient were determined for the two variables. Pearson's correlation coefficient between the two variables temperature and rainfall were determined to measure the strength of linear dependence between two variables as expressed in equation 1. For a sample of size *n*, the *n* raw scores X_i, Y_i are converted to ranks x_i, y_i and ρ is computed from these:

$$\rho = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}} \quad (1)$$

Where ρ is the Pearson's correlation coefficient,

x_i and $\bar{x}$ are variable 1 and its mean, while y_i and $\bar{y}$ are variable 2 and its mean respectively. The spectral density function helps in determining which frequencies explain the variance of the series. Equation 2 gave the expression of the spectral analysis technique called Spectral density function, g(f);

$$g(f) = 2\left[1 + 2\sum_{t=1}^{\eta} r_1 \cos(2\pi f t)\right]; 0 \le f \le \frac{1}{2} \quad (2)$$

Where, f is the frequency.

Coefficient of variation (CV) aims at describing the dispersion of the variables in such a way that it does not depend on the variable's measurement unit.

III. RESULTS AND DISCUSSION

There were 12 observations of temperature data. The study shows the average yearly minimum and maximum temperatures recorded as 9.72^0C and 23.52^0C respectively. There was a constant increase in temperature over the years, 1996 through 2010. The marginal increases were observed between the years 1998 and 2000, 2002 and 2004 & 2008 and 2010 as shown in Figure 1. The average yearly temperature of the study area increases significantly by a constant of about 0.1168444 (Pearson correlation coefficient, p = 0.163; 95 % confidence level: -0.054 – 0.288) as shown in Tables 1 to 4. The CV for temperature was found to be about 29.590. The variance is a measure of how far a set of numbers is spread out. The variance of this set of observations is 26.625. Figures 2 and 3 showed the spectral density function derived from autocorrelation of Temperature and rainfall respectively, while Figures 1 and 2 showed their graphical patterns. Rainfall data were available for a longer period of years (1983 to 2010) unlike temperature data. Precipitation reached a peak of an average of 60 mm in 1988 and 44 mm in 1991, while the lowest with an average of 12 mm was recorded in 1992 as shown in Figure 4. It was observed that precipitation is maximum in the summer and minimum during winter. The involvement of non-zero values in the serial correlation indicated the significance of the deterministic component in the data.

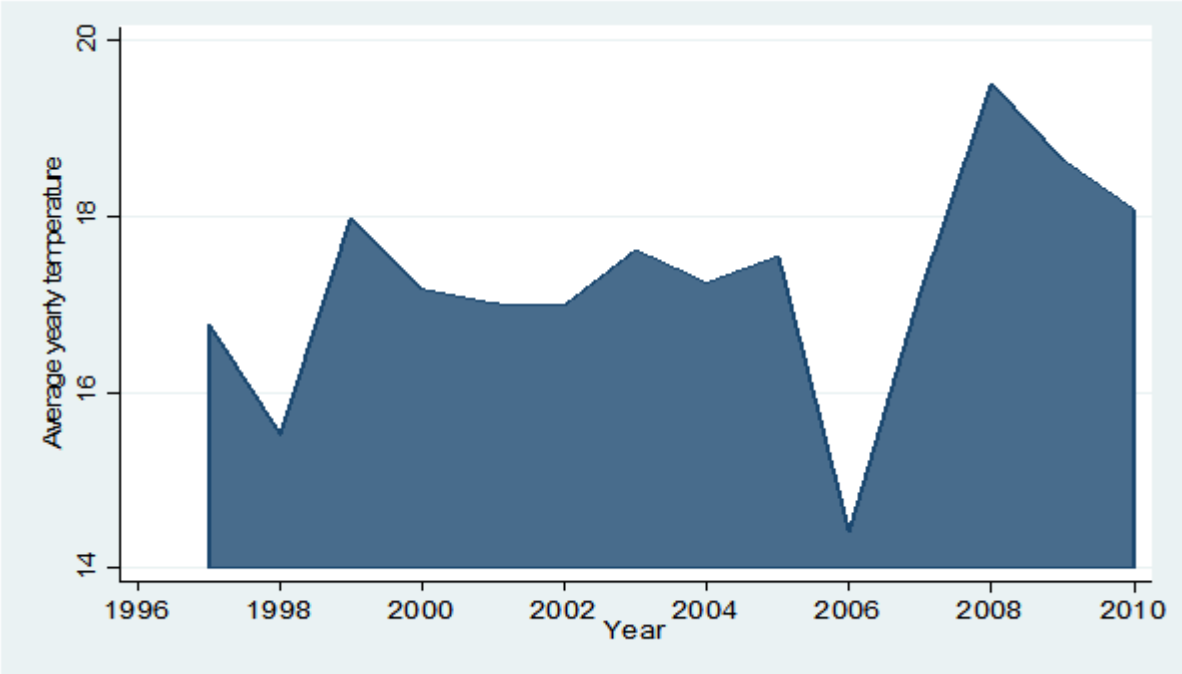

Figure 1: Average yearly temperature for the study area

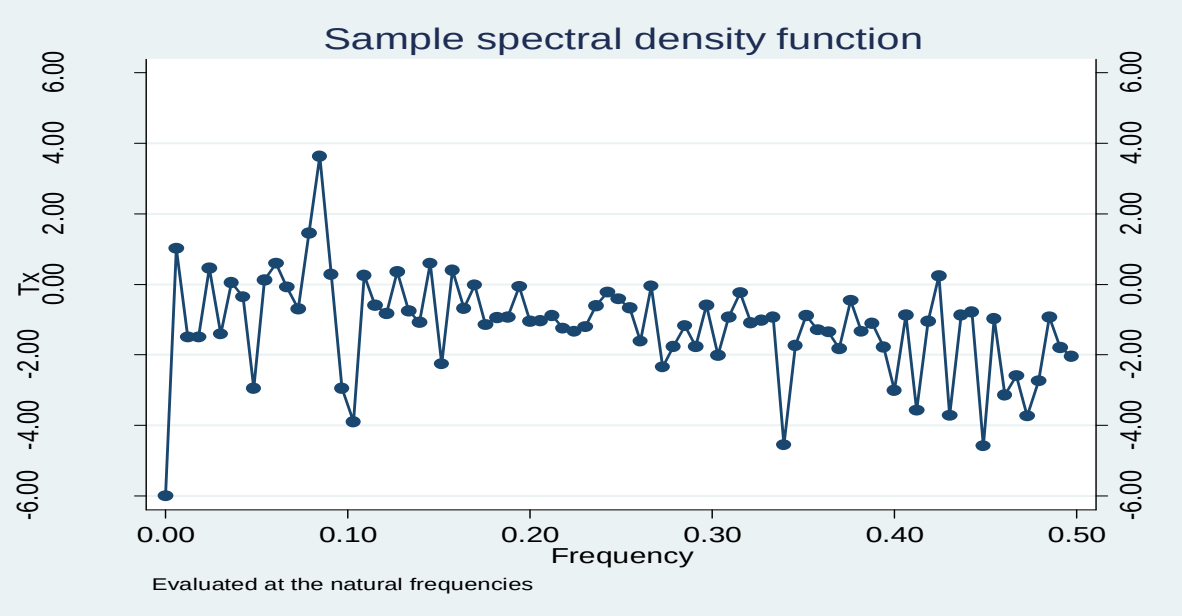

Figure 2: Autocorrelation graph of maximum temperature for VHS

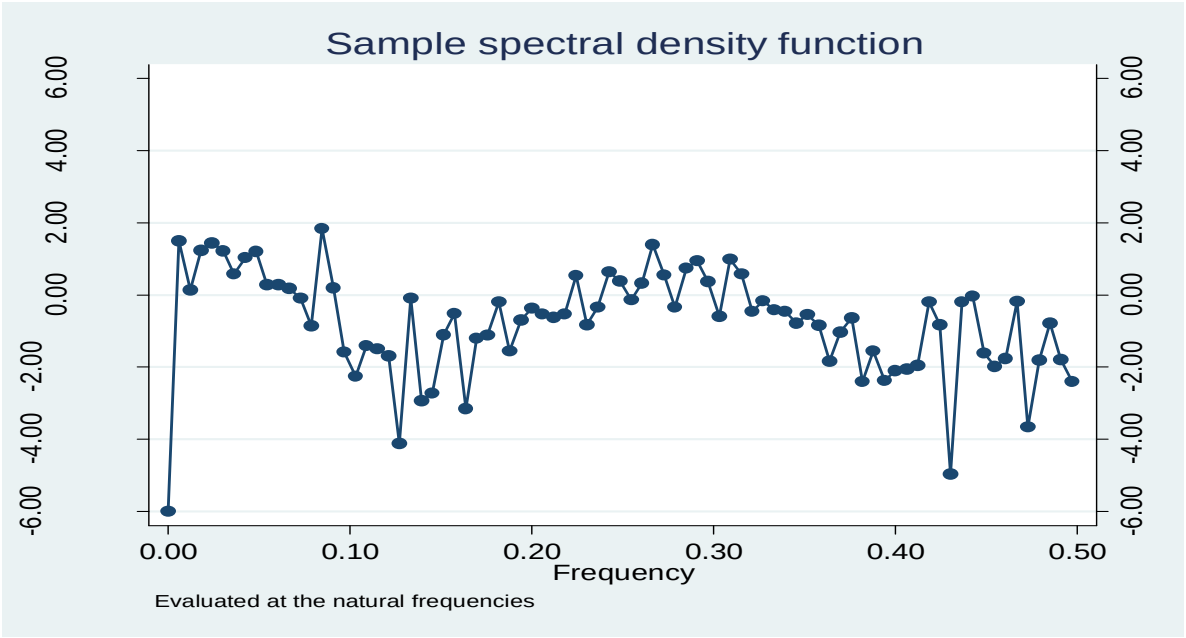

Figure 3: Autocorrelation graph of rainfall for VHS

Table 1: Monthly summary of temperature data

Elem	Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total for the year
Rainfall (mm)	01\01\1996	25\10\2010	116.58	84.48	56.2	53.31	76.23	42.04	3.36	21.72	12.94	40.25	54.31	59.68	621.1
T * (°C)	01\01\1996	25\10\2010	22.4	22.63	21.22	17.16	12.78	9.76	9.72	12.43	16.21	19.81	21.62	23.52	

Table 2: Summary of the analyzed basic temperature data

Variable	Observation	Mean	Std. Dev	Ave. Min.	Ave. Max.
Temp ºC	12	17.438	5.160	9.720	23.520

Table 3: Summary of the analyzed temperature results

Temp mean	Coefficient	Std. Error	T	P > |t|	Ave. Max.	Interval
Years considered	.117 -216.839	.079 157.427	1.490 -1.380	0.163 0.194	-0.544 -559.843	.288 126.165

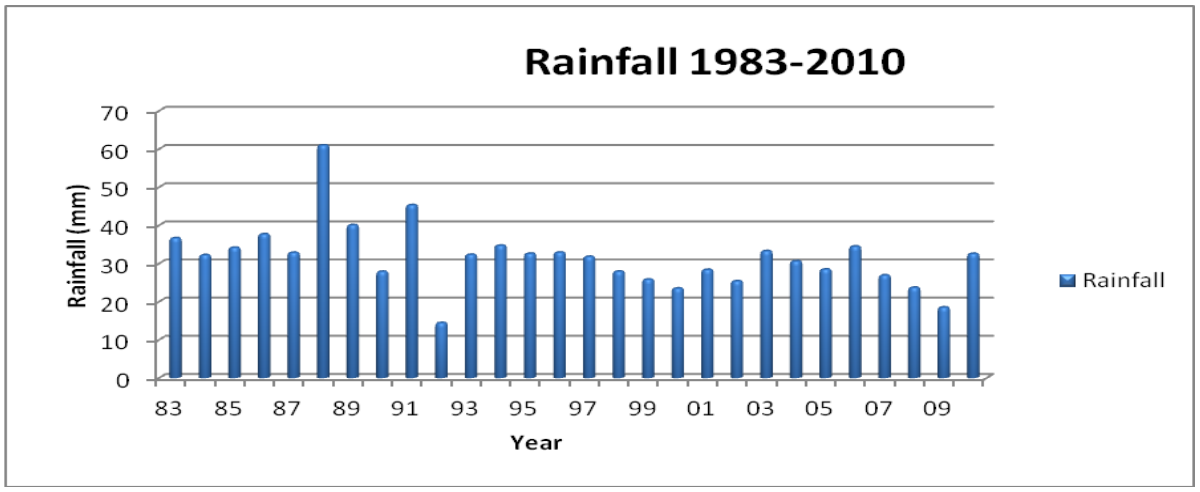

Figure 4: Average yearly rainfall for the study area.

Pearson correlation coefficient was used to test for correlation between rainfall and temperature. The correlation between the two variables was significantly negative (P= -0.036; P < 0.05), meaning that an increase in one resulted in a decrease in the other parameter. However, the strength of the correlation was weak. The strength of the relationship was also very weak as summarized in Table 4.

Table 4: Summary of the analysed weather data

Variable	Obser.	Mean	Std. Dev.	Min	Max
Temp. max ^{o}C	4330	27.237	7.583	8.1	339.2
Temp. min ^{o}C	4332	11.833	24.010	-4.0	195.2
Rainfall (mm)	4802	1.766	10.370	0	304.0

Table 5: Pearson correlation for Temperature and Rainfall

	Temperature	Rain
Temperature	1.000	1.000
Rain	-0.036*1.000 0.018	1.000

IV. CONCLUSIONS

VIS air temperature and rainfall data were analyzed using statistical analysis techniques. The mean, variance, coefficient of variation, Pearson's correlation was determined for the data sets. The temperature observations were with the average of about 17.44^{0}C. The minimum and maximum temperatures recorded were 9.72^{0}C and 23.52^{0}C. The variance of this set of observations is 26.625. The average yearly temperature of the study area increases significantly by a constant of about 0.117 (Pearson correlation coefficient, p = 0.163; 95 % confidence level: -0.054 – 0.288). It was observed that precipitation is maximum in the summer and minimum during winter. Precipitation with highest average of 60 mm in 1988, and lowest average was 12 mm in 1992. The involvement of non-zero values in the serial correlation indicated the significance of the deterministic component in the data. The results of this analysis enhance our understanding of the characteristics of air temperature and rainfall in the study area for effective planning of farming operations.

V. ACKNOWLEDGEMENTS

Appreciation goes to South Africa Weather Service for providing the weather data for the analysis.

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Application of Artificial Neural Network For Path Loss Prediction In Urban Macrocellular Environment

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Abstract: **-** An artificial neural network model for the prediction of path loss in urban macrocellular environment is presented. The model consists of a multilayer perceptron trained with measured data using Scaled Conjugate Gradient algorithm. Comparison between the proposed model on one hand, and the free space, Hata and Egli models on the other hand shows a better prediction result. With the proposed ANN model a good generalization is achieved, and it is accurate in environments different from the one used in training the network.

Keywords:- *Artificial neural network, path loss, prediction, macrocellular environment.*

I. INTRODUCTION

Path loss prediction is a crucial task in the design and planning of network in modern mobile communication system. A great variety of models has been proposed for predicting path loss. These models can generally be grouped into two categories; empirical models and deterministic models. Empirical models like the Okumura, Hata and COST-231 models [1, 2] are based on measurements of electric field strength carried out in specific representative environment. The empirical models are computationally efficient, but they may not be very accurate in different propagation environment without modifications [3]. On the other hand, the deterministic models such as the geometrical theory of wave diffraction, ray-tracing technology are very accurate. But the problem with the deterministic models is that it requires excessive computational time, and it needs detailed information of the environment [2, 4].

In recent studies, artificial neural network (ANN) models have successfully been applied in the prediction of path loss in rural, urban, and indoor environments [5, 6, 7, 8, 9]. ANN models bring together the gains of empirical and deterministic models. Because of its intrinsic parallelism, ANN has high processing speed and can process large volume of data. ANN models have the flexibility to adapt to different environments. An ANN prediction model can be trained to perform well in environments similar to where the training data are collected.

To develop an ANN model that is accurate and generalizes well, measurement data from different environments are applied in the training process. There are many methods of improving the performance of the training process. These include Resilient Backpropagation, Scaled Conjugate, Fletcher-Powell Conjugate Gradient, Conjugate Gradient with Powell/Beale Restarts, Levenberg-Marquardt and BFGS Quasi-Newton algorithms. Each algorithm has its advantages and disadvantages, but their suitability depends on actual application situations.

Also the input parameters strongly influence the performance of ANN model, therefore the choice of inputs to be used become imparative. The ANN model presented in this paper has the following inputs: distance between base station transmitter and mobile receiver *(d)*, carrier frequency (*f*), street orientation (θ), height of base station antenna (h_{BS}), height of building (h_b), separation distance between buildings (Δh_e), difference between base station antenna height and building height (Δh_f), height of mobile antenna (h_{ms}), difference between building height and mobile antenna height (Δh_g), street width *(sw)*, base station transmitter output power (BS_{pr}), transmitter antenna gain (G_t), receiver antenna gain (G_r), free space transmission path loss (L_{fs}).

II. ARTIFICIAL NEURAL NETWORK MODEL

The basic features of the ANN is for it to be able to create its own internal model of behavior of radio waves by just observing the measured data [10]. Measured data have inherent behavior of the network from where it was collected imbedded in it; as such some measured data are needed for the creation of ANN model. Later on, this internal model can be used for predicting path loss values in the places where the measurements were not made by generalizing the observed measured values.

The work presented in this paper is modeled as multilayer perceptron (MLP) consisting of input layer, one hidden layer and an output layer [11]. The tan-sigmoid and linear activation functions were used in the hidden layer and output layer respectively.

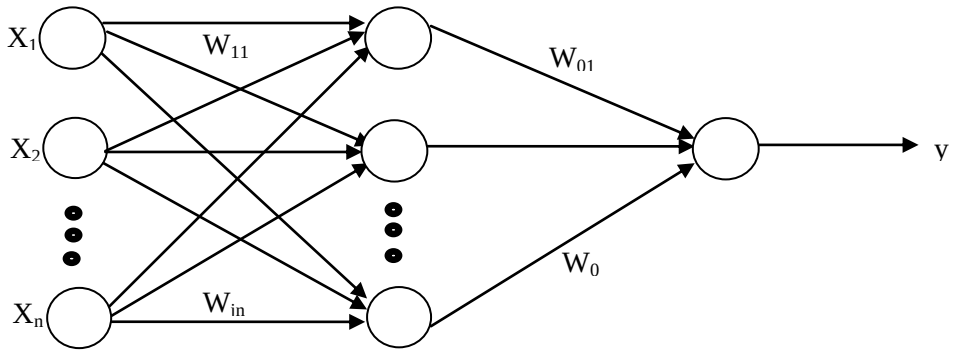


Figure 1. Configuration of multilayer perceptron.

Two kinds of signals propagate through the network [7]:

a. The input signals that are fed at the input port of the network, and propagate forward (neuron by neuron) through the whole structure and reach the output end as output signals.
b. The error signals that originate at the output port and proceed backward (layer by layer) through the structure.

The output of the system is described by the following equation [7, 12, 13]:

$$y = F_0\{\sum_{j=0}^{M} w_{0j}\ [F_h \sum_{i=0}^{N}(w_{ij}\, x_{ij})]\} \qquad (1)$$

where N = number of neurons in the input layer, M = number of neurons in the output layer

w_{0j} = synaptic weights from jthneuron in the hidden layer to the single output neuron.

w_{ij} = the connection weights between the neurons of the hidden layer and the input layer

x_{ij} = the ith element of the input vector

F_h = activation function of the hidden layer, F_0 = activation function of the output layer

The training parameters such as weight values, bias values, pre-processing and post-processing functions were selected in default way. The system parameters such as the weight and threshold values are adjusted by the training process. The training phase of the network continues by adaptively adjusting these parameters based on the mean square error, *mse*[4, 14], between the predicted value and the measured data for a selection of appropriate set of training examples.

$$mse = \frac{1}{N}\sum_{i=1}^{N}(y_i - d_i)^2 \qquad (2)$$

where y_i = output value calculated by the network, d_i = expected or predicted output, N = number of samples.

When the error between the network output and the predicted output is minimized the training process is terminated. The network can then be used in a testing phase with test vectors. At that stage the network is described by the optimum configuration of the weights.MLP network of different sizes and six different algorithms were compared to determine the fastest algorithms, prediction accuracy, generalization properties and the optimal configuration for the proposed ANN model.

A **Hewlett Packard** laptop computer, ***Model HP 620***, was used for the experiments. Accordingly, 14 variables were presented to the input layer of the network structure, and the number of neurons in the hidden layer was varied from 9 to 20. Table 1 gives a summary of the execution time (in seconds) for training the network with different algorithms. Each entry in the table is the mean value of 10 different trials (with different random initial weights in each trial). For the BFGS Quasi-Newton algorithm, 5 trials were carried out in each entry. In each case, the network is trained until the minimum value of the mean squared error (***mse***) is obtained.

Table 1: Execution time (in seconds) for different training algorithms.

S/N	Types of Algorithm	NUMBER OF NEURONS IN THE HIDDEN LAYER											
		9	10	11	12	13	14	15	16	17	18	19	20
1	Scaled Conjugate Gradient	0.863	0.878	0.878	0.903	0.905	0.912	0.925	0.926	0.935	0.956	0.974	0.986
2	Resilient Backpropagation	0.890	0.905	0.919	0.920	0.922	0.928	0.932	0.937	0.942	0.962	0.977	0.998
3	Fletcher-Powell Conjugate Gradient	0.895	0.918	0.927	0.936	0.937	0.942	0.944	0.946	0.968	1.005	1.006	1.080
4	Conjugate Gradient with Powell/Beale Restarts	0.898	0.934	0.945	0.986	0.994	0.997	1.000	1.004	1.013	1.016	1.018	1.168
5	Levenberg-Marquardt	8.89	11.62	18.19	20.77	27.24	32.75	34.48	44.96	53.50	58.00	63.14	75.78
6	BFGS Quasi-Newton	51.96	79.36	82.78	151.71	155.90	204.60	292.94	99.44	354.53	356.74	413..60	491.43

For the network structures considered in Table 1, Scaled Conjugate Gradient is the fastest training algorithm, followed closely by Resilient Backpropagation, Fletcher-Powell Conjugate Gradient, and Conjugate Gradient with Powell/Beale Restarts algorithms in that order.

Scaled Conjugate Gradient and Resilient Backpropagation algorithms were further compared to find out which one of them had a lower **mse** value (using 1000m as the separation distance between the transmitter and receiver). The summary of the result is given in Table 2.

Table 2: Mean value of **mse** for a separation distance of 1000m between transmitter and receiver

S/N	Types of Algorithm	NUMBER OF NEURONS IN THE HIDDEN LAYER											
		9	10	11	12	13	14	15	16	17	18	19	20
1	Scaled Conjugate Gradient	*1.78*	*1.70*	*1.69*	*1.76*	*1.74*	*1.67*	*1.78*	*1.76*	*1.75*	*1.73*	*1.71*	*1.79*
2	Resilient Backpropagation	*2.08*	*2..00*	*2.05*	*\2.09*	*2.06*	*2.16*	*2.00*	*1.98*	*2.15*	*2.04*	*2.78*	*2.20*

From the data in Table 2, Scaled Conjugate Gradient algorithm had lower **mse** values for the respective network structures. This algorithm was selected for training the network and to create an effective model that can make proper path loss predictions. The optimal number of neurons in the hidden layer is obtained by searching for the best convergence of the network during the training process. From Table 2 the network structure with 14 hidden neurons had the least **mse** value, and as such it was chosen for the model.

III. METHODOLOGY

Measured data is needed to evaluate and tune the ANN model [10] so that the network can create its own model of behavior of radio waves. The network has to be trained by some examples of correct pairs of inputs/outputs. These pairs are based on measured samples of field strength in various conditions.

The work presented in this paper used the field strength measurement conducted in Uyo, Akwa Ibom State, Nigeria, at a carrier frequency of 870.52MHz [14]. A set of path loss data recorded at distances of 1km to 5km between transmitter and receiver was used in the training. 2100 measurement samples were used. The sample set was randomly divided into three sub-groups. 60% of the data for training the network, 20% was used to validate the network generalization. Training continues as long as it decreases the network's error on the validation vectors. When the network memorizes the training set, training is stopped to avoid the problem of over-fitting [6].

Finally, the last 20% of the data is used for performance evaluation of the network model; it is an independent test of network generalization of data that the network has not seen.

MLP network of different sizes were analyzed to determine the network complexity required to obtain accurate path loss predictions. To reduce the training time and still maintain the prediction accuracy and generalization property Scaled Conjugate Gradient algorithm was used to train the network. This algorithm is generally faster than the others and very ideal for the network model.

During the training phase the characteristics of the network were modified by this iterative algorithm until a minimum error is obtained, that is the error between the network (predicted) output and the desired

(measured) output is minimized. The training phase operates based on the mean squared error (2) between predicted path loss and measured path loss for a set of properly selected training examples [3].

The purpose of the prediction model includes generation of minimal errors for the training examples, and to perform well with examples not used in the training operation. The generalization property of the network is very important in practical prediction situations where the intention is to use the path loss prediction model to find the coverage area of potential transmitter locations for which no or limited information are available [7].

IV. RESULTS

Our objective was to design an ANN model that can accurately predict propagation path loss. 2100 measurement samples, which were shared in the ratio of 60%, 20% and 20%, were used to respectively train, validate and test the network. The performance of the ANN model was evaluated by making a comparison between expected and measured values based on mean squared error, *mse*.

Table 3 represents the result of the ANN model in terms of *mse*. Also indicated in the table is the separation distance, (d), between the transmitter and the receiver, and the corresponding values of *mse*.

Table 3: Mean squared error values, *mse*, of the ANN model:

Separation distance (d)	***mse* (dB)**
1km	2.52
2km	2.35
3km	1.31
4km	1.53
5km	0.68
Average	1.68

Furthermore, Table 4 presents the *mse* value of the ANN model and those contained in [14]. The ANN model was shown to have a better performance.

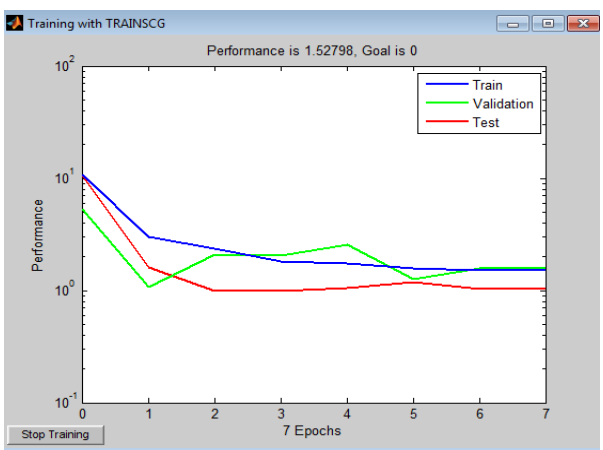
Table 4: *mse* values for Free space path loss, Hata, Egli and ANN models.

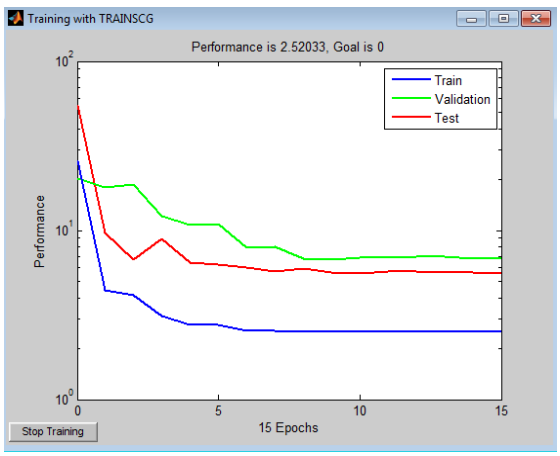
Free space path loss (dB)	**Hata model (dB)**	**Egli model (dB)**	**ANN model (dB)**
16.24	2.37	8.40	1.68

From Table 4, the ANN model has an average value of 1.68dB. This is acceptable because it is below the minimum value of 6dB for good signal propagation.

V. OBSERVATIONS

Some observations were made during the training process. It was noticed that different results were obtained each time the network was trained. This was as a result of different initial weight and bias values, and different divisions of measured data into training, validation and test sets [11]. Thus it is possible that different artificial neural structures trained on the same problem can generate different outputs for the same input. To actualize a neural network of good accuracy it is necessary to retrain several times. Another thing that should be noted is that the network is sensitive to the number of neurons in the hidden layer. When the number is few it leads to underfitting but when the number is too many it causes overfitting.





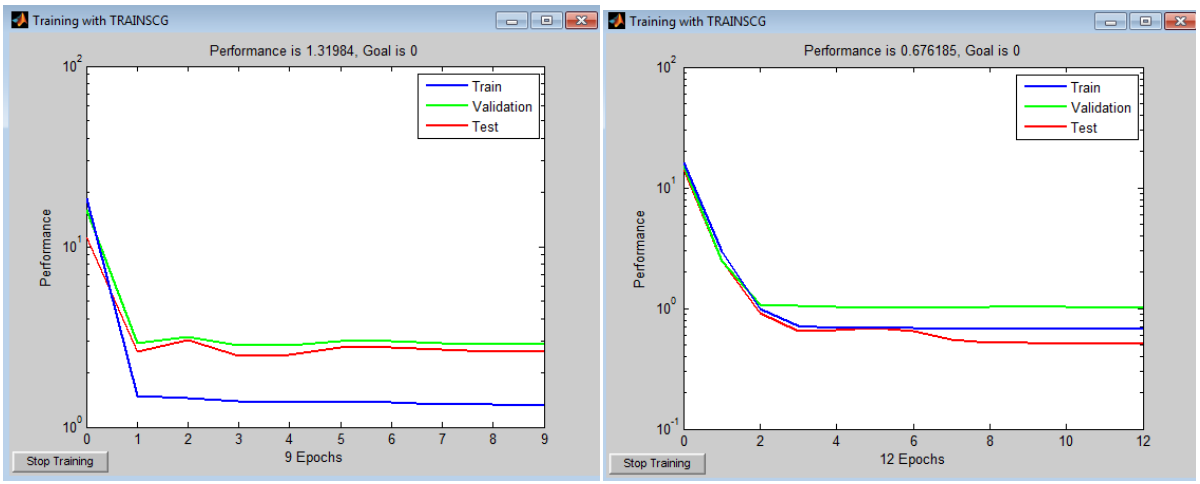


Figure 2. Some results of the network performance .

VI. CONCLUSION

The ANN model thus developed is for path loss prediction in urban macrocellular propagation environment. Its performance was compared with the predictions made by different empirical models. It is noticed that due to its generalization property the ANN model has significant improvement over the other models. The model has the ability to perform interpolation or extrapolation if test data exceed the training data space. Also because the model is trained with measured data, it makes the included propagation effect more realistic.

Another important advantage of the model is the fact that unlike the deterministic approach, the ANN model is simpler and computationally faster. It achieved the stated improvement without going through the rigorous problems of having a substantial and precise knowledge of the propagation environments.

VII. RECOMMENDATIONS

The ANN model is just introduced in a simple way. To further improve the performance and the generalization property of the model, more input variables such as land usage, terrain clearance angle and vegetation density can be incorporated in the system.

Based on the relative advantages of the model over the empirical and deterministic models, telecommunication companies in Nigeria can improve their services by the ANN model in the design and analysis of their budget link.

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Bank credit risk management to corporate customers in the province DEA approach

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Abstract: **-**the purpose of this study was to identify the factors affecting export credit risk Credit risk is the applicant's legal clients. Companies surveyed in the study, during the period of one year since 2011 to 2012 have been selected, based on the way an exhaustive review of the literature related issues, in the form of research library for collecting data and information from the financial statements and the balance sheets of companies in which the Saderat Bank receiving facilities have been used. The results have shown the efficiency of companies receiving facility DEA is using a sample of 49 companies , only 9 companies are effective , but they are ineffective, the remaining companies

Keywords: - *Credit risk management, efficiency, data envelopment analysis (DEA), the Bank*

I. INTRODUCTION

Investigation reveals that the international economic system .The level of investment and economic development are closely related .This means that countries with efficient pattern allocation of capital to different sectors of economy, economic development, and thus often have a higher social welfare (Gutman, 2000).
The bank seeks to companies that own facilitieswhile having a low risk of returns commensurate with the benefits they have facilities. This is achieved when the banks were able to identify both natural and legal persons and their credit customers based on their ability and willingness to repay the full and timely financial and non-financial liabilities, using criteria appropriate class to sort.(1999, John).
Despite the importance of credit risk in the banking and financial institutions, it seems thatCoherent and organized movement for the creation of credit risk models has been done .For example, in the financial markets on the one hand, the lack of credit risk indicators and rating agencies clearly feel it is and on the other

Facilities to customers in theCoherent and orderly process for determining credit risk and ranking them based on risk and credit ceilings, are not consideredAnd now experts credit Committee to determine their pay . In this case, having an efficient risk model, not only in the field of credit decisions and will facilitate obtaining documentationit will cause followed by the country's banking system and a model of efficiency in allocating capital to different sectors of the economy will benefit.According to the description above present research , Credit risk model to identify factors affecting the credit ratings of clients seeking legal Facilities in saderat bank of Mazandaran province withusingthe DEA method.

II. RESEARCH HISTORY

1-George Asif (2010):In his research on the technical efficiency of Saudi banks, this study examines the technical efficiency of Saudi banks . Period 2007-1999 is used as input data for these study three cases: 1) the total employed labor force, 2) fixed assets 3) Total deposits and outputs include: 1) loans to customers, 2) securities 3) loans between banking is. Results indicate that the technical efficiency of Saudi banks from 2004 onwards has improved, which includes banks that are operating with foreign capital is too.
2- Thinner Lin (2009):In his research, the use of DEA in analyzing a bank's operational efficiency in Taiwanin this study, 117 subsidiaries of Bank of Taiwan in 2006 as samples and using the DEA,Enable banks to assess operational efficiency, have been evaluated.Variables used in this study consists of four inputs : 1) the number of employees, 2) interest expense , 3) the amount deposited in non- vision 4) deposits and four outcomes : 1)

the amount of the mortgage payment , 2) Income 3) Get operation 4) interest income is. The results show that overall technical efficiency of banks in the sample had a low level, so that the various branches of its average 8/54 and their average scale efficiency level of 82 %.

3-Mohammad Bahreini (2009): In their study comparing the economic performance of public and private banks in Iran using DEA (inclusive) data (DEA), is discussed. In this analysis two intermediate attitude and the attitude of the income approach is used to interface with value added approach. In the first approach Inputs include 1) Deposits, 2) labor and 3) capital and output are different loans (total outstanding loans and partnerships) and the second approach is to deposit a given output and other variables are defined as the first approach. One approach to calculating performance shows that the economic performance of public banks than private banks. In the second approach is considered the economic efficiency of private banks is higher than state-owned banks.

III. RESEARCH METHODOLOGY

The research method is type of Analytical With the aim of Applied. The results of the data collected with the help of information and documents that the Export Development Bank of Iran Export Bank facilities have received, is derived forAnd using the results, the analysis is done .To analyze the collected data to Excel and SPSS software outcomes and DEA Solver can be used .Finally, using linear programming and data envelopment analysis is used to evaluate the performance of branches .

Variables in this study include:

Variables in DEA (input and output)

A) Output:

Equity to total assets, current assets, fixed assets, ROA, license and experience refunds

B) Input: Short-term debt to total assets ratio of total debt to total asset s.

The study population research survey Bank balance sheet and financial documents of 49 companies that have received loans from the saderatbank extracted.

IV. RESEARCH QUESTION

A key question :

1-Does the financial indicators and non-financial indicators of risk, credit risk impact ?

2 - What is the bank's corporate customer's credit rating?

Results and findings :

1-5-review the research question using methods

Analyze data using CCR model

Table 4-5: Level of corporate efficiency and input and output weights using CCR model.

$U(O_5)$	$U(O_4)$	$U(O_3)$	$U(O_2)$	$U(O_1)$	$V(I_2)$	$V(I_1)$	Efficiency	
0.276896	0	0.49349	0	0	0.328744	5.44E-02	0.28	1
7.90E-02	0	1.570247	0	2.40E-03	5.52E-03	1.194558	0.10	2
0.946035	4.56E-02	0.21731	4.20E-03	4.10E-02	6.02E-03	18.59665	1	3
9.99E-02	0	1.986656	0	3.03E-03	6.98E-03	1.511339	0.13	4
0.473896	0.160347	1.130253	5.66E-05	0	0.753024	0.1245	0.65	5
0	0.901299	5.518667	0	9.70E-03	0.937959	3.046283	0.90	6
0.984102	9.64E-02	0.459123	1.20E-02	0.112913	2.87E-04	45.33172	1	7
0.208266	6.01E-02	0	3.36E-05	0	0.308839	6.09E-02	0.26	8
0.370803	0.10729	0	6.00E-05	1.92E-03	0.550098	0.109824	0.47	9
6.45E-02	0.00368	1.364988	0	2.08E-03	4.25E-03	1.038941	0.23	10
0.765773	0.230352	0.419436	1.16E-04	4.05E-03	1.154719	0.221675	1	11
0.384011	0.110788	0	6.20E-05	0	0.569452	0.112211	0.49	12
6.23E-02	3.08E-03	0	0	0	4.08E-04	1.152992	0.0623	13
0.448664	0.15181	1.070075	5.36E-05	0	0.712931	0.117872	0.61	14
0.25806	0.087317	0.61548	3.08E-05	0	0.410059	6.78E-02	0.354	15
0.374765	0.126805	0.893822	4.48E-05	0	0.595504	9.85E-02	0.51	16
0.104866	0	0.186876	9.36E-06	0	0.124505	2.06E-02	0.10	17
0.452613	0.153623	1.082614	5.41E-05	2.54E-03	0.719651	0.120812	0.62	18
0.556348	0.160508	0	8.99E-05	0	0.825011	0.16257	0.71	19

0.373792	0.12687	0.894081	4.47E-05	2.10E-03	0.594327	9.98E-02	0.53	20
0.377006	0	0.671843	3.37E-05	0	0.447611	7.40E-02	0.39	21
0.33036	0.11178	0.787917	3.95E-05	0	0.524945	8.68E-02	0.45	22
0.086467	0.829028	5.278949	1.14E-04	8.49E-04	0.861769	3.188316	1	23
0.341422	0.115523	0.814299	4.08E-05	0	0.542522	0.089697	0.46	24
0	0.337539	2.066754	0	3.63E-03	0.351268	1.14084	0.34	25
0.528115	0	0.941128	4.72E-05	0	0.627021	0.103668	0.54	26
0	0.210431	1.288474	0	2.26E-03	0.21899	0.711233	0.21	27
0.251246	0	0	3.15E-05	0	0.289152	5.70E-02	0.25	28
0.195226	6.61E-02	0.465619	2.33E-05	0	0.310216	5.13E-02	0.27	29
0.401214	0	0	5.03E-05	0	0.461747	9.10E-02	0.40	30
0.305596	8.82E-02	0	4.94E-05	0	0.453169	8.93E-02	0.40	31
0	0	22.67574	0	0	8.10E-06	0.865733	1	32
0.303075	0.102548	0.722841	3.62E-05	0	0.481588	7.96E-02	0.41	33
0.30042	0.140546	0	0	0	0.507472	0.100033	0.44	34
0	0.215314	0	0	2.42E-03	0.221341	0.730575	0.21	35
0.448701	0	0.799608	4.01E-05	0	0.532734	8.81E-02	0.45	36
0.902578	0.902578	4.297989	0.124039	1.147003	2.69E-03	427.5174	1	37
0.325334	9.39E-02	0	5.25E-05	0	0.482439	9.51E-02	0.41	38
0.499827	0.499827	2.380128	6.61E-04	3.81E-02	4.155469	0.146291	1	39
0	0	0	1.75E-06	1.19E-04	4.40E-06	1.303524	1	40
0.398091	0.135117	0.952202	4.76E-05	2.23E-03	0.632962	0.106259	0.61	41
0.359845	0.121757	0.858237	4.30E-05	0	0.571795	9.45E-02	0.50	42
0.286977	0.097101	0.684447	3.43E-05	0	0.456009	7.54E-02	0.39	43
0.259732	8.79E-02	0.619467	3.10E-05	0	0.412716	6.82E-02	0.35	44
0.391932	0.113073	0	6.33E-05	0	0.581198	0.114526	0.50	45
0	0.219938	1.346686	0	2.37E-03	0.228884	0.743365	0.22	46
0.544322	0.107548	1.47455	1.26E-04	0	0.872776	0	0.82	47
0.417745	0.141348	0.996332	4.99E-05	0	0.6638	0.109749	0.66	48
7.77E-03	7.77E-03	3.70E-02	1.03E-05	9.66E-03	2.32E-05	3.595611	1	49

As shown in the tableninecompanies out of 49 companies have higher efficiencyand effectively known .The average performance of the whole company, 52/0 and a standard deviation of 28/0 and a minimum efficiency of 13 companies with about 06/0 is obtained

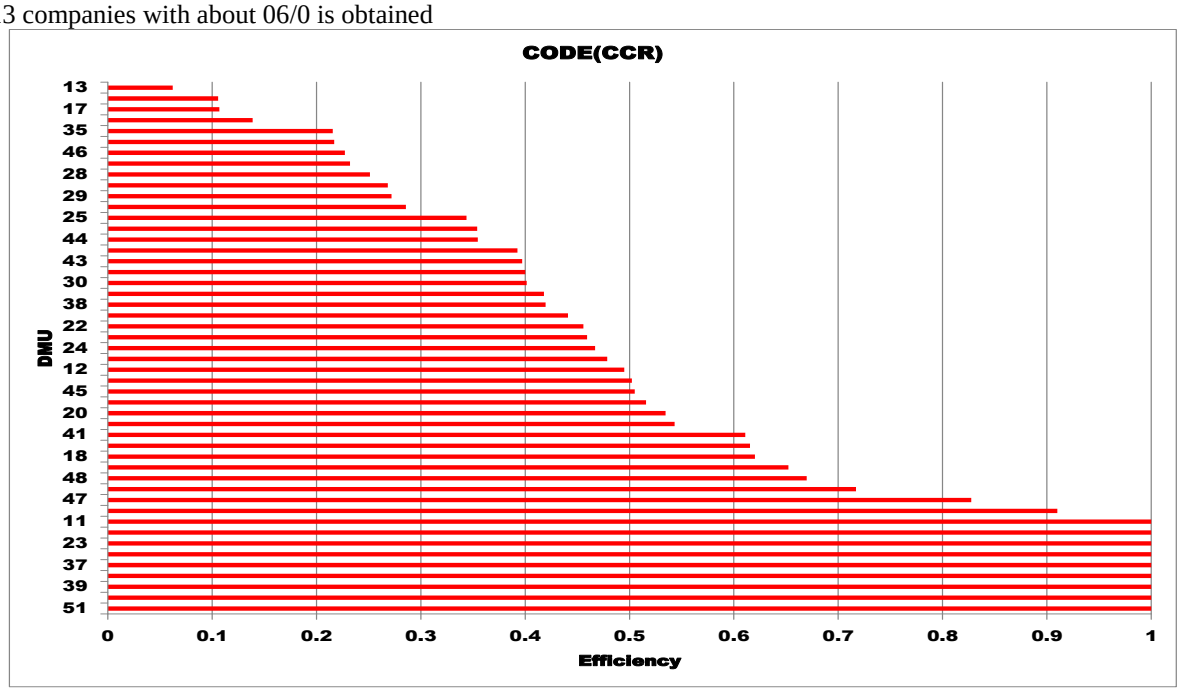

Figure 4-1: efficacy models using CCR

Figure 4-1, the order of arrangement of the efficient units (now No. 51) to the inertia of the useful (now No. 13) shows. And according to the model CCR 9 units (company) is to be expressed .

Table 4-6 details the input excess and output shortfall

Repayment history	Business License S^+	ROA S^+	Current assets to fixed assets	Equity to total assets S^+	Ratio of total debt to total assets S^-	Short-term loans to total assets S^-	Efficiency	
0	0	0	0.19848	0.149336	0	0	0.2857	1
0	0.963842	0	0.361784	0	0	0	0.1057	2
0	0	0	0	0	0	0	1	3
0	0.965543	0	0.394991	0	0	0	0.1388	4
0	0	0	0	1.48E-02	0	0	0.6523	5
4.15E-03	0	0	503.8375	0	0	0	0.909	6
0	0	0	0	0	0	0	1	7
0	0	3.98E-03	0	0.109485	0	0	0.2683	8
0	0	7.47E-04	0	0	0	0	0.4785	9
0	0	0	0.446213	0	0	0	0.2321	10
0	0	0	0	0	0	0	1	11
0	0	6.11E-03	0	0.142404	0	0	0.4949	12
0	0	3.15E-04	2.458385	0.728108	0	0	6.23E-02	13
0	0	0	0	0.167063	0	0	0.6154	14
0	0	0	0	0.228728	0	0	0.354	15
0	0	0	0	0.08757	0	0	0.5158	16
0	1	0	0	2.04E-02	0	0	0.107007	17
0	0	0	0	0	0	0	0.6202	18
0	0	1.19E-03	0	6.44E-02	0	0	0.716992	19
0	0	0	0	0	0	0	0.534607	20
0	0	0	0	0.137932	0	0	0.392641	21
0	0	0	0	0.227783	0	0	0.455828	22
0	0	0	0	0	0	0	1	23
0	0	0	0	0.240209	0	0	0.467057	24
1.12E-02	0	0	493.1931	0	0	0	0.343863	25
0	0	0	0	9.86E-02	0	0	0.54326	26
0.022343	0	0	585.5605	0	0	0	0.21703	27
0	0	6.25E-03	0	3.11E-02	0	0	0.251263	28
0	0	0	0	3.50E-02	0	0	0.272002	29
0	0	3.32E-03	0	0.136453	0	0	0.401528	30
0	0	4.11E-03	0	3.62E-02	0	0	0.400019	31
0	0	0	0	0	0	0	1	32
0	0	0	0	1.10E-02	0	0	0.417969	33
0	0	2.64E-04	2.21E-02	0.160424	0	0	0.440966	34
6.23E-04	0	3.72E-04	566.2115	0	0	0	0.215512	35
0	0	0	0	0.144131	0	0	0.459312	36
0	0	0	0	0	0	0	1	37
0	0	3.53E-03	0	0.192708	0	0	0.419522	38
0	0	0	0	0	0	0	1	39
0	0	0	0	0	0	0	1	40
0	0	0	0	0	0	0	0.611	41
0	0	0	0	6.68E-02	0	0	0.50224	42
0	0	0	0	0.190025	0	0	0.39714	43
0	0	0	0	0.215277	0	0	0.354603	44
0	0	5.37E-03	0	0.108646	0	0	0.505038	45
2.42E-02	0	0	608.3658	0	0	0	0.227221	46
0	0	0	0	0.162436	0	2.52E-02	0.827452	47
0	0	0	0	0.174729	0	0	0.66974	48
0	0	0	0	0	0	0	1	49

Due to the fact the province of companies out there that has the same level of consumer input into an efficient unit .DEA is able tothe rate of change in inputs anda Consumer outcome in each of inefficient firms is computed using the reference to company performance .These companies are focusing on this aspect to increase their efficiency and to achieve the level of a functional unit .Reference set of inefficient units is shown in Table 4-3.

Table 4-7: Reference unit each inefficient unit

Reference Unit	Inefficient units
1,23,32	1
3,23,32,51	2
51,32,23,3	3
11,23,32,40	4
32,37,39,51	5
11,23,40	6
11,23,40,51	7
3,23,32,51,37	8
11,23,40,32	9
3,7	10
11,23,40,32	11
11,23,40,32	12
11,23,40,32	13
11,23,40,32	14
11,23,40,32,51	15
11,23,40	16
11,23,40,32,51	17
11,23,40,32	18
11,23,40,32	19
11,23,40,32	20
32,37,39,51	21
11,23,40,32	22
32,37,39,51	23
11,23,40	24
11,23,40,32	25
11,23,40,32	26
11,23,40,32	27
11,23,40,32	28
11,23,40,32	29
11,23,40,32	30
11,23,40,32	31
37	32
11,23,40,32,51	33
11,23,40,32,51	34
11,23,40,32	35
11,23,40,32	36
11,23,40,32	37
11,23,40	38
32,37,39,51	39
11,23,40	40
11,23,40,32	41

The results of the review of the Bank's performance to corporate customers using data envelopment analysis

Performance calculated in accordance with law firms in both output-based and input based BSI results for the year 1390-1391 is as follows

The company has an excellent performance of the 49 companies are known to work. The average performance of the whole company, 52/0 and a standard deviation of 28/0 and the minimum efficiency for about 06/0 is

obtainedto obtain optimum performance and efficient entry of firms, it now references, efficient company .It is a combination of inputs, input the desired amount of non-functional company, is determined to reach the efficiency frontier. For example ,Short-term debt to total assets ratio of inefficient companies 1 to about 13/1 and the desired value of about 32/0 is., this means a 72% deviation from the optimal level. In other words, the company must first be converted into an efficient unit is about 71/0 ratio decreased.

V. RECOMMENDATIONS BASED ON RESEARCH RESULTS

1-Use of efficient portfolio companies, to invest, to reduce investment risk and optimal portfolio choice .
2-Using the model results (DEA) in order to raise the efficiency of the company and the company's weaknesses and recognize the impact of improving the level of efficiency of the company's portfolio is efficient .
3 -Sequential prediction and change the degree of credit risk transfer credit facilities to their customers who granted the right measures to prevent the event of non-repayment..

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Characterization of dielectric constant of solid materials (Leather belt) at X-Band

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Abstract: - This paper discusses the experimental measurement technique for dielectric constant (i.e. permittivity) of leather belt at X-band. This measurement play selection of dielectric constant for antenna substrate. This leather can be used as flexible substrate of wearable microstrip antenna. This measurement system consist of solid state klystron power supply, isolator, VSWR meter, frequency meter, solid dielectric cell (XC-501). This data may be interested in flexibility wearable microstrip antenna studies.

Keywords: - *Solis dielectric cell; leather belt, solid dielectric cell (XC-501).*

I. INTRODUCTION

Recently, as the number of system using high frequency electromagnetic wave has increased , serious electromagnetic compatibility (EMC) problem have become apparent. This has lead to search for electromagnetic wave absorbing material useful in microwave frequencies.

The permeability and permittivity of a Leather belt plays an important role to determine reflection properties. It is very essential to determine accurately the dielectric constant of Leather material. Such type of absorbing materials have varied application such as construction of wearable microstrip antenna , improvement of antenna pattern and improvement in wearable antenna performance.

II. MEASUREMENT U USING RECTANGULAR WAVEGUIDES X- BAND

A representative study was carried on leather belt . In this work the thickness of dielectric sample of leather 2.5 cm. [1]. The accuracy of sample largely depends upon smoothness of the sample in waveguide and care which has been taken to ensure that its surface are properly squared with respect to each other.[2]. The machine sample has taken very carefully for smoothness, the size and squared surfaces.

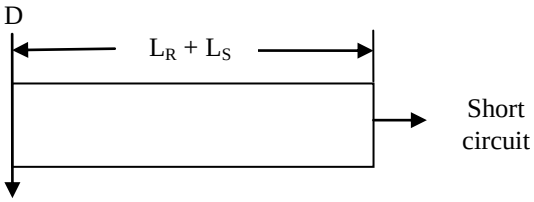
The figure 2(a) shows an empty short circuited waveguide with probe located at voltage minimum L_R Figure 2(b) the sample waveguide containing sample of length L_ε with a probe located at new voltage minimum D.

Factor affecting Dielectric Constant of Leather

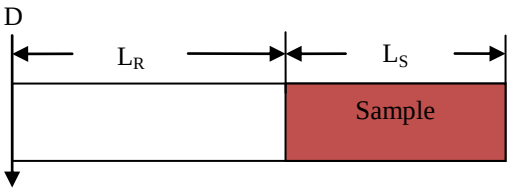
Electromagnetically a leather is, in general a four component dielectric mixture consisting of air , rawhide, bound water. Due to forces acting upon it the bound water molecule interacts with an incident electromagnetic wave in a manner dissimilar to that free water molecule, thereby exhibiting a dielectric dispersion spectrum, very different from that of free water molecule. Therefore, the dielectric constant of leather mixture is greatly influenced by a number of factors such as total water content due to humidity of environment ,frequency, temperature etc.[6].

Many of the studies on dielectric properties of leather have been carried out in laboratory conditions. In general, it has been observed that dielectric constant of leather primarily related to leather moisture content [7]. Dielectric constant of water is 80, hence variation in leather moisture content makes significant in dielectric properties of leather.

III. PROCEDURE



(a) Empty short circuited waveguide



(b) Wave guide containing sample

Where

L_R = empty cavity length

L_S = sample (i.e. dielectric material) length

Fig1. Figure shows waveguide with dielectric and without dielectric sample

The basic arrangement of equipment were connected as shown in Fig. 2.

1. Connect the equipment as shown in Figure 2 (c).
2. With no sample dielectric in the short circuited line, measure D_R position of the minimum in the slotted line with respect to arbitrary chosen reference plane (D = 0), was find out.
3. The guide wavelength (λg) was obtained by measuring distance between alternate in the slotted line.
4. The dielectric , i.e. the leather sample in this case was inserted in the short circuit in such a manner that it touches the end of the sample.
5. Measure D, the position of minima in the slotted with respect to the reference plane.

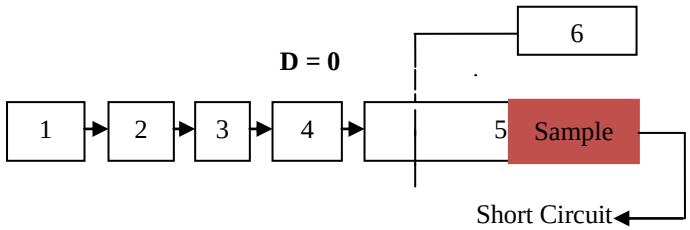


Fig. 2 Experimental Set Up for Dielectric Constant measurement

1. Microwave Source (Klystron power supply)
2. Isolator
3. Frequency meter
4. Variable attenuator
5. Wave containing sample
6. Detector

IV. WAVEGUDE INSIDE A DIELECTRIC

The wavelength in a dielectric medium is always smaller than free space wavelength. The wavelength in any unbounded dielectric medium λ_d is

$$\lambda_d = \frac{\lambda_0}{\sqrt{k'\mu'}}$$

Where

k' = dielectric constant of the medium (i.e. leather belt)

μ' = permeability of the medium
λ_c = cut-off wavelength of the waveguide
λ_0 = wavelength in vacuum
For most of the dielectric materials μ' = 1 and therefore

$$\lambda_d = \frac{\lambda_0}{\sqrt{k'}}$$

The wavelength λg in the air field rectangular waveguide is given by

$$\lambda_g = \frac{\lambda_0}{\sqrt{\left[1 - \left(\frac{\lambda_0}{\lambda_c}\right)^2\right]}}$$

Where
λ_c = cut-off wavelength of the waveguide.
If the waveguide is filled with a medium of dielectric constant k' the new wavelength λ'_g in the waveguide is given by

$$\lambda'_g = \frac{\lambda_0}{\sqrt{\left[k' - \left(\frac{\lambda_0}{\lambda'_c}\right)^2\right]}}$$

Where,

$$\lambda'_g = \frac{\lambda_g}{\sqrt{k'}}$$

and

$$\lambda'_c = \sqrt{k'}\lambda_c$$

after solving these equation we obtain dielectric constant of leather belt (i.e. k') of leather sample is 1.6587.

V. CONCLUSION

In this paper measurement of dielectric constant of leather belt determined. From the computed result it is conclude that dielectric constant depends on thickness of the sample and at lower frequency dielectric constant are high.

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