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MATHEMATICAL MODEL FOR THE FLOW STRESS CONSTITUTIVE EQUATION USING SERIES EXPANSION

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Abstract- Conventional constitutive equations defining the flow stress relationship with the allied parameters are independent of one or more parameters. So the combined effect of all the flow parameters on true stress cannot be imagined in the existing frame of reference. In addition the same set of arbitrary constants does not works for all true strain, strain and temperature values for such models and their equations, which further adds new drawbacks while working with these relations. The present article works to complete the relationship between such flow parameters and the equation has been validated to Al 2024 aluminum alloy.

Keywords- Material Modeling, Hot deformation, Flow/ True stress, True strain rate deformation, Thermo-mechanical process.

I INTRODUCTION

Deformation Constitutive equations are those which describes the linear and non-linear relationship among the process variables viz. effective stress, effective strain, effective strain rate and temperature at different deformation levels. Such equations are required for the development of realistic dynamic material models involving various processes. The functional form of the constitutive relation representing flow behavior is given by

$$\sigma = f(\varepsilon, \dot{\varepsilon}, T) \quad (1)$$

Where, σ represents the Flow stress, ε represents the True strain, $\dot{\varepsilon}$ represents the True strain rate and T represents the temperature.

The prominent material models in this category can be divided to three categories;

(a) First stage equations:

i) Holloman equation [1, 2]

It gives a direct dependency of flow stress on strain. According to it the flow stress can be defined in terms of strain as,

$$\sigma = k\varepsilon^n \quad (2)$$

Where, k and n are the strength coefficient and strain hardening exponent respectively.

ii) Ludwik equation [3]

This model includes the effect of yield stress σ_0 . According to it flow stress can be expressed as,

$$\sigma = \sigma_0 + k\varepsilon^n \quad (3)$$

iii) Swift equation [4]

This model includes the effect of yield strain ε_0 .

$$\sigma = k(\varepsilon_0 + \varepsilon)^n \quad (4)$$

iv) Voce equation [2, 4]

$$\sigma = A - Ke^{(-C\varepsilon)} \quad (5)$$

Equations 1, 2, 3 and 4 do not have strain rate and temperature terms. Thus the effects of these parameters cannot be observed.

(b) Second stage equations:

Another type of equations containing strain terms are:

i) Strain independent power law [1]

It is,

$$\sigma = k_1 \dot{\varepsilon}^m \quad (6)$$

k_1 is constant for particular strain, strain rate and temperature, The exponent "m" is also constant at a given strain and temperature

ii) Strain dependent power law [5]

$$\sigma = k_1 \varepsilon^n \dot{\varepsilon}^m \quad (7)$$

In these equations the dependency of flow stress on strain and strain rate has been considered but the effect of temperature has been neglected.

(c) Third stage equations:

They are the equations that contain both strain rate and temperature in determining the flow stress. They are called Arrhenius equation, Exponential law, Hyperbolic sine law [6], [7]. They are often used as the kinetic models and generally referred to define such relationship. These equations are as follows in equation 2, 3, 4 respectively.

$$\dot{\epsilon} \exp(Q/RT) = A\sigma^n \quad (8)$$

$$\dot{\epsilon} \exp(Q/RT) = A' \exp(\beta\sigma) \quad (9)$$

$$\dot{\epsilon} \exp(Q/RT) = A'' (\sinh\alpha\sigma)^n \quad (10)$$

A common drawback to these equation is the lack of absolute relationship between all the four variables i.e. true stress (σ), true strain (ϵ), true strain rate ($\dot{\epsilon}$) and deformation temperature (T) i.e. one or more parameter is absent in the constituting relationship. However the equation defined by “N.S. Babu, S. B. Tiwari and B. Nageshwara Rao” in the paper entitled “Modified in stability condition for identification of unstable metal flow regions in processing maps of magnesium alloys”, involves the inclusion of all parameters [9]. Mathematically, Babu Model has the following functional form,

$$F = f(\epsilon, \dot{\epsilon}, T, d) \quad (11)$$

It obtains the constitutive relationship in logarithmic scale by using Taylor’s series expansion defined as,

$$\ln \sigma = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K C_{ijk} \epsilon^{i-1} \Theta^{j-1} (\ln \dot{\epsilon})^{k-1} \quad (12)$$

Where, $\Theta = 1000/T$ and T is in Kelvin.

This relation however involves true strain but the number of constants C_{ijk} need to completely define the relationship is 48 numbers which are very exhaustive with no physical significance. Another difficulty in this formula occurs during estimation of flow stress, since three values of dependent variable and 48 values of arbitrary constants has to be substituted for each theoretical calculation.

The present work is an attempt to remove these drawbacks by the inclusion of true strain (ϵ) parameter to the remaining three parameter with limited number

of constants. In order to validate the equation, the data were taken from “HOT WORKING GUIDE” [9].

II PROPOSED MODEL & ITS VALIDATION

This article shows a constitutive equation with comparatively lesser number of coefficients in which different parameters and arbitrary constants follow the following form,

$$\ln \sigma = \sum_{i=1,2} \sum_{j=i}^{i+1} A_{ij} \epsilon^{i-1} X^{j-1} \quad (13)$$

$$\text{Or, } \sigma = \exp\left(\sum_{i=1,2} \sum_{j=i}^{i+1} A_{ij} \epsilon^{i-1} X^{j-1}\right) \quad (14)$$

Where, $X = \ln \dot{\epsilon}$, A_{ij} are the functions of T.

The alloy taken under study is Al-2024 Aluminum alloy. $\ln(\text{True stress})-\ln(\text{True strain rate})$ plots has been shown in fig-1 at $\epsilon = 0.2, 0.4$ which helps to establish $\sigma-\epsilon$ relationship.

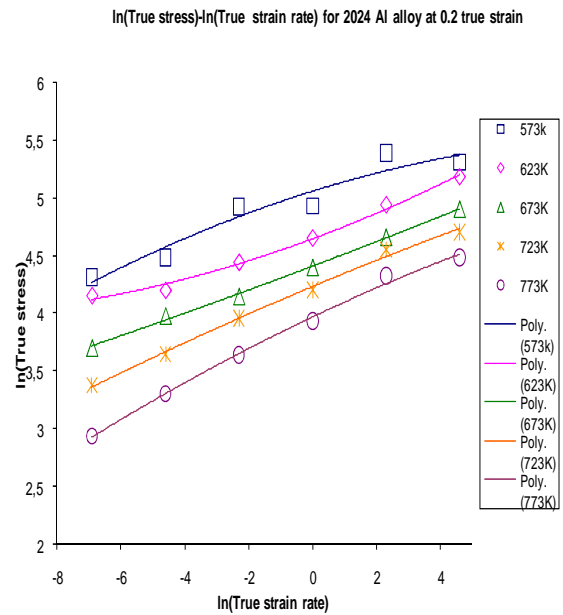


Figure 1: (a) $\sigma-\epsilon$ relationship at (a) $\epsilon = 0.2$ (b) $\epsilon = 0.4$

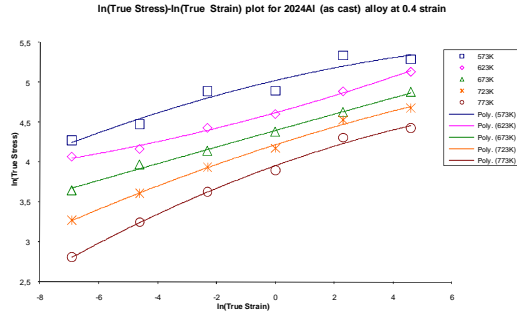


Figure1:(b) σ - ε relationship at (b) $\varepsilon = 0.4$

Similar relation plots were made w.r.t other parameters.

III RESULTS & DISCUSSION

Proceeding through the equation (14), we obtain the value of parameter for our case study alloy Al 2024. They are shown in Table-1. A Comparison between the experimental results (R) & calculated results (c) by equation (14) at different temperatures w.r.t. other parameters are made in terms of the flow stress curves in fig-2.

A_{ij}	Value of A_{ij}
A_{11}	$2367.5/T + 0.921$
A_{12}	$0.0002T - 0.0249$
A_{13}	$-112420/T^2 + 338.5/T - 0.2513$
A_{21}	$-275.5/T + 0.3235$
A_{22}	-0.026
A_{23}	$9620/T^2 - 5.4/T - 0.0195$

Table 1: Value of A_{ij}

These plots made in Fig-2 clearly show that the present model can predict the value of flow stress over a wide range of practically feasible parameters. Further it reduces the number of constants from 48 to 13 in number.

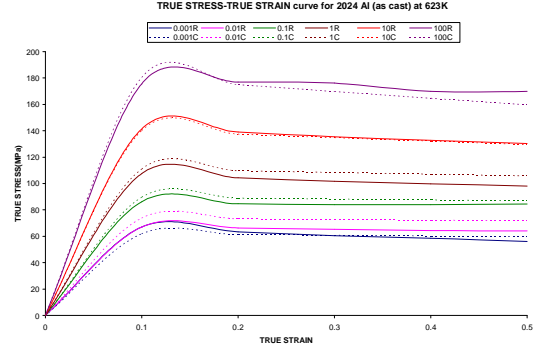


Figure2: (a)

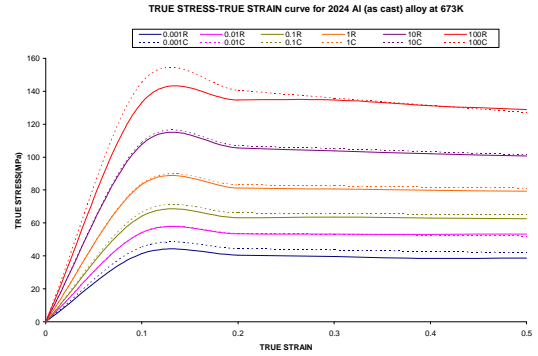


Figure2: (b)

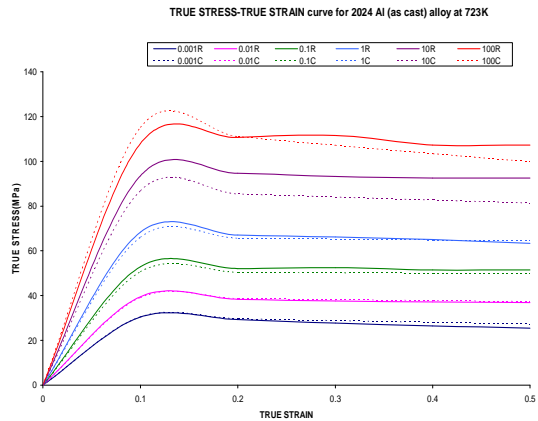


Figure2: (c)

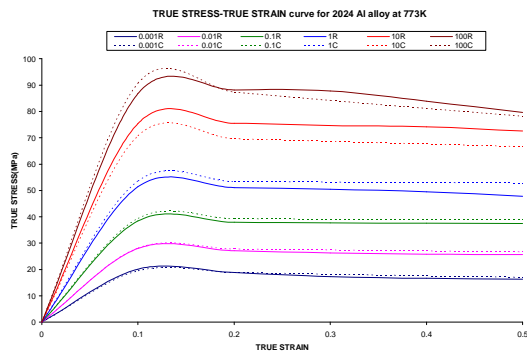


Figure-2: (d) Comparison between the experimental results-R(full lines) & calculated results-C (Dotted lines) by equation (14) at (a) 623K (b) 673K (c) 723K (d) 773K

IV CONCLUSION

Analysis carried out in this research article reflects the dependency of the flow stress on other deformation parameters. The main conclusions are as follows,

- (a) The proposed model shows a good correlation between experimental and theoretical results.
- (b) It shows a direct relation of flow stress with its influencing factors viz. strain, strain rate and temperature.
- (c) It reduces the number of constants from 48 in N.S. Babu Model [9] to 13 in number.
- (d) Values at stringent experimental conditions can be obtained by Extrapolation/ interpolation.
- (e) This model may be used to eliminate the experimental error due to sudden change in physical conditions like voltage fluctuation.
- (f) The proposed model can ably covers a wider range of materials exhibiting the similar compressive behavior under the deforming compressive load and ably fingerprints the experimental results with accuracy.

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PHASE TRANSITION OF CeO₂ UNDER HIGH PRESSURE

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Abstract- The Pressure induced structural phase transition of Ceria (CeO₂) has been investigated using an effective interionic interaction potential. The present potential had been found to reproduce well the experimentally observed phase fluorite to orthorhombic transition pressure and associated volume collapses and elastic constants of CeO₂ is in good agreement with their corresponding experimental data (31.5 GPa). We have also reported the elastic properties of CeO₂ in both phases.

KeyWord- Gibbs Free Energy, High Pressure, Phase Transition, Relative Volume Collapse. PACS Code-64.70.Kb.,62.20.Dc.

I INTRODUCTION

Cerium dioxide (CeO₂) is one of the extensively studied dioxides because of its technological applications and theoretical implications [1]. The pressure-induced transition of CeO₂ has been the subject of some recent studies [2] because it can be related to the systematic of the high-pressure behaviour of the fluorite type ceria [3]. At ambient pressure and temperature Ceria (CeO₂) has fluorite symmetry and its electronic structure of it is characterized by unoccupied 4f states of Ce⁴⁺ (4f⁰) [4]. Under high pressure behaviour of pure Ceria revealed the presence of its transformation to orthorhombic (PbCl₂) type structure [5-7].

In the present paper we have investigated the high pressure structural phase transition (phase transition pressure, relative volume collapse), cohesive energy and elastic properties of Ceria from fluorite lattice (B_F) (*Fm3m*) space group to orthorhombic (B_O) (*Pnam*) space group using inter-ionic potential model. Major part of the cohesion in these potential is contributed by long range (L-R) Coulomb interactions, (*Pnam*) space group using inter-ionic potential model. Major part of the cohesion in these potential is contributed by long range (L-R) Coulomb interactions, which are counter balanced by short range (S-R)

overlap repulsion. Surveys of literature, shows that, many experimental results are being available, but no theoretical attentions have been made to explain the structural properties of CeO₂ for their description. Motivated from this fact we thought it pertinent to apply an effective interionic potential which have been successfully applied to describe the superionic solids [8-10] and binary semiconductors. The consequent formulation of effective interionic potential has been described in section II. The application of present potential to predict the phase transition pressure and elastic constants are presented and discussed in the next section.

II THEORY AND FORMULATION

The stability of a lattice is attained at the minimum Gibbs free energy for a particular lattice spacing r , given as:

$$G=U+PV-TS \quad (1)$$

Here, U is the internal energy, which at 0K corresponds to the cohesive energy, S is the vibrational entropy at absolute temperature T and V is the volume at pressure P. At sufficient low temperature nearly zero (T=0K) one can ignore entropy term (TS), thus Gibbs free energy for Fluorite (B_F) and Orthorhombic (B_O) structures are expressed as:

$$G_{B_F}(r)=U_{B_F}(r)+PV_{B_F}(r) \quad (2)$$

$$G_{B_O}(r')=U_{B_O}(r')+PV_{B_O}(r') \quad (3)$$

with lattice energies (U) defined as:

$$U_{B_F}(r)=-\frac{\alpha_M e^2 Z^2}{r}+b\sum_{ij}\beta_{ij}\exp\left(\frac{r_i+r_j-r_{ij}}{\rho}\right) \quad (4)$$

$$U_{B_O}(r')=-\frac{\alpha'_M e^2 Z^2}{r'}+b\sum_{ij}\beta_{ij}\exp\left(\frac{r_i+r_j-r'_{ij}}{\rho}\right) \quad (5)$$

Here, first term represents the Coulomb attraction corresponding to nearest neighbor separations $r(r')$ and Madelung constant $\alpha_M(\alpha'_M)$ for Fluorite (Orthorhombic) structure and Ze is the ionic charge. The second term is the Hafemeister-Flgyare (HF) type repulsive interaction operative upto the second neighbor ions. β_{ij} is the Pauling coefficients with $r_i(r_j)$ as the

ionic radii of the cations (anions); ρ , b are the range and hardness model parameters determined by the equilibrium condition

$$\left. \frac{dU(r)}{dr} \right|_{r=r_0} = 0 \text{ and } B = \frac{1}{9Kr_0^3} \left[\frac{d^2U(r)}{dr^2} \right]_{r=r_0} \quad (6)$$

where, B is bulk modulus, r is the nearest interionic separation; r_0 is the equilibrium separation i.e. $r = r_0$ and K as the crystal structure constant. The pressure variations of C_{11} , C_{12} , C_{44} and B have been computed using the expression given elsewhere [8] for both phases is listed in table.

III RESULT AND DISCUSSION

The present effective interaction potential contains only two model parameters (ρ and b) which have been

evaluated by using input data taken from ref [5] are listed in Table 1.

Crystal	Input Data		Model Parameters	
	$r_0(\text{\AA})$	$B(\text{GPa})$	$\rho(\text{\AA})$	$b(10^{12}\text{erg})$
CeO ₂	2.703	230	0.297	0.242

Table 1:

We have followed the minimization techniques of cohesive energy at different pressure in order to obtain, the inter-ionic separations for fluorite and orthorhombic phases. The computed cohesive energy using the model parameters are reported in Table 2.

Crystal	U_{BF}	U_{BO}
CeO ₂	-289.313	-477.943

Table 2:

Our comments on the reliability of cohesive energy value for both the phases are restricted until the experimental data report on them. In an attempt to reveal the structural phase transition of CeO₂; we minimized the Gibbs free energies for both the phases. As pressure is increased, ΔG decreases to zero at phase transition pressure and becomes negative when pressure is further increased. The phase transition pressure and relative volume collapse evaluated is reported in Table 3 and plotted as a function of pressure in fig 1 and fig 2 respectively. Table 3:

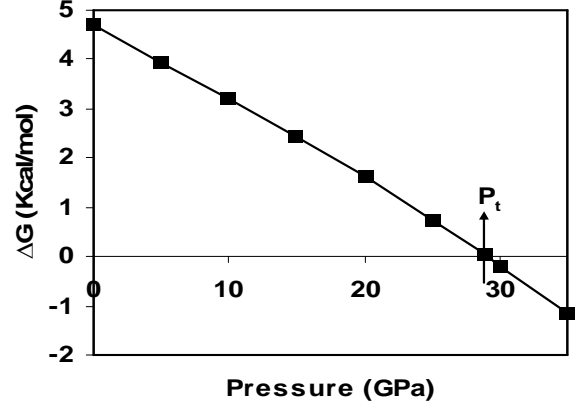


Figure 1: Change in Gibbs free energy from Fluorite → Orthorhombic structure.

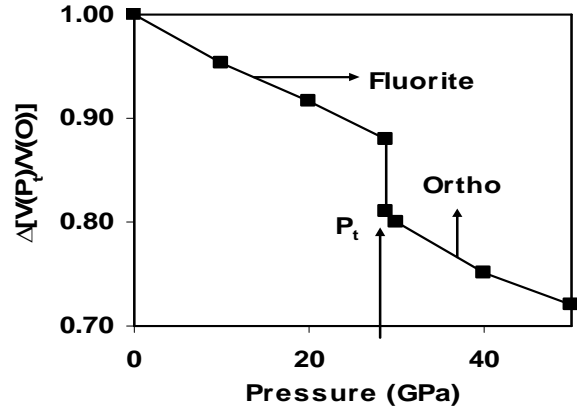


Figure 2: Volume Collapse as function of pressure (P) from Fluorite → Orthorhombic structure.

Crystal	$P_t(\text{GPa})$	$\Delta[V(P_t)/V(O)](\%)$
CeO ₂ Fluorite-	28.9	6.9
Ortho	(31.5 ^a , 22.3-6.5 ^b)	(7.5 ^{ab})

^a ref. [5-7], ^b ref. [11]

Table 3:

The phase transition pressure, at which ΔG approaches zero is known as phase transition pressure (P_t). Ambient pressures, CeO₂ crystallize on fluorite (B_F) structure and undergo a transition to orthorhombic (B_O) structure upon compression. The (-) sign shows the compression in CeO₂. The value of phase transition pressure and relative volume collapse are in satisfactorily agreement with the available experimental data.

In order to understand the high pressure elastic behaviour of CeO₂ we have calculated SOEC's and B for both the phases and reported them in Table 4. The accuracy of the bulk modulus is remarkably good.

CeO ₂	Fluorite	Orthorhombic
C_{11} (GPa)	289.98	333.88

C_{12} (GPa)	197.92	281.73
C_{44} (GPa)	123.6	219.51
B (GPa)	228.61 (230) ^a	299.11 (304) ^a

Table 4:

IV CONCLUSION

On the basis of overall achievement it may be concluded that the present effective interionic potential has evolved more realistic representation of interaction mechanism to describe the high pressure phase transition and elastic properties of CeO₂.

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PARAMETERS ANALYSIS & STUDY OF AN ARROW SHAPED PATCH ANTENNA IN INCREASING SLOTS MODE KEEPING INPUT PARAMETERS CONSTANT

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I INTRODUCTION

Microstrip antenna consists of a radiating patch of any planar geometry (e.g. Circular, square, Ellipse, ring and rectangular) on one side of a dielectric material substrate backed by a ground plane on the other side. It has some advantages such as light weight, low cost etc. and some disadvantages such as low bandwidth low gain. My

methodology is to improve the performance of patch antenna by introducing slots in its cross-section and analyzing the effects. IE3D software is used as simulator and study to generate a conclusion that what will happen with the important antenna parameters if in any antenna slots are increased at different positions. The discussion will start from the basic geometry of the antenna; I have taken an arrow shaped antenna for this practice

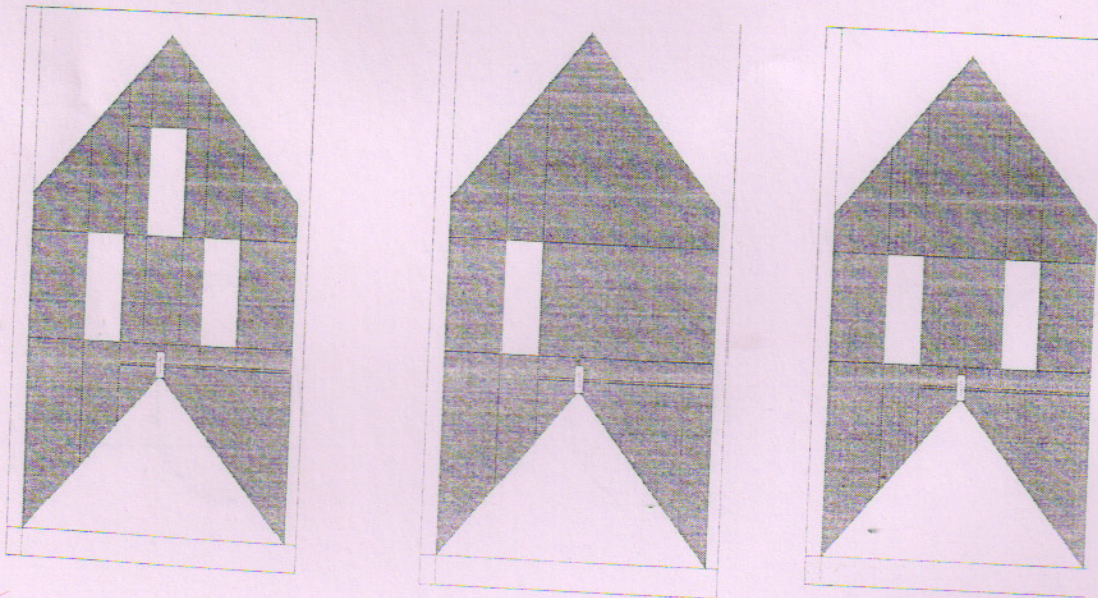


Figure 1: Single slot arrow shape MSA Figure 2: Double slot arrow shape MSA Figure 3: Triple slot arrow shape MSA

Figure 1, Figure 2 and Figure 3 are representing the three samples and they are taken for analysis in this paper. The coordinates of this basic arrow shape in which have dig these holes, starting from origin (0,0) are (18.06,15), (36.12,0), (36.12,31.51), (18.06,46.51) and

(0.31,51). The feed Point is given as (18,16) and then by simulation on IE3D following results are generated and compared, Figure 4, 5 and 6 show the value of return loss of antennas.

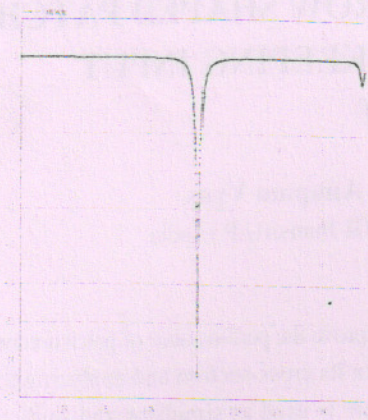


Figure 4 : Return Loss Graph of Single slot arrow shape MSA

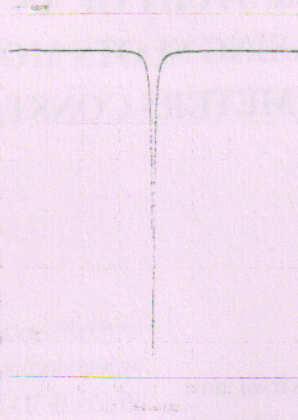


Figure 5: Return Loss Graph of Double slot arrow shape MSA

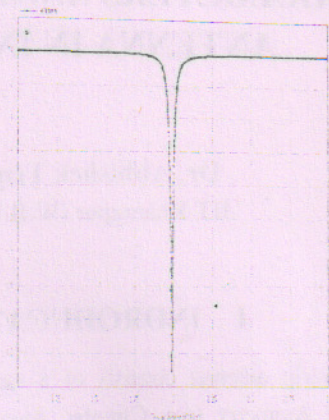


Figure 6 : Return Loss Graph of triple slot arrow shape MSA

Smith chart of each antenna has been drawn as show in the figures 7,8 & 9.

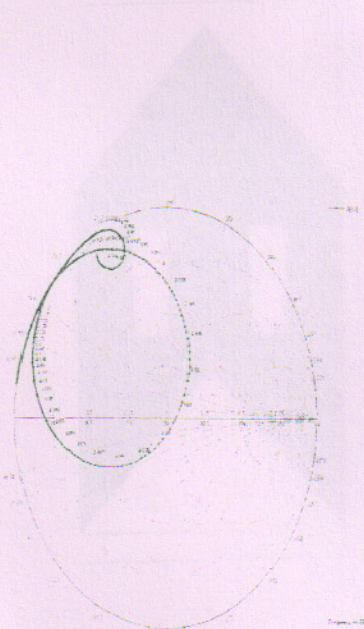


Figure 7: Smith Chart of Single slot arrow shape MSA

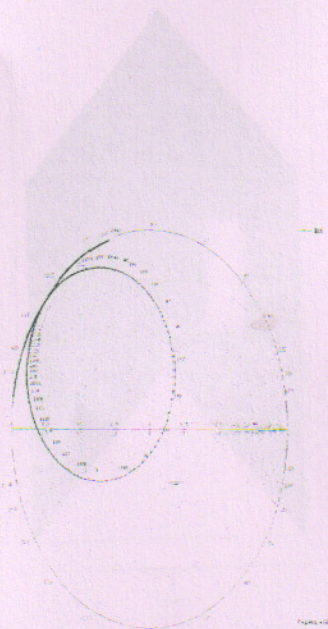


Figure 8: Smith Chart of Double slot arrow shape MSA

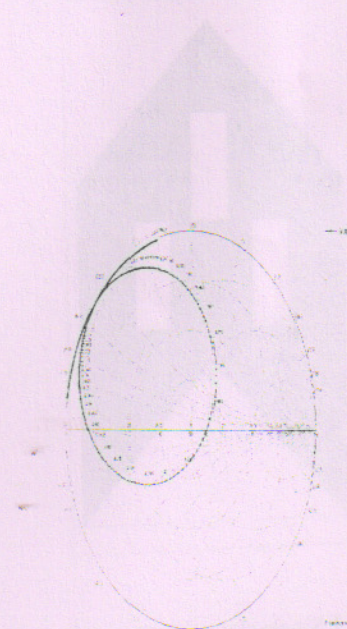


Figure 9 :Smith Chart of Triple slot arrow shape MSA

VSWR Graphs of the slotted arrow shaped antenna have been drawn at figure 8,9,and10.

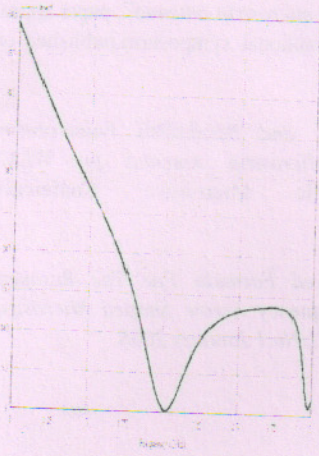


Figure 8

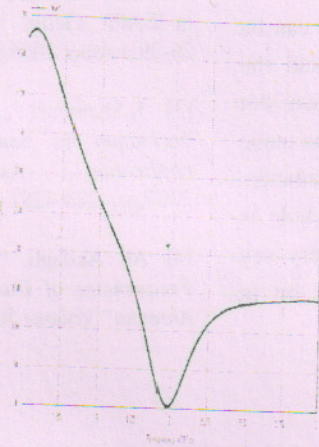


Figure 9

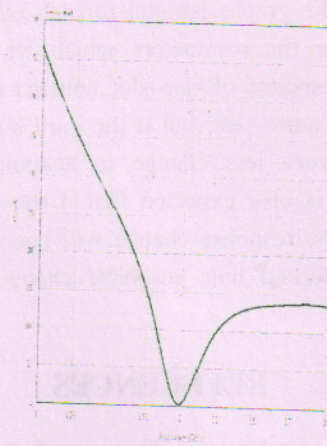


Figure 10

Both Real and Imaginary parts of S-Parameters of antennas as generated by IE3D respectively are shown figure 11 to 16

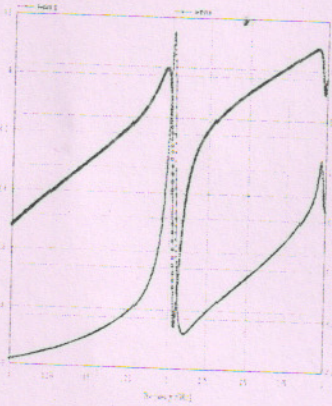


Figure 11

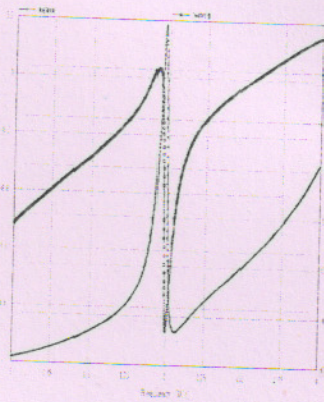


Figure 12

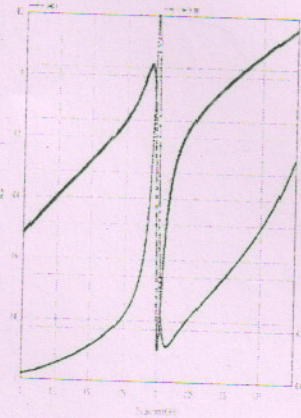


Figure 13

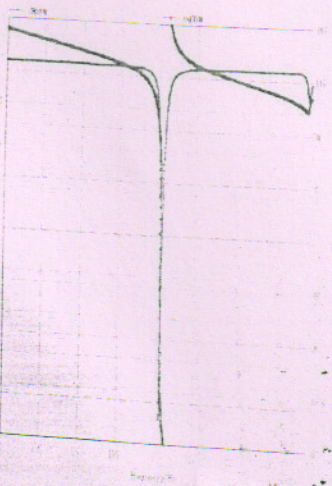


Figure 14

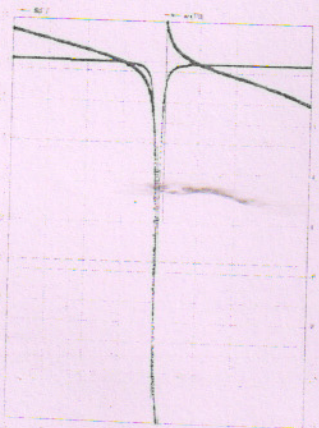


Figure 15

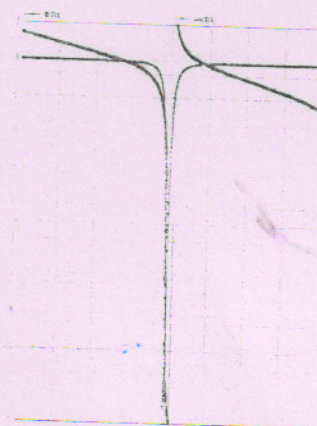


Figure 16

II CONCLUSION

By putting the graphs parallel to each other it can be seen that for the parameters which we worked the change in response of one slot antenna and two slot antenna was quite clear but if the third hole was made then there very less change in antenna parameters response. it is also expected that if the forth hole is made then the response change will become very very less. For succeed hole response change will be in significant.

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BROADBAND RECTANGULAR RING SLOT MICROSTRIP ANTENNA WITH HIGH RETURN LOSS AND ALSO COMPARE WITH RECTANGULAR MSA

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Abstract- A rectangular MSA and ring slot MSA with circular polarization radiation. The antenna has a high return loss, where the return loss is compared with its experimental value. The experimental results of both antennas compared with each other, the proposed antenna is able to achieve the return loss above -10db .

Key Word- Micro strip, Ring slot, returns loss

I INTRODUCTION

Antennas are a very important component of communication systems [1]. By definition, an antenna is a device used to transform an RF signal, traveling on a conductor, into an electromagnetic wave in free space. The broadband circularly polarized MSA, plays a vital role in wireless communication due to its low-profile, small-size and light weight. As well known, a circularly polarized wave can be obtained when spatially orthogonal modes are excited with equal amplitude. Conventional designs [2] of MSA for circular polarization are usually achieved by truncating patch corners, cutting rectangular ring slots in the rectangular patch.

II SUBSTRATE MATERIAL

The first design step is to choose a suitable dielectric substrate of appropriate thickness h and loss tangent [3]. A thicker substrate, besides being mechanically strong, will increase the radiated power, reduce conductor loss, and improve impedance, bandwidth, however it will also increase the weight, dielectric loss, surface wave loss, and extraneous radiations from the probe field. Substrate dielectric constant ϵ_r plays a role similar to that of the substrate thickness.

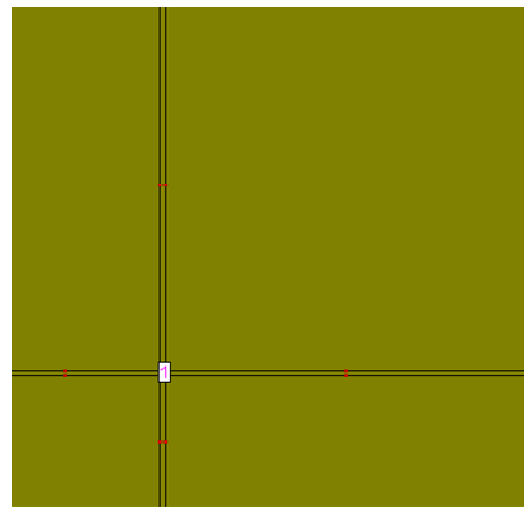


Figure 1: Proposed Geometry of rectangular Antenna on IE3D

III ANTENNA DESIGN

Figure 1 and Figure 7 show the geometry of the proposed broadband MSA. The radiating rectangular patch, printed on a substrate of thickness h and relative permittivity ϵ_r , has the dielectric material thickness is 1.6mm. The length of both sides, $L=29\text{mm}$ and $W=30\text{mm}$. Which are oriented in orthogonal directions and have the same distance of feed point is $X=3\text{mm}$ and $Y=3\text{mm}$ for rectangular ring slotted antenna and other feed point is $X=8\text{mm}$ and $Y=10\text{mm}$ for rectangular antenna [4] [5].

IV EXPERIMENTAL RESULTS

To validate whether the design technique is applicable, the antenna has been simulated with IE3D. Fig. 2, Fig. 3 and Fig. 4 show the Gain, VSWR versus frequency and smith chart respectively. The proposed rectangular slotted antenna, Fig. 7, Fig. 8, and Fig. 9 show the Gain, VSWR versus frequency and smith chart respectively.

for the proposed rectangular antenna .From the simulation results, we observe that the proposed rectangular slotted antenna and ring slot is able to achieve the gain is -15.55db,-29.20db respectively and the VSWR less than 2. The output result by the spectrum analyzer is shown in Fig.5and Fig.11, return loss (reflection coefficient) versus frequency of the proposed antenna. Since the feed point connected with the coaxial connector [6] [7], have good equal amplitude and 90° phase shift, broadband CP radiation can be achieved. Furthermore, by using the thick air substrate, much wider CP bandwidth can thus be obtained. The impedance matching of the antenna can be achieved by fine adjusting the feed position, and the distance between the radiating patch and the ground plane (1.6mm) [8].

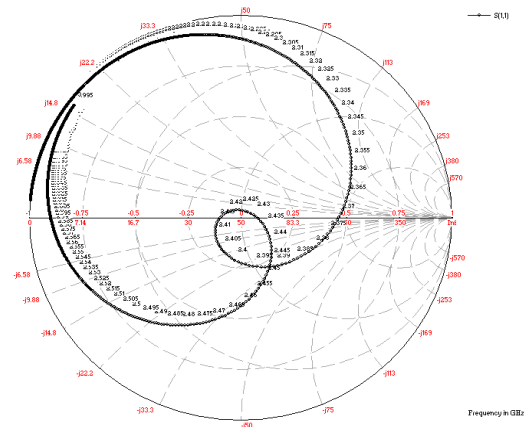


Figure 4: Smith chart of rectangular antenna

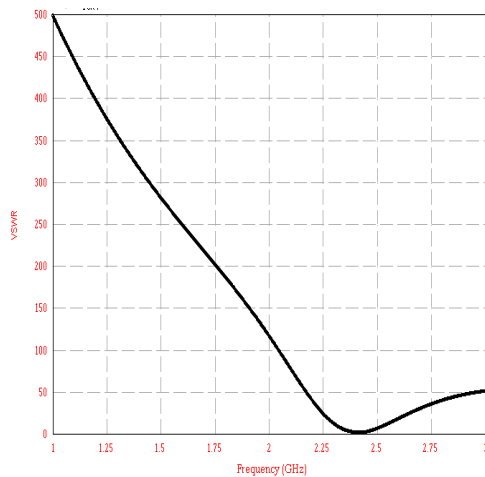


Figure 2: Return loss Vs frequency of rectangular antenna

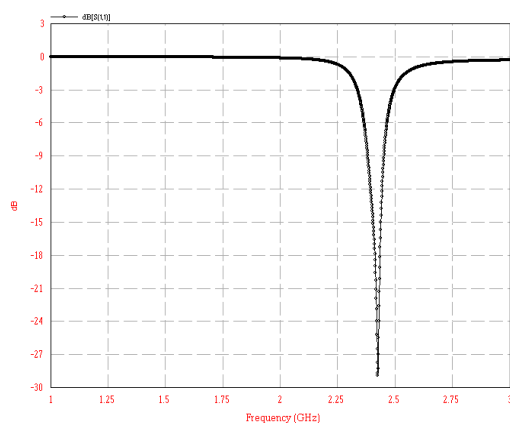


Figure 3: VSWR Vs frequency of rectangular antenna

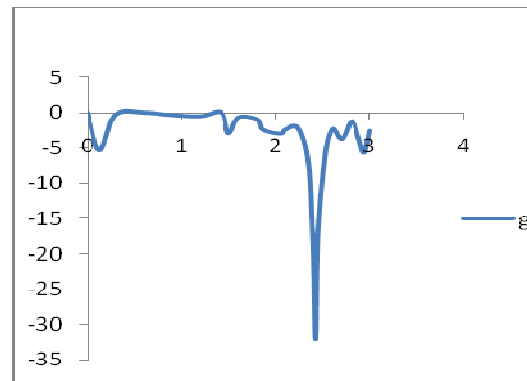


Figure 5: Practical graph (Return loss Vs frequency of Rectangular Antenna on axial)

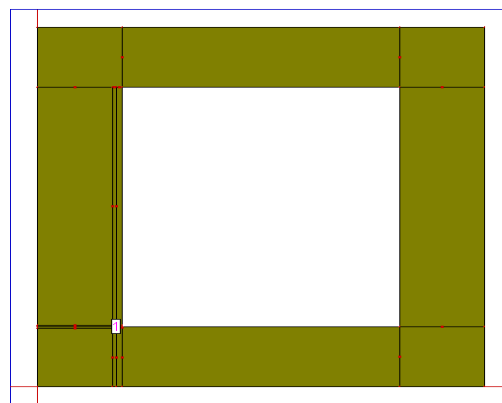


Figure 6: Return loss of rectangular microstrip antenna by spectrum



Figure 7: Proposed Geometry of rectangular ring

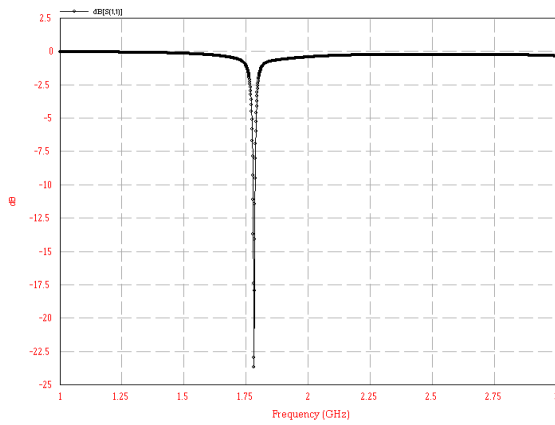


Figure 8: Return loss Vs frequency of rectangular ring slot antenna on IE3D

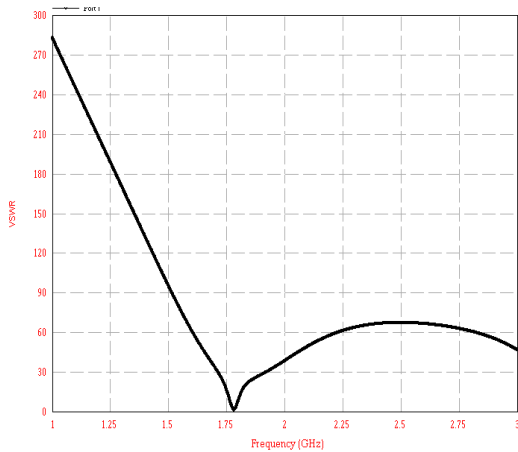


Figure. 9: VSWR versus frequency of rectangular ring slot antenna

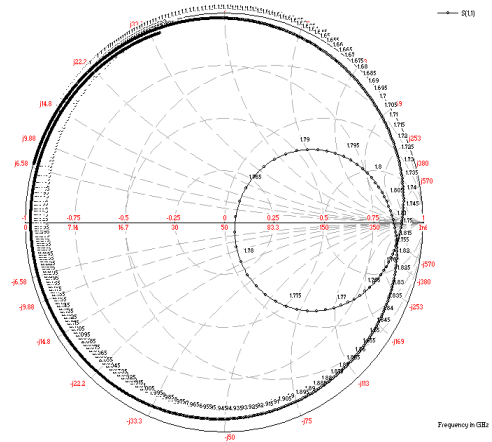


Figure 10: Smith chart of S11 parameter

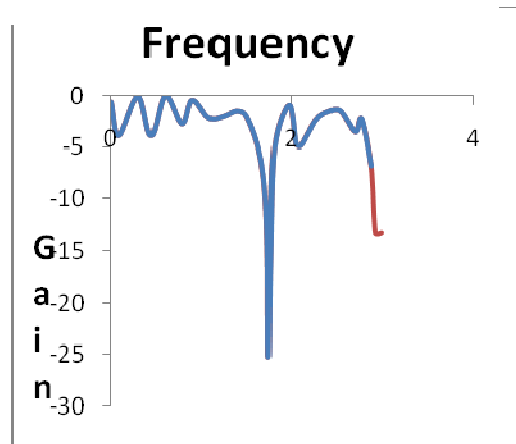


Figure.11: Practical graph (Gain Vs frequency of rectangular ring slotted antenna) on excel.

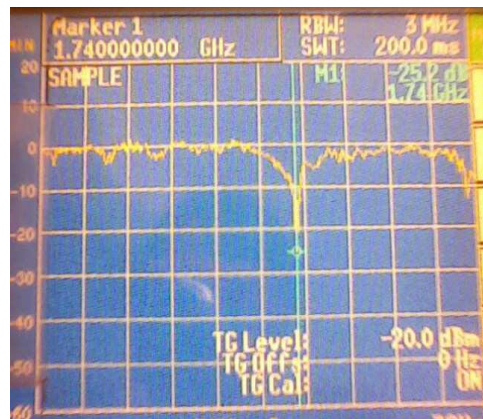


Figure 12: Return loss of rectangular ring slotted microstrip antenna on spectrum analyzer

Fr. in GHz.	Experimental value(return loss)	IE3D output (return loss)
2.5	-25.25	-15.55
2.5	-30.20	-29.20

Table1: content the experimental value

IE3D simulation output (return loss) which is at frequency 2.5 GHz. Table 1, shows the two output readings of antennas, at 2.5 GHz. Antenna 1st is rectangular slotted and 2nd is rectangular ring slotted antenna. In this paper, a new design [9] of broadband rectangular ring slotted MSA with 2.5 GHz is presented. The antenna has an output by using IE3D and compared with the experimental value. A thick air substrate is used in the present proposed design, and impedance matching is obtained through the rectangular radiating patch. The experimental results show that the proposed antenna is able to achieve VSWR less than 2 and the return loss less than -10 dB.

IV CONCLUSION

Characteristics of a design of broadband rectangular slotted and rectangular ring slotted microstrip antenna (MSA) have been experimental studies. The proposed antenna is achieved high return loss of -10 dB by using the experimental results show that the broadband MSA is able to achieve for VSWR less than 2 and the return loss less than -10 dB. So this is applicable in wireless communication. And also guide during the tenure of work.

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PEAK TO AVERAGE POWER RATIO and BIT ERROR RATIO Analysis of MIMO SFBC CI-OFDM System

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Abstract- In this paper we are going to discuss OFDM, CI-OFDM, MIMO, SFBC. The OFDM design is fairly complex and some important design blocks are chosen for verification purposes. The CI-OFDM (carrier interferometry orthogonal frequency division multiplexing) system has been widely studied in the multi-carrier communication system. In this paper, focusing on the two Tx (transmit) / one Rx (receive) antennas and two Tx / two Rx antennas configuration, we evaluate the performance of MIMO OFDM and MIMO CIOFDM system. SFBC (space frequency block coding) is applied into both MIMO OFDM system and MIMO CIOFDM system. For CI- OFDM realization, digital implemented CI-OFDM structure is used in which CI code spreading operation and carrier allocation are separately processed by simple IFFT type operation. From the simulation results, it is shown that MIMO SFBC CI-OFDM reduces PAPR significantly compared with MIMO SFBC-OFDM system. The out-of band re-growth of signal spectrum in MIMO SFBC CI-OFDM system is much smaller than MIMO SFBC OFDM. In the NBI (narrow band interference) channel MIMO SFBC CI-OFDM system achieves considerable BER improvement, compared with the MIMO SFBC-OFDM system in which error floor occurs in most of SNR range.

Keywords-OFDM (orthogonal frequency division multiplexing), CI (carrier interferometry), PAPR(peak to average power ratio), MIMO(multiple input and multiple output), SFBC(space frequency block coding)

I INTRODUCTION

OFDM : It is a technology used to compress a large amount of data into a small amount of bandwidth This is done by dividing a large amount of data into smaller chunks, then sending that data simultaneously over a number of frequencies. Such parallel data transmission method is analyzed for the first time in a paper published in 1967. In this method, an available bandwidth is divided into several sub-channels. These sub-channels are independently modulated with different carrier frequencies. It was proved that the use of

a large number of narrow channels combats delay and related amplitude distortion in a transmission medium effectively. Based on this concept, OFDM was introduced through a US patent issued in 1970. The name orthogonal comes from the fact that the subcarriers are orthogonal to each other.

The key advantages of this technique are:

- OFDM is an efficient way to deal with multipath; for a given delay spread, the implementation complexity is significantly lower than that of a single carrier system with an equalizer.
- In relatively slow time-varying channels, it is possible to significantly enhance the capacity by adapting the data rate per subcarrier according to the signal-to-noise-ratio of that particular subcarrier.
- OFDM is robust against narrowband interference, because such interference aspects only a small percentage of the subcarriers.

A standard block diagram implementation of OFDM is shown in

Transmitter:

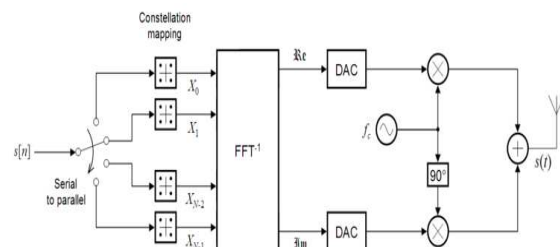


Figure 1: Block Diagram Implementation Of OFDM

An OFDM carrier signal is the sum of a number of orthogonal sub-carriers, with data on each sub-carrier being independently modulated commonly using some type of quadrature. Amplitude modulation (QAM) or phase-shift

keying (PSK). This composite baseband signal is typically used to modulate a main RF carrier. An inverse FFT is computed on each set of symbols, giving a set of complex time-domain samples. These samples are then quadrature-mixed to passband in the standard way. The real and imaginary components are first converted to the analogue domain using digital-to-analogue converters (DACs); the analogue signals are then used to modulate cosine and sine waves at the carrier frequency, f_c , respectively. These signals are then summed to give the transmission signal, $s(t)$.

Receiver:

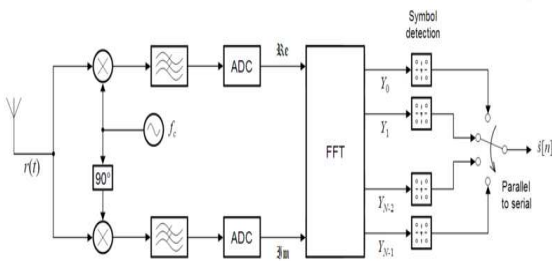


Figure 2: Block Diagram Receiver

The receiver picks up the signal $r(t)$, which is then quadrature-mixed down to baseband using cosine and sine waves at the carrier frequency. This also creates signals centered on $2f_c$, so low-pass filters are used to reject these. The baseband signals are then sampled and digitised using analog-to-digital converters (ADCs), and a forward FFT is used to convert back to the frequency domain.

CI – OFDM: In the CI-OFDM technique, each information symbol is sent simultaneously over all carriers and the each carrier for the symbol is assigned a corresponding orthogonal CI spreading code. This CI/OFDM system not only can reduce PAPR problem significantly but also achieve frequency diversity gains without any loss in throughput. Recently, CI-OFDM system was proposed for the PAPR reduction using CI phase offset codes and it shows the BER improvement by frequency diversity effect in the narrow band interference channel. This system spreads one information data into N sub carrier and the orthogonal CI spread codes are multiplied. So, it can achieve the good BER performance because of the frequency diversity benefit in each bit. However CI-OFDM system will be degraded when there is mismatch of phase effect due to the random phase noise.

MIMO : Multiple-input and multiple-output, or **MIMO** is the use of multiple antennas at both the transmitter and

receiver to improve communication performance. It is one of several forms of smart antenna technology. Note that the terms *input* and *output* refer to the radio channel carrying the signal, not to the devices having antennas. MIMO technology has attracted attention in wireless communications, because it offers significant increases in data throughput and link range without additional bandwidth or increased transmit power. It achieves this goal by spreading the same total transmit power over the antennas to achieve an array gain that improves the spectral efficiency (more bits per second per hertz of bandwidth) or to achieve a diversity gain that improves the link reliability (reduced fading). Because of these properties, MIMO is an important part of modern wireless communication standards such as IEEE 802.11n (Wi-Fi), 4G, 3GPP Long Term Evolution, Wi-MAX and HSPA+.

SFBC : The SFBC (space-frequency block coding) method is more efficient for the high quality transmission.

II SYSTEM DESCRIPTION

In this paper, SFBC transmit diversity technique is applied into the OFDM system. Simply, the 2Tx/1Rx and 2Tx/2Rx antenna configuration are considered to compare the system performance of the MIMO OFDM and MIMO CI-OFDM system. First, we discuss the traditional MIMO SFBC OFDM structure with 2Tx/1Rx and 2Tx/2Rx antenna.

A) 2Tx-1Rx SFBC OFDM system

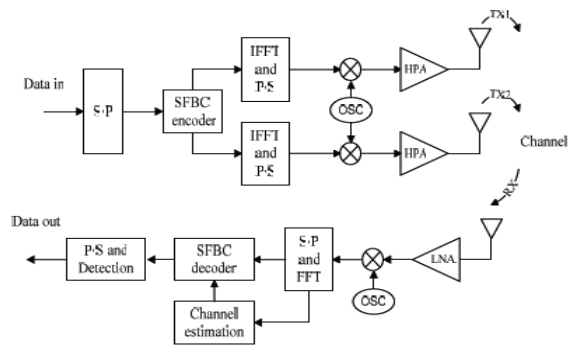


Figure 3: MIMO SFBC OFDM Transceiver Diagram With 2 X 1 Diversity.

When 2 Tx antennas and 1 Rx antenna are considered, assuming the system transmits data symbol $X_0, X_1, \dots, X_k, X_{k+1}, \dots, X_{N-1}$ carriers $0, 1, \dots, k, k+1, \dots, N-1$, respectively, the encoding algorithm is

$$\begin{bmatrix} f_k \\ f_{k+1} \end{bmatrix} \begin{bmatrix} Tx1 & Tx2 \\ X_k & X_{k+1} \\ -X_{k+1}^* & X_k^* \end{bmatrix}$$

Channel description between the Tx antennas and Rx antenna is as Fig.2.

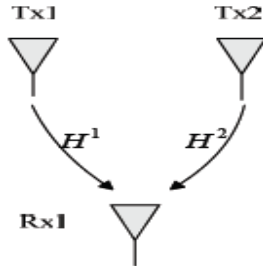


Figure 4: Channel Definition In 2*1 Diversity Scheme .

Received signals at the Rx antenna is defined as:

	Rx antenna 1
<i>k</i> th carrier	R_k
<i>k</i> + 1 th carrier	R_{k+1}

So, received signal in frequency domain can be

$$R = \begin{bmatrix} R_k \\ R_{k+1} \end{bmatrix} = HX + N = \begin{bmatrix} H_k^1 & H_k^2 \\ H_{k+1}^{2*} & -H_{k+1}^{1*} \end{bmatrix} \begin{bmatrix} X_k \\ X_{k+1} \end{bmatrix} + \begin{bmatrix} N_k \\ N_{k+1} \end{bmatrix} \quad (1)$$

Let's assume that adjacent two carriers have same channel characteristic, such as

$$H_k^1 = H_{k+1}^1 = H^1, H_k^2 = H_{k+1}^2 = H^2.$$

Then, decoding algorithm is as follows.

$$\begin{aligned} \hat{R} &= \begin{bmatrix} \hat{R}_k \\ \hat{R}_{k+1} \end{bmatrix} = H^H R = \begin{bmatrix} H^{1*} & H^2 \\ H^{2*} & -H^1 \end{bmatrix} \begin{bmatrix} R_k \\ R_{k+1} \end{bmatrix} \\ &= (|H^1|^2 + |H^2|^2) \cdot \begin{bmatrix} X_k \\ X_{k+1} \end{bmatrix} + \begin{bmatrix} \tilde{N}_k \\ \tilde{N}_{k+1} \end{bmatrix} \end{aligned} \quad (2)$$

where H^H means the conjugate transpose of H , and

$$\begin{bmatrix} \tilde{N}_k \\ \tilde{N}_{k+1} \end{bmatrix} = \begin{bmatrix} H^{1*} & H^2 \\ H^{2*} & -H^1 \end{bmatrix} \begin{bmatrix} N_k \\ N_{k+1} \end{bmatrix}. \quad (3)$$

B) 2TX-2RX SFBC OFDM SYSTEM

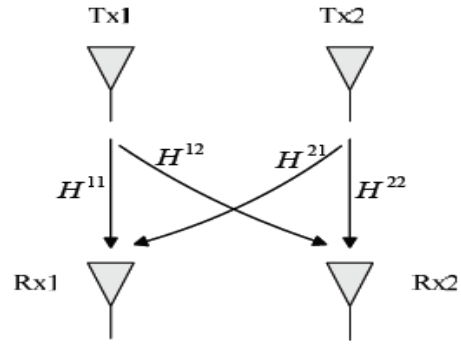


Figure 5: Channel Definition In 2 X 2 Diversity Scheme

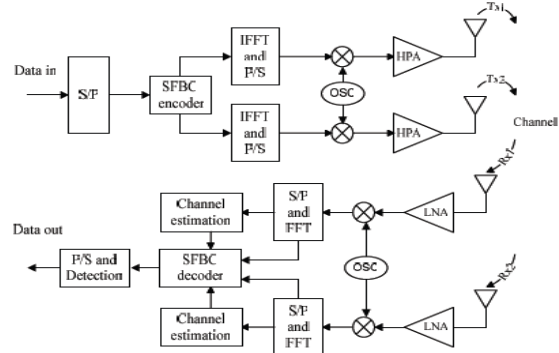


Figure 6: MIMO SFBC OFDM Transceiver Diagram With 2 X 2 Diversity.

When there are 2 Tx antennas and 2 Rx antennas, channel between the Tx and Rx antennas is described as Fig.3. Received signals at the two Rx antennas are defined as

	Rx antenna 1	Rx antenna 2
<i>k</i> th carrier	R_k^1	R_k^2
<i>k</i> + 1 th carrier	R_{k+1}^1	R_{k+1}^2

So, received signals in frequency domain are expressed as follows:

$$R = \begin{bmatrix} R_k^1 \\ R_{k+1}^1 \\ R_k^2 \\ R_{k+1}^2 \end{bmatrix} = HX + N = \begin{bmatrix} H_k^{11} & H_k^{21} \\ H_{k+1}^{21*} & -H_{k+1}^{11*} \\ H_k^{12} & H_k^{22} \\ H_{k+1}^{22*} & -H_{k+1}^{12*} \end{bmatrix} \begin{bmatrix} X_k \\ X_{k+1} \end{bmatrix} + \begin{bmatrix} N_k^1 \\ N_{k+1}^1 \\ N_k^2 \\ N_{k+1}^2 \end{bmatrix} \quad (4)$$

Suppose adjacent two carriers have same channel characteristic, such as

$$\begin{aligned} H_k^{11} = H_{k+1}^{11} = H^{11}, H_k^{12} = H_{k+1}^{12} = H^{12}, \\ H_k^{22} = H_{k+1}^{22} = H^{22}, H_k^{21} = H_{k+1}^{21} = H^{21}. \end{aligned}$$

Then decoding algorithm is as follows

$$\hat{R} = \begin{bmatrix} \hat{R}_k \\ \hat{R}_{k+1} \end{bmatrix} = H^H R = \begin{bmatrix} H^{11*} & H^{21} & H^{12*} & H^{22} \\ H^{21*} & -H^{11} & H^{22*} & -H^{12} \end{bmatrix} \begin{bmatrix} R_k^1 \\ R_{k+1}^1 \\ R_k^2 \\ R_{k+1}^2 \end{bmatrix}$$

$$= (|H^{11}|^2 + |H^{22}|^2 + |H^{12}|^2 + |H^{21}|^2) \cdot \begin{bmatrix} X_k \\ X_{k+1} \end{bmatrix} + \begin{bmatrix} \tilde{N}_k \\ \tilde{N}_{k+1} \end{bmatrix} \quad (5)$$

Where

$$\begin{bmatrix} \tilde{N}_k \\ \tilde{N}_{k+1} \end{bmatrix} = \begin{bmatrix} H^{11*} & H^{21} & H^{12*} & H^{22} \\ H^{21*} & -H^{11} & H^{22*} & -H^{12} \end{bmatrix} \begin{bmatrix} N_k^1 \\ N_{k+1}^1 \\ N_k^2 \\ N_{k+1}^2 \end{bmatrix} \quad (6)$$

III MIMO SFBC CI-OFDM SYSTEM

In the MIMO SFBC CI-OFDM system, the CI spreading process can be expressed as follows:

$$C_i(t) = \sum_{k=0}^{N-1} e^{j2\pi k \Delta f t} \cdot e^{j k \Delta \theta_i}$$

$$\Delta \theta_i = \frac{2\pi}{N} i, \quad i = 0, 1, \dots, N-1 \quad (7)$$

where, $j = -1$, N is the total number of sub-carriers, Δf means the carrier spacing and $\Delta \theta_i$ is the assigned base spreading phase offset for the i th parallel data. Here, for general expression, we define CI spreading sequence series for the i th parallel data as before passing through nonlinear HPA, the l th Tx transmitted signal for one entire MIMO SFBC CI-OFDM symbol is as follows:

$$[c_i] = \{c_i^0, c_i^1, \dots, c_i^{N-1}\} = \left\{ e^{j \frac{2\pi}{N} i \cdot 0}, e^{j \frac{2\pi}{N} i \cdot 1}, \dots, e^{j \frac{2\pi}{N} i \cdot (N-1)} \right\}$$

$$S^l(t) = \sum_{k=0}^{N-1} \sum_{i=0}^{N-1} x_k^l \cdot e^{j2\pi k \Delta f t} \cdot e^{j k \Delta \theta_i} \cdot e^{j2\pi f_c t} \cdot p(t)$$

$$= e^{j2\pi f_c t} \cdot \sum_{k=0}^{N-1} s_k^l \cdot e^{j2\pi k \Delta f t} \quad (8)$$

where, $l k x$ is the time domain SFBC coded data on the k th carrier and l th Tx antenna, $c f$ is the center frequency and $P(t)$ is the pulse shaping for the bit duration $b T$. Besides,

here, $\sum_{i=0}^{N-1} x_k^l \cdot e^{j k \Delta \theta_i}$ is defined as s_k^l .

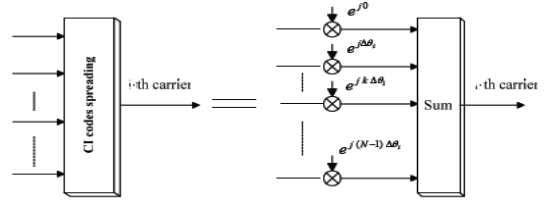


Figure7: CI Codes Spreading Block.

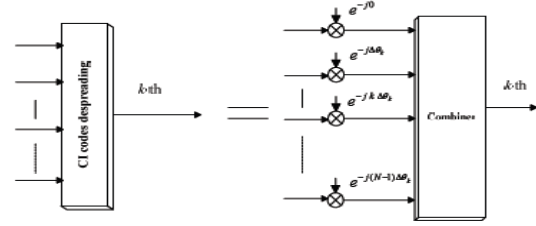


Figure 8: CI codes despreading block

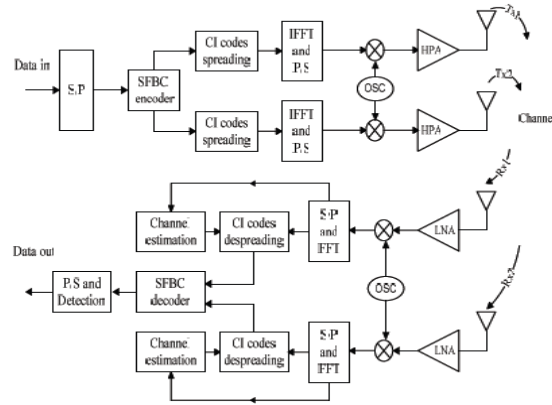


Figure 9: MIMO SFBC CI-OFDM Transceiver Diagram (2Tx-2Rx).

Theoretically, in the MIMO SFBC CI-OFDM receiver side, the j th Rx received signal can be expressed as follows:

$$R^j(t) = e^{j2\pi f_c t} \cdot \sum_{l=1}^L \sum_{k=0}^{N-1} h_k^l \cdot s_k^l \cdot e^{j2\pi k \Delta f t} + n^j(t)$$

$$= e^{j2\pi f_c t} \cdot \sum_{l=1}^L \sum_{k=0}^{N-1} \alpha_k^l \cdot s_k^l \cdot e^{j2\pi k \Delta f t} \cdot e^{j\phi_k^l} + n^j(t)$$

$$= e^{j2\pi f_c t} \cdot \sum_{l=1}^L \sum_{k=0}^{N-1} \alpha_k^l \cdot e^{j2\pi k \Delta f t} \cdot e^{j\phi_k^l} \cdot \sum_{i=0}^{N-1} x_k^l \cdot e^{j k \Delta \theta_i} + n^j(t)$$

$$= \sum_{l=1}^L \sum_{k=0}^{N-1} \sum_{i=0}^{N-1} \alpha_k^l \cdot x_k^l \cdot e^{j2\pi k \Delta f t} \cdot e^{j k \Delta \theta_i} \cdot e^{j2\pi f_c t} \cdot e^{j\phi_k^l} + n^j(t) \quad (9)$$

where L is the total transmit antenna number and here supposed to $L = 2$. $R^j(t)$ is the j th Rx antenna received signal, $l j k h$ is the time domain channel response of the k th carrier from l th Tx antenna to j th Rx antenna when channel is frequency selective fading channel, $l j k a$ and $l j$ are the fade parameter and phase offset of $l j k h$ respectively, and $n^j(t)$ is the AWGN (additive white Gaussian noise) with a power spectral density equal to $20 N$ from l th Tx antenna to j th Rx

antenna. The above received signal is separated into its N orthogonal sub-carriers through FFT process. After channel state estimation, each symbol stream's phase offset due to spreading is removed from each carrier by CI codes de-spreading. The obtained vectors from each carrier are then combined by certain combining strategy. The combining strategy is employed to help restore orthogonality between symbol streams, maximize frequency diversity benefits, and minimize interference and noise. In AWGN or flat fading channel, EGC (equal gain combining) can be used. In the frequency selective channel, MMSEC (minimum mean-square error combining) can be used to minimize inter-symbol interference from other spreading codes and noise.

IV PERFORMANCE ANALYSES AND DISCUSSION

Based on the above theoretical analysis, in order to compare the transmission performance both in the MIMO SFBC OFDM and MIMO SFBC CI-OFDM system

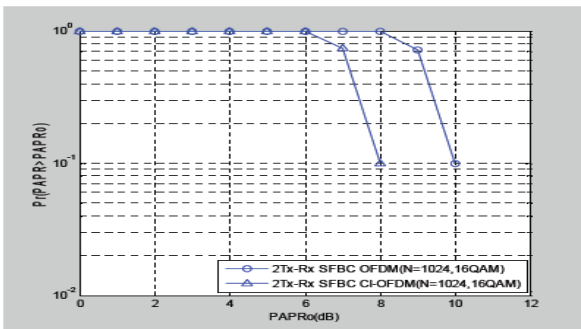


Figure 10 : PAPR In MIMO SFBC OFDM And MIMO SFBC CI-OFDM (N=1024,16QAM)

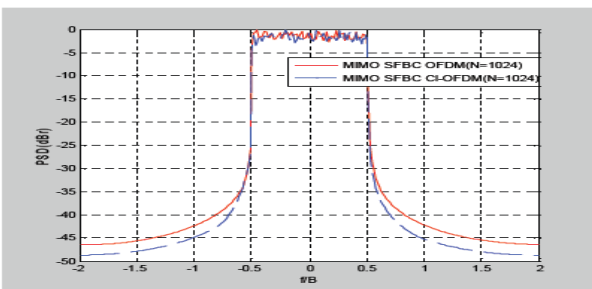


Figure 11: Spectrum in MIMO SFBC OFDM and MIMO SFBC CI-OFDM (N=1024, 16QAM)

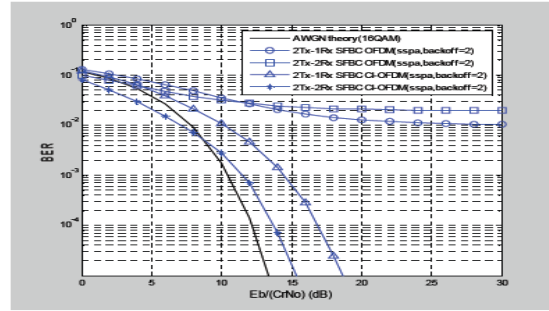


Figure 12: BER in MIMO SFBC OFDM and MIMO SFBC CI-OFDM with SSPA (N=1024, 16QAM, AWGN channel)

V CONCLUSION

In this paper, focused on the two Tx/one Rx antenna and two Tx/two Rx antenna configurations, we evaluate the system performance of MIMO SFBC OFDM and MIMO SFBC CIOFDM system on the basis of MIMO technique theoretical analysis. SFBC coding is applied in both MIMO OFDM system and MIMO CI-OFDM system. For CI-OFDM realization, digital implemented CI-OFDM structure is used, in which CI codes spreading operation and carrier allocation are separately processed by simple IFFT type operation.

- (a) From the simulation results, it is found that MIMO SFBC CI-OFDM reduces PAPR significantly compared with MIMO SFBC-OFDM system. The carefully selected CI codes result in one symbol stream's power reaching a maximum, when the powers of the remaining $N-1$ symbol streams are at a minimum. Therefore, a more stable envelope, average PAPR and standard deviation of PAPR far smaller than traditional schemes can be achieved.
- (b) The out-of band re-growth of signal spectrum in MIMO SFBC CI-OFDM system is much smaller than MIMO SFBC OFDM.
- (c) When the Narrow band interference exists, MIMO SFBC CI-OFDM system achieves considerable BER improvement compared with the MIMO SFBC-OFDM system in which error floor occurs even in high SNR. It is because that CIOFDM method has frequency diversity benefit so that it brings robustness to the narrow band interference.

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ARBUSCULAR MYCORRHIZAL FUNGI (AMF) A KEY COMPONENT OF THE SYMBIOTIC SOIL MICROBIAL POPULATIONS - A CRITICAL STUDY

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Abstract -Arbuscular mycorrhizal fungi (AMF) are one of the most important microbial symbionts in the roots of maximum plants on the Earth. Commonly, AMF are non host specific and have symbiotic interactions with different plants species. But some AMF species at certain combinations with host's plant species have shown some host specificity. The beneficial interactions of AMF with plants growth result in the improvement of plant health and soil fertility. Under stress conditions of plants and especially in phosphate-limited condition, AMF can influence plant community development, nutrient uptake, water relations and aboveground productivity. They can also act as bioprotectants against pathogens and toxic stresses. AMF have different types of interactions with different kinds of rhizosphere microorganisms, particularly with rhizospheric bacteria that exhibiting some specific characteristics and functions in associations of them.

These interactions may result in spore formation and germination through root colonization to external hyphae during AMF life cycle. The nature of these bacteria-fungal interactions may be inhibitory or stimulatory, competitive or mutualistic to each other or for the plant. In nature, the plant species impact on the selection of their bacterial associates and strongly influence the composition of AMF community. Indirectly AMF species also influence on the selection of bacteria in the mycorrhizosphere. Several kinds of bacterial species have been studied that are present in plant-AMF mycorrhizosphere, but bacteria associated with AMF spores (AMB) with different interaction are not well studied yet. These AMB may be involved in the biocontrol of plant pathogens and to improve supply of nutrients. The knowledge of interactions between

plant AMF, AMB and plant pathogens have been found helpful for the development of sustainable management of soil fertility and to increase crop production.

I INTRODUCTION

Frank in 1885 for the first time coined the term mycorrhiza (mykes =fungus, rhiza= root) to describe the symbiosis between a soil fungus and plant roots. These soil fungi make various types of associations with plant roots. Different types of mycorrhizal associations based on the type of fungus involved and the resulting structures produced by the root-fungus combination have been identified; *e.g.* AMF(Arbuscular Mycorrhizal Fungi) ectomycorrhiza, ectendomycorrhiza, ericoid, arbutoid, orchid and monotropoid. The AMF symbiosis is generally mutualistic in which bi-directional nutrient transfers between the host plant and the fungus takes place and where carbon flows to the fungal partner and different nutrients move to the plant (Smith & Read, 1997).

It has been estimated that AMF are the most common mycorrhiza that colonize about 80 % of plant families from all terrestrial plants (Schüßler, Schwarzott & Walker, 2001). AMF are strictly obligate i.e. AM fungi need the living plant roots to survive. But some reports showed that AM species can grow upto the spore production phase *in vitro* in the absence of plant roots and in the presence of some selected strains of sporeassociated bacteria (Hildebrandt, Janetta & Bothe, 2002; Hildebrandt *et al.*, 2006). The AM fungal root colonization is affected by the type of plant species *e.g.* host vs non-host plant, presence of inoculum level in the rhizosphere, AM fungal species and its associated microbes, phosphorus availability of soil (Hayman, 1982), soil water content (Jasper, Abbott & Robson, 1993), temperature (Kobayashi, 1988), soil pH, and agrochemical applications.

II CLASSIFICATION, IDENTIFICATION AND DIVERSITY

AMF are recognized based on their specific traits such as obligate biotrophy, asexual reproduction, large and multinucleate spores with layered walls, non-septate hyphae and arbuscules formation in plant roots. AMF reproduce asexually by spore production. There is no evidence that AMF reproduce sexually (Kuhn *et al.*, 2001). Only low level or no genetic recombination has been detected using molecular marker genes (Kuhn *et al.*, 2001). Therefore, it is generally assumed that the AMF spores are formed asexually. The spores are relatively large (40-800 µm) with layered walls and lipids in their cytoplasm. Spores are important for identification of AMF. Traditionally AM fungal taxonomy has been based on the spore morphology particularly spore wall layer structure and the way of spore formation on the hypha (Morton, 1998). AMF under Phylum Glomeromycota consists of four orders, nine families and twelve genera. AMF are found to be the sister group of *Ascomycota* and *Basidiomycota* but not the monophyletic with any part of the *Zygomycota* based on rDNA phylogeny. In earlier classification AMF were placed in order Glomales within the division *Zygomycota* because AMF have non-septate hyphae, a similar characteristic to that found in most of the *Zygomycota*. However, AMF are distinguished from the Zygomycotan lineages due to some specific characteristics *e.g.* mutualistic symbiotic nutritional habit and lack of formation of characteristic zygospores. The rDNA analysis exposed a clear separation of AMF from other fungal groups (Schüßler, Schwarzott & Walker, 2001) and AMF are now placed in a separate new phylum *Glomeromycota* (Schüßler, Schwarzott & Walker, 2001). The phylum *Glomeromycota* is divided into four orders, eight families and ten genera (Walker & Schüßler, 2004) and it consists of more than 150 species that have been identified on the basis of spore morphology (Redecker & Raab, 2006).

Based on molecular studies 200 species have been identified. These studies indicate a strong estimation of true diversity of Glomeromycotan fungi that have been described as morphospecies (Husband *et al.*, 2002; Vandenkoornhuys *et al.*, 2002). Recently, two new AMF genera, *Kuklospora* and *Intraspora* have been

included in the phylum *Glomeromycota* (Sieverding & Oehl, 2006).

Classification of AMF under Phylum *Glomeromycota* with different orders, families and genera are described in the present figure 1

PHYLUM GLOMEROMYCOTA CLASS GLOMEROMYCETES		
Orders	Families	Genera
Glomerales Diversisporales	Glomeraceae	Glomus
	Gigasporaceae	Gigaspora, Scutellospora
	Acaulosporaceae	Acaulospora, Kuklospora
	Enterophosporaceae	Enterophospora
	Pacisporaceae	Pacispora
	Diversisporaceae	Diversispora
Paraglomerales	Paraglomeraceae	Paraglomous
Archeosporales	Geosiphonaceae	Geosiphon
	Archaeosporaceae	Archaeospora, Intraspora

Table 1: Recent classification of arbuscular mycorrhizal fungi (Sieverding & Oehl, 2006)

Eom *et al.*, (2000) have described that plant species play important role in the regulation of species composition and diversity of AM fungal communities. AMF exhibits a great diversity in rhizosphere in which different types of interactions occur between soil microbes and plants. These interactions can influence plant community development, nutrient uptake, water relations and aboveground productivity. The differences observed in AMF diversity depends on the type of ecosystems, agricultural practices, soil conditions and methods used for AMF identification.

AMF are identified on the basis of classical spore morphology produced by them. Nowadays by using modern techniques of PCR-based molecular approaches are generally used for identification of AMF. Both of these approaches are not well satisfied and have problems. By using spore techniques, it is not always possible to identify all the spores. Spore may have different morphological structures produced during their different developing stages. Sometimes their morphological structures may be distorted or disturbed during sieving from soil and or during isolation and

separation of the spores by using different techniques of isolations. On the other hand AMF in plant roots donot produce spores and sometimes only mycelium are present colonizing the roots (Clapp *et al.*, 1995; Clapp, Rodriguez & Dodd, 2002).

By using molecular approaches, the main problem is that most approaches are based on rDNA sequences. AMF species have polymorphic rDNA sequences (Sanders, 2002; Redecker, Hijri & Wiemken, 2003). Thus, it is always normal to recover multiple sequences by PCR amplifications from a single spore as a single spore can contain a thousand or more nuclei (Antoniolli *et al.*, 2000; Pawlowska & Taylor, 2004). Presently, there are no individual rDNA primers that permit identification of all major Glomalean lineages and most molecular approaches used till date are not able to detect all rDNA sequences present (Redecker, 2000; Vandenkoornhuys *et al.*, 2002; Redecker, Hijri & Wiemken, 2003; Schüßler, Schwarzott & Walker, 2003). Thus the identification of AMF communities based on either spore morphology (Landis, Gargas & Givnish, 2004) or molecular identification alone is insufficient to cover the whole spectrum within a community. Therefore, both of these approaches are recommended as they complement each other (van der Heijden & Scheublin, 2007).

III LIFE CYCLE

The life cycle of mycorrhiza starts from the spores present in soil or from adjacent plant roots harboring mycorrhizal mycelia. Hypha(H) emerge from spores or mycorrhizal roots grow towards the adjacent plant root. On the surface of the root the tip of hyphae swells at the point of attachment and forms a specific structure called appressorium (Ap) (Mandelbaum & Piche, 2000). Then from appressoria, the infective pegs (Ip) emerge to enter inside host root. Hyphae penetrate the adjacent epidermal root cell walls with the help of penetration pegs. This particular point from where for the first time hyphae from any propagule enters the root is called a primary entry point (E) (Fig 1). The number of primary entry points formed on a root surface by a fungus is equivalent to its inoculum potential (Garrett, 1956; Bouhot, 1979). After the entry of hyphae inside the root, hyphae grows intercellularly. Inside the cells, the host cell membrane invaginates and envelopes the fungus. The hyphae form different special types of

structures such as hyphal coils, characteristic arbuscules (Ar) and vesicles (V) inside the cortical cells. These structures are formed outside the cytoplasm. Arbuscules are highly dichotomously branched intracellular structures and could be the site of exchange for phosphorus, carbon, water and other nutrients (Wright, 2005; Smith & Read, 1997). Vesicles are lipid-filled structures of special characteristics and thought to be carbon storage structures but they can also serve as reproductive propagules (Sylvia, 2002). It is not necessary that all AMF form vesicles. Formation of the vesicles depends on the fungal symbiont as well as on the environmental conditions (Smith & Read, 1997).

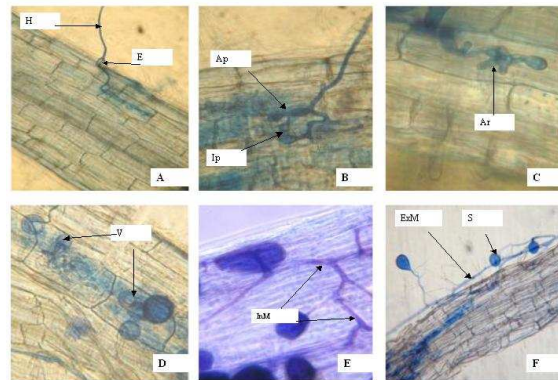


Figure 1: Different structures involved in AMF life cycle were observed in potato roots during this study: hyphae (H), entry point (E), appressorium (Ap), infection peg (Ip), arbuscule (Ar), vesicle (V), intraradical mycelium (InM), extraradical mycelium (ExM) and spore (S).

Once the infection has begun, colonization starts both within a root by intraradical mycelium (InM) and along the root by the extraradical mycelium (ExM). The intraradical mycelium inside the root grows in different patterns. Mycorrhiza have been categorized in three different groups based on the structure of colonized intraradical mycelium as *Arum*, *Paris* and *Intermediate* type (Gallaud, 1905). In *Arum*-type, intercellular hyphae grow in a longitudinal manner through the root and penetrate the root cortical cells to form arbuscules. Arbuscules arise on short side branches from these intercellular hyphae typically at right angles to the main root axis (Smith & Smith, 1997). The *Arum*-type morphology is abundant in crop plants (Smith & Smith, 1997; Ahlu, Nakata & Nonaka, 2005). In *Paris*-type, intercellular hyphae are absent and the hyphae are entirely intracellular with irregular coiled hyphae, some of which form arbuscules that are not terminal but are

localised in definite layers. The arbuscules are formed as intercalary structures and called as arbusculate coils (Gallaud, 1905; Yawney & Schultz, 1990; Cavagnaro *et al.*, 2001). *Paris*-type morphology is found in plants of natural ecosystems (Brundrett & Kendrick, 1988; Ahulu, Nakata & Nonaka, 2005). Sometimes, both types are present in the same root system than it is called the *Intermediate*-type (Smith & Smith, 1997) found in plants cucumber and tomato (Kubota, McGonigle & Hyakumachi 2005).

The extraradical mycelium is found attached with the roots that radiates out into the soil. Two different types of hypha are produced by extraradical mycelium termed as runner and absorbing (Friese & Allen, 1991). The runner hypha are thicker, grow in the soil and penetrates the host roots. The absorbing hypha always develop from the running hypha and form a network of thinner hyphae extending into the soil. Their main function is to absorb the nutrients from the soil and supply to the host plant. Some mycorrhizal species produce typical clustered swellings that are formed on extraradical hyphae called auxiliary cells *e.g.* *Gigaspora* and *Scutellospora* species. The function of these structures is yet to be known.

Reproductive structures of mycorrhiza are spores (S) be formed as hyphal swellings. Hypha swell up either in the roots or, more commonly, in the soil to produce spores. Spores may be formed singly or in clusters. Spores are thought to be mainly as storage structures, resting stage and propagules (Brundrett *et al.*, 1996).

IV AMF INTERACTION WITH PLANTS

About 80% of land plants have been found associating mycorrhiza. AMF colonize the host roots by forming intercellular and intracellular hyphae and intracellular arbuscules. Plants species belonging to family Cruciferae and Chenopodiaceae are known to be either non-mycorrhizal or non hosts of AMF (Smith & Read, 1997).

AMF are non host specific or have very low host specificity. Most of the AMF colonize a wide range of hosts and the same plant root can be colonized by a mixture of AMF species. Some studies indicate that plants might select AM fungus (van der Heijden *et al.*,

1998) and Vandenkoornhuyse *et al.*, (2002) observed that different AMF type were found associated with different plants.

V AMF AND SOIL BACTERIA

The mycorrhizosphere is the soil surrounding and influenced by the mycorrhizal fungi (Rambelli, 1973), where the fungus colonizes the roots and modifies the root soil aggregation and water distribution in the soil through its extramatrical hyphae (Andrade *et al.*, 1998). In mycorrhizosphere AMF interact with different types of microorganisms present in soil. Particularly soil bacteria influence the development and symbiotic establishment of AMF. The interactions between AMF and bacteria can be positive (Bagyaraj & Menge, 1978) or negative (Gryndler, Hrselova, & Chvatalova, 1996; McAllister *et al.*, 1995) or neutral (Edwards, Young & Fitter, 1998). In positive interactions development and function of mycorrhiza is enhanced. Synergistic positive interactions have been reported as nitrogen fixers, fluorescent pseudomonads and sporulating bacilli (Hameeda *et al.*, 2007). During negative interactions it can reduce spore germination, hyphal length, root colonization and metabolic activity of the mycelium.

It is believed that the AM symbiosis reduces phosphate stress resulting in enhanced N₂ fixation that indirectly promotes plant growth and mycorrhizal development (Bethlenfalvay, 1992; Fraga-Beddiar & Le Tacon, 1990).

These interactions lead to changes in the microbial composition (Hodge, 2000). The change in bacterial populations can take place due to several modes; *e.g.* competition for nutrients, changes in soil structure, changes in plant root exudate patterns and energy- rich compounds provided by the extra-radical mycelium of AM fungi (Andrade *et al.*, 1997; Tisdall & Oades, 1979; Ravnskov, Nybroe & Jakobsen, 1999; Söderberg, Olsson & Bååth, 2002; Mayo, Davis & Motta, 1986). The composition of bacterial populations in mycorrhizosphere of AM plants can affect the interaction between plant and AM fungi (Andrade *et al.*, 1997). There are reports that indicate some bacteria have been found associated with AMF mycelium *e.g.* Genus *Paenibacillus* intimately associated with the mycelium of *G. intraradices* (Mansfeld-Giese, Larsen

& Bodker, 2002) and *Bacillus cereus* with *G. dussii* (Artursson & Jansson, 2003). It reveals that some bacteria are more specific to particular type of AMF, which might be due to the secretion of specific exudates by specific AMF species (Artursson & Jansson, 2003). Mosse, (1962) for the first time reported that bacteria colonize the spores of AM fungi. Different studies have since then shown that the spore-associated bacteria can influence the germination of AMF spores, the growth of AMF (Bianciotto & Bonfante, 2002; Hildebrandt, Janetta & Bothe, 2002; Walley & Germida, 1996; Xavier & Germida, 2003) and on the formation of the mycorrhizosphere (Budi *et al.*, 1999). Mechanisms controlling associations of bacteria with AMF and plant roots in the mycorrhizosphere (Artursson, Finlay & Jansson, 2005, Bharadwaj *et al.*, 2008) are not fully elucidated. But a deeper understanding about interactions between the AM fungi and their associated bacteria can partly be gained by characterizing the bacterial spectrum of different habitats in the plant rhizosphere.

VI AMF IN DISEASE CONTROL

Meyer & Linderman, (1986) reported for the first time the role of the mycorrhizosphere in biocontrol of pathogens. They found that the extracts of rhizosphere soil from mycorrhizal plants reduced sporangia formation of *Phytophthora cinnamomi* in comparison with extracts of rhizosphere soil from non-mycorrhizal plants. These authors hypothesized that either the sporulation-inducing microorganisms were missing or that the number of sporulation-inhibiting microorganisms increased.

Reports are available indicating that AM fungi play an important function in the reduction of plant pathogens (St-Arnaud *et al.*, 1995; Azcón-Aguilar & Barea, 1996; Whipps, 2004) such as *Fusarium oxysporum* (Dehne & Schönbeck, 1979; Caron, Richard & Fortin, 1986; St-Arnaud *et al.*, 1997; Fillion, St-Arnaud & Fortin, 1999), different *Phytophthora* species (Davis & Menge, 1980; Cordier, Gianinazzi & Gianinazzi-Pearson, 1996; Trotta *et al.*, 1996), *Rhizoctonia solani* (Yao, Tweddell & Desilets, 2002) and *Pythium ultimum* (Calvet, Pera & Barea, 1993) in different crops. AMF has also been shown to reduce the bacterial diseases (Dehne, 1982) and affect the nematode development (Diedhiou *et al.*, 2003; Ryan *et al.*, 2000; Talavera, Itou & Mizukubo, 2001). *G. intraradices* is shown to suppress the

Fusarium sambucinum, causal organism of potato dry rot (Niemira, Hammerschmidt, & Safir, 1996) and *R. solani* (Yao, Tweddell & Desilets, 2002) and *G. etunicum* suppress the *R. solani* in potato (Yao, Tweddell & Desilets, 2002). The mode of action of biocontrol activity of AM fungi is assumed to be the direct interactions between AM fungi and pathogens but mycorrhiza-mediated triggering of plant defense reactions have also been proposed (Azcón-Aguilar & Barea, 1996; Whipps, 2004). In addition, antagonism from bacteria inhibiting mycorrhizosphere has also been suggested as a possible mechanism (Budi *et al.*, 1999).

VII AMF IN DISEASE CONTROL

Secilia & Bagyaraj, (1987) also found that the antagonistic actinomycetes got increased in the rhizosphere of mycorrhizal plants compared to that in the rhizosphere of non-mycorrhizal plants. Budi *et al.*, (1999) reported that a *Paenibacillus* strain isolated from surface-sterilized *G. mosseae* spores inhibited a number of different plant pathogens *viz.* *Aphanomyces euteiches*, *Chalara elegans*, *Pythium* sp., *Fusarium culmorum*, *F. oxysporum*, *Phytophthora parasitica* and *R. solani*. There are some studies on bacteria associated with AMF spores such as *Pseudomonas*, *Bacillus* (Meyer & Linderman, 1986), *Burkholderia* (Mao *et al.*, 1998), *Paenibacillus* (Budi *et al.*, 1999) and *Streptomyces* (Secilia & Bagyaraj, 1987) showing that AM have the potential to control plant pathogens.

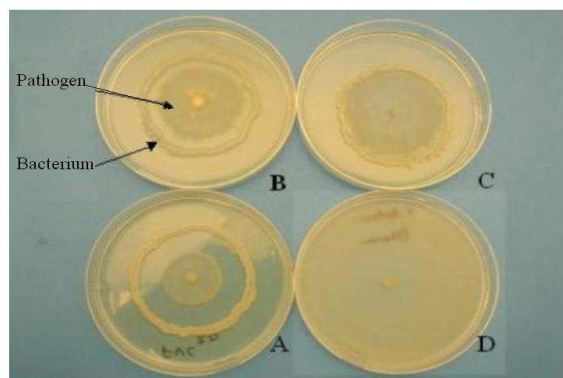


Figure 3: Effect of three different AMB isolates inhibiting the radial growth of *Rhizoctonia solani*. A=Strong inhibition, B=Moderate inhibition, C= Weak or no inhibition, and D= control (*R. solani* only) (Bharadwaj, Lundquist & Alström 2012)

Some AMB have antagonistic potential against several soil-borne pathogens *in vitro* and against *Phytophthora parasitica* also *in vivo* Budi *et al.*, (1999). The antagonistic potential of spore-associated bacteria against pathogens needs to be fully explored in order to obtain information on the plant health promoting effect of the mycorrhizosphere. Interest in research on spore-associated bacteria has increased because these have shown potential to support fungal growth to complete spore production *in vitro* in the absence of a host (Hildebrandt, Janetta & Bothe, 2002). Plant pathogens sharing the same niche compete with plants and their associated microflora. The knowledge about the specific effects of individual plant species on composition of AMF and AMB and also the ecological function of these AMB in the development of AMF and plants is still very limited. Hence it has become a thrust area of study in plant-mycorrhiza associated bacteria.

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STRATEGIES FOR HANDLING THE FUTURE GLOBAL RECESSION

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Abstract-World has recently suffered a global 2008-2009 recession which partially hits up to 2012. This recession has undoubtedly affected the economic life through its financial modern. This article presents an eye view of its impact on the economy and discusses the future strategies to handle such financial recessions. It also enlightens the causes and the ways to handle this epidemic with the adapting policies to mute it in the next future.

I INTRODUCTION

In economics, a *recession* is nothing but a general slowdown in the economic activity. It results in a decline of various economic indicators like GDP, employment, investment spending, capacity utilization, household income, business profits, stock market and inflation which in turn increases the tax evasion, bankruptcies and the unemployment rate [1-3]. It not only affects the economic policies of a nation but produces a China wall to the growth of science and public benefit. The investing know-how policies of an individual investigator have been turned to block the investment and market growth. Growth is the epitome of progress. Such fallouts misbalance the market channel through disturbing the 1:1 ratio of production and requirement and pack the window of market opportunity. We are an agrarian society and on the path of fast economic and commercial development by assimilating the new concepts of advancement. We have a greedy customer's requirement and desires of adapting the new path way that make us economically sound. Unfortunately, such disturbances make us lean on the path of economic nourishment. The world has just suffered a global decrement due to recession from 2008 to present time. A good discussion of the 2008 recession with respect to the panics and consequences can be obtained in many standard books like [4, 5]. Now, we are on the verge of uproot of the recession through adapting new policies. But the question arises that:- Is it the last fall-out? Can we efficiently manage the next jerk? This article enlightens all such questions

and illustrates the ways to handle with care these types of economic downs.

The Business Cycle Dating Committee at the National Bureau of Economic Research (NBER) looks after if there is a recession taking place. This committee continuously determines the amount of business activity in the economy by looking the fundamental economic parameters like employment, industrial production, average individual's income and wholesale-retail.

II HISTORY OF RECESSION

By this yardstick, the detailed history of recession observed by NBER for the 20th century has been produced as shown in Table-1 [6]. The Table shows that recessions were a common economic event, often occurring in chain after every few years. The longest recession of 20th century of over 2 years is observed in 1910-1912. The recessions of 1973-1975 & 1981-1982 lasted approximately 16 months were the longest since World War-II. The present recession ran from 2008 to this time.

Date	Duration
Sept. 1902-Aug. 1904	23
May 1907-June 1908	13
Jan. 1910-Jan. 1912	24
Jan. 1913-Dec. 1914	23
Aug. 1918-March 1919	07
Jan. 1920-July 1921	18
May 1923-July 1924	14
Oct. 1926-Nov. 1927	13
Aug. 1929-March 1933	43
May 1937-June 1938	13
Feb. 1945-Oct. 1945	08
Nov. 1948-Oct. 1949	11

July 1953-May 1954	10
Aug. 1957-April 1958	08
April 1960-Feb. 1961	10
Dec. 1969-Nov. 1970	11
Nov. 1973-March 1975	16
Jan. 1980-July 1980	06
July 1981-Nov. 1982	16
July 1990-March 1991	08
March 2001-Nov. 2001	08

Table-1: Recessions of the 20th Century

III IMPACT OF RECESSION

Recession is a normal (albeit unpleasant) part of the business cycle. However, it is generally considered less severe than a depression which is classified as continues

long recession. Both of them are unfavorable for the economic and commercial sustainability. However, some of the impacts of these declinations are as follows:

1. Economy contracts unexpectedly.
2. Manufacturing sector weakens globally.
3. Creates a question mark to long-term sustainable business opportunities.
4. Creates a mind sickness to the developmental policies.
5. Affects the progress of a nation, obstructs its strategies and hurdles the implementation of infrastructural advancement.
6. Badly start uprooting the E-commerce outlines and economics of technological management.
7. Destroys the role of direct in-house and foreign investment policies in the competitive market.
8. It not only harms the Intellectual property but also blames the international transactions and agreements.
9. It Spin-offs various public technology sources and resources.
10. Harms the technological cooperation patterns, various R&D consortium and international strategic alliances.

India also affected by the 2008-12 recession due to the following ways:

- 1) Huge fall in share Market.
- 2) Weakening of Rupees over Dollar
- 3) Shortage of funds in banks due to trapping of money in the market.

However, India is among the lesser victims of this epidemic as compared to many other nations like USA who is under a dreadful economic plague. This causes many to lose their jobs due to reduction wage bill policies of the employer. Many MNCs like HP and Nokia announces 71K jobs cut globally" at the prelude to the Global Recession. Banks fall is the shortage of money and in capacitive to run huge stuff.

IV CAUSES OF RECESSION

There is no single obvious cause of recession. Recessions generally occur when there is a widespread drop in spending, following an adverse supply market and the bursting of an economic bubble. Although overall blame generally falls in the hand of federal leadership either on the President / Prime minister of the country or on the head of the Federal Reserve or on the entire bureaucratic administration.

Approaching to 2008, the business community of various countries suffered major economic crisis due to huge investment in real estate. The over construction of houses and commercial spaces caused a decline in the property prices thereby grasping the returning capacity of the borrowers. The borrowers had no money to return their loans and meanwhile the interest rates continued to soar. The situation became worst when the loan amounts exceeded the total cost of the house and gave way to the current recession.

The money for investment came from many unknown foreign sources which led to crisis due to poor banking practices to handle such money transfer and investment. After the crisis the U.S. dollars slips badly. At that time, the American economy got so flooded that it is on the verge of outlet. The rechanneling has been made by increasing borrowing and spending monetary investments. The U.S. financial system works in offering monetary loans at low percentage interest and give easy finances by disrespecting the flaws and risks associating such erudition that a borrower is lured to buy them. Figure-1 shows the Global Housing Price changes since the years (i) 2000 (ii) 2006 & (iii) 2008 [7]. It is clear from the chart that U.S. home prices dropped the most since 2006 among key countries.

Japan's home prices have also been on a downward trend.

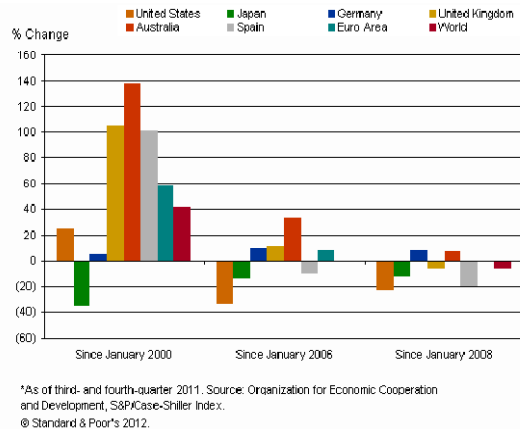


Figure 1: Global Housing Price changes

Dating back to one more recession of 2001 which was caused due to irrational exuberance in High Tech. In 1999, there was a boom in computer and software sales due to Y2K problem i.e. the operating code is not able to understand the difference between 2000 and 1900. Many companies and individuals bought new computer systems to make sure their software was Y2K compliant. This lead investor's money to the hands of high tech company resulting their high share prices irrespective they were showing profits or not. All are prepared up to December 1999 to handle Y2K. In January 2000 the computer orders were going towards sharp decline, leading to a stock-market sell-off in March 2000. As stock prices declined, the value of the computer and software companies' declines and many went bankrupt.

V WINNING STRATEGIES IN RECESSIONS

The two examples of recession discussed in the last part of this article shows that the sudden draw fall in commercial commodity market pinches the monetary fall outs. In the harsh face of economic recession most of the companies lose their market share. In that situation, company that really ventures to cope up with the slumped demands can lead succeed through innovation in product design and pricing.

A glaring example is the Samsung Electronics which

proves himself as the world's largest information technology company (as measured by 2011 revenues). Despite the launch of numerous products like Mobile phones based on strong features and style, the company makes a hard hand policy in reviews and marketing. By this, the company not only copes up with the recession but at the same time it widens its market share and become the market leader in selling and manufacturing smart phones. The administrative Governments can also handle recessions by adopting luring money bonded economic policies like increasing money supply, alluring either completely tax free or nearly tax free investments, expanding foreign market relationship, increasing government stacking and decrease taxation.

VI CONCLUSION

The history tells us that recession is a common upheaval of economic activities. It comes in play due to sudden misbalance in customer demand and the productivity. It occurs when the demand shifts its pace towards a specific regime causing a huge negligibility to other part of consumer market and ends with declining the stake value of the same product or the particular market regime. The company can successfully handle such situation through its innovation and with the help of constructive government policies. The only need is the constitution of the financial system that makes a continuous economic watch to the flooding consumer market and Alarms at the right time. Employing proper policies through the policymaker, the worst of such crisis can be ended at the right instant.

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EXPERIMENTS ON NEW STILLING BASINS FOR PIPE OUTLETS

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Abstract— This paper presents an experimental study on new stilling basins for non circular pipe outlet. The new developed models were tested in a rectangular shaped pipe outlet of size 10.8cm x 6.3 cm with three inflow Froude numbers $Fr = 1.85, 2.85$ and 3.85 in comparison to USBR VI stilling basin model recommended for the pipe outlets. The new stilling basin models were developed by changing the shapes of the end sills of same height, while keeping the other configuration of stilling basin geometry same. To compare the performance of stilling basin models in different Froude numbers, the maximum scour depth and its location from end sill were measured for each model. The study indicates that due to changing the end sill geometry, scour pattern and hence the performance of stilling basin affected significantly.

Keywords- End sill, Froude number, Scour pattern, Stilling Basin.

I INTRODUCTION

Stilling basins are used for dissipating the excessive kinetic energy of flowing water downstream of hydraulic structures like overflow spillways, sluices, pipe outlets, etc. to prevent scouring of the riverbed and failure of the structure (Alikhani et al. 2010). Various types of recommended stilling basin designs used for pipe outlets are, by Bradley and Peterka (1957), Fiala and Albertson (1961), Keim (1962), Vollmer & Khader (1971), Garde et al. (1986), Verma & Goel (2000 & 2003), Goel (2008) and Tiwari et al. (2011), etc. A stilling basin for a pipe outlet consists of appurtenances like splitter block, impact wall, intermediate sill and an end sill etc. The vertical end sill is an element in the stilling basin, which has a great contribution in reduction of energy of flowing water and assists to improve the flow pattern downstream of the channel. The sill height, configuration and position have great impact on the formation and control of hydraulic jump and ultimately leading to the dissipation of energy of

flowing water. Several shapes of the end sill have been used by many investigators. In the USBR stilling basin type VI model, a sloping end sill is used as proposed by Bradley & Peterka (1957), while Garde et al. (1986) and Verma & Goel (2003) have recommended a semi circular shaped end sill as well. In this research article, experimental investigation was carried out to study the geometry of end sill in order to develop the new models of the stilling basin for rectangular pipe outlet in comparison to USBR VI stilling basin model. Different geometry of end sill studied is shown in Fig.1.

II MATERIALS AND METHODS

(a) Flume & Basin

Experimental work was carried out in a recirculating flume of dimensions 0.95 m wide, 1 m deep and 25 m long in the hydraulics laboratory of Civil Engineering Department of MANIT Bhopal. According to the stilling basin design considerations as suggested by Bradley & Peterka (1957), the width of flume was reduced to 58.8 cm by constructing a brick wall along the length as per the requirement of width of flume. Rectangular pipe of 10.8 cm x 6.3 cm was used to represent the outlet pipe. This pipe was connected with feeding pipe of diameter of 10.26 cm connected with centrifugal pump. For measurement of discharge, venturimeter was fitted in to the feeding pipe. The exit of outlet pipe was kept above stilling basin by one equivalent diameter ($d = 9.3$ cm). A wooden floor of size 58.8cm wide and 78.6 cm long was provided, downstream of the exit of the pipe outlet for fixing the appurtenances inside the basin. Three inflow Froude numbers namely $Fr = 1.85, 2.85$ and 3.85 were used as per discharge consideration in the flume. A manual tail gate was used at the end of the test bed in the flume to control the tail water depth for experimentation.

(b) Bed Materials

To observe the scour, after the end sill of stilling basin, an erodible bed, consisting of coarse sand of specific gravity as 2.76, and passing through IS sieve opening size 2.36 mm. and retained on IS sieve opening size 1.18 mm was used. For all testing same bed material was used to compare the basin performance. The characteristics of bed materials are summarized in Table 1.

Specific gravity (S)	Density ρ_s (kg/m ³)	Uniformity coefficient c_u	Coefficient of curvature c_c	d_{60} (m)	d_{50} (m)	d_{30} (m)	d_{10} (m)
2.76	1648	1.57	0.93	2.2	1.9	1.7	1.4

Table 1 :Characteristic Of Sand Bed Materials

(c) End Sills

During the experimentation to evolve new stilling basin models rectangular, square, and triangular of varying slope from 1V:0.5H to 1V:2H and trapezoidal end sills were used as shown in Figure 1. Impact wall of dimension 1d x 2.2d was employed to facilitate the dissipation of energy in the basin.

III EXPERIMENTAL PROCEDURE

First of all, the movable sand material was filled up to the height of end sill and leveled then normal depth was maintained over the sand bed by allowing the water from the overhead tank inside the flume by operating the tail gate. Later on, a centrifugal pump of capacity 20 HP was switched on while keeping the control valve closed, fitted into the feeding pipe. The flow into the flume was increased gradually so as to achieve required Froude number with a minimum possible disturbance to the erodible sand bed. The discharge was measured by a calibrated venturimeter installed in the feeding pipe. With the operation of tail gate, the desired steady flow condition with normal depth of flow was maintained, which was computed by Manning’s formula corresponding to the inflow Froude number $Fr = V/(gd)^{0.5}$, where V is the average velocity in the pipe, g is the acceleration due to gravity and d is the equivalent diameter of the pipe. As soon as the required amount of water flowing from pipe outlet, reached the erodible

bed material, the movement of bed materials started and the geometry of scour hole started changing with time. After one hour test run, the motor was switched off. The value of maximum depth of scour (d_m) and its location from the end sill (d_s) were noted. All the models were tested for constant run time of one hour and with the same erodible material for all Froude numbers. To start the experimentation, a stilling basin model was designed for the inflow Froude number ($Fr = 3.85$) and fabricated in the flume as per USBR impact type VI design. It includes an impact wall of size 1d x 2.2d having a bottom gap 1d, located at 3d from the exit of pipe outlet and followed by sloping end sill (slope 1V:1H) of height 1d positioned at 8.4 d where d is the equivalent diameter of the pipe outlet. Later on, in order to study the end sill geometry, new stilling basin models were fabricated by changing the shape and the size of end sills (10 Models). During the test runs for all the stilling basin models, the grain size of the material forming the erodible bed and test run time of one hour were kept the same for the purpose of comparison of the model performance. The details of stilling basin models tested have been mentioned in Table 2. Some of the tested models are shown in Figs. 2&3

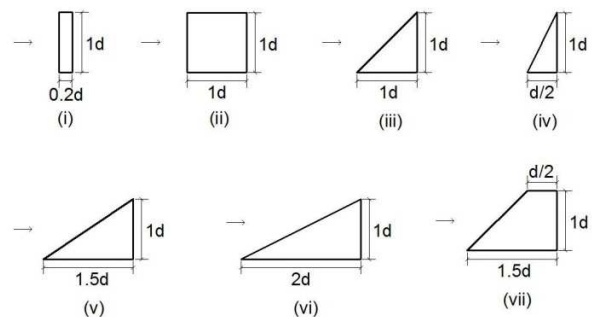


Figure 1 :Different shapes of end sills

tested

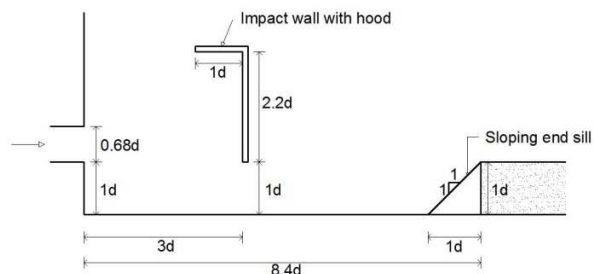


Figure 3 :Stilling Basin model MSM-6 having sloping end sill with impact wall

Model number	Stilling basin length	USBR VI Impact wall			End sill of height 1d
		Size	Location	Bottom gap	
MSM-1	8.4d	-	-	-	Rectangular
MSM-2	8.4d	-	-	-	Square
MSM-3	8.4d	-	-	-	Sloping(1V:1H)
MSM-4	8.4d	1dx2 .2d	3d	1d	Rectangular
MSM-5	8.4d	1dx2 .2d	3d	1d	Square
MSM-6	8.4d	1dx2 .2d	3d	1d	Sloping(1V:1H)
MSM-7	8.4d	1dx2 .2d	3d	1d	Sloping (1V:0.5H)
MSM-8	8.4d	1dx2 .2d	3d	1d	Sloping(1V:1.5H)
MSM-9	8.4d	1dx2 .2d	3d	1d	Sloping(1V:2H)
MSM-10	8.4d	1dx2 .2d	3d	1d	Trapezoidal Sloping(1V:1.5H) with top width d/2

Table 2 :Scheme Of Experimentation

IV CONCLUSION

An experimental study was carried out in the laboratory for investing the performance of new stilling basin with end sill for non circular pipe outlet. Based on the experimental results, it is found that the shape of end sill in a basin affects the performance of stilling basin significantly due to change in the flow conditions. During the study it was found that the shape of end sill affects the flow conditions and ultimately scour pattern downstream of the stilling basin. This study also revealed that the sloping vertical end sill (slope 1V:1H) dissipates more energy of flow and found to perform better for all flow conditions as compared to other end

sills (showing lower values of d_m) tested for rectangular pipe outlet basin. The variation of scour parameters is due to the variation in flow geometry because of varying the shape of end sill.

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A TWO STAGE TANDEM REPAIRABLE REMANUFACTURING SYSTEM WITH WORK-IN-PROCESS (WIP) INVENTORY CONTROL

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***Abstract-**This paper deals with an unreliable remanufacturing system involved in the processing and remanufacturing of WIP inventory. While processing the items to be recycled, the system may become out of order followed by a two stage tandem repair. The system capacity K is assumed to be finite. As soon as the items start entering the system and queue up to seek service, the server takes some start up time to activate and then waits to serve until the N items of WIP inventory are accumulated. Once the system becomes full, further arrival of items is not allowed until the queue length decreases to a pre-specified level F . The time dependent behavior of the system is analyzed using Runge-Kutta 4th order method. To explore the system's effectiveness, the model formulated has been tested numerically.*

***Keywords-**Unreliable remanufacturing system, WIP inventory, Tandem repair*

I INTRODUCTION

Work in process (acronym: WIP) or **in-process inventory** includes the set of unfinished items or used items for products in a production process. These items are those which are not yet manufactured as desired but either are just being fabricated or waiting in a queue for further processing or lie in a buffer storage. Remanufacturing differs from other recovery processes in its completeness: a remanufactured product should match the same customer expectation as new products. Remanufacturing is also described as an industrial process in which worn-out products or the used products are restored equivalent to new condition. Through an industrial process in a factory environment, a discarded product is completely disassembled. Useable parts are cleaned, refurbished, and put into inventory. Then the product is reassembled from the old parts (and where necessary, new parts) to produce a unit fully equivalent and sometimes superior in performance and with expected lifetime to the original new product. Remanufacturing helps in cost cutting of the entire system as reworked units cost lesser than the new units. Many researchers have worked on WIP inventory control in context of manufacturing systems. Tsiotras and

Tapiero (1992) studied the mutual effects of WIP inventory, manufacturing process reliability and quality control in a queue like manufacturing system. Nye et al. (2001) developed a model based on queueing theory, which permits it to estimate WIP levels as a function of decision variables, batch size and setup time. Papadopoulos and Vidalis (2001) worked on the optimal buffer allocation (OBA) to minimize the average work in process (WIP) inventory, subject to minimum required throughput. Ma and Koren (2004) introduced a novel approach to meet the production target and to minimize the work in process inventory for large manufacturing systems with buffers. Qiu (2005) introduced a practical solution to a manageable and well distributed WIP control system by addressing issues such as real time performance, scalability and reconfigurability. Chan et al. (2007) established a mathematical model for the production control problem of a manufacturing system with time delay, demand uncertainty and extra capacity with the objective of minimizing the mean costs for WIP inventory and occupation of extra production capacity. Liu and Lian (2009) considered the cost effective inventory control of work-in-process (WIP) and finished products in a two stage distributed system. Ahiska and King (2010) discussed the inventory optimization of a single product recoverable manufacturing system where customer demands were satisfied through either regular production of new items or remanufacturing of returned items. In a queueing system or an inventory system, the server is always susceptible to random failure and thus considered unreliable. The efficiency of the entire system becomes low due to unreliable server. The broken down server is repairable and can be restored to make it available to serve the queued up units. Many researchers have contributed in the direction related to unreliable systems. Dohi et al. (2001) developed a stochastic model for the optimal control of preventive maintenance schedule and safety stocks in an unreliable manufacturing environment. An unreliable production-inventory model with two phase erlang demand arrival process was studied by Wang et al. (2002). Wang and Srinivasan (2005) investigated a production-inventory system with hyper-exponential renewal demand processes. They

obtained steady state distribution for the stability condition of the inventory process and used it to calculate system's performance. Ke(2006) studied the control policies of an M/G/1 queueing system with a startup and unreliable server, in which the length of the vacation period was controlled either by the number of arrivals during the idle period or by a timer. An analytical model was formulated by Kenne et al. (2007) for the joint determination of an optimal age-dependent buffer inventory and preventive maintenance policy in a production environment that was subject to random machine breakdowns. The system characteristics of a two-unit repairable system were studied by Ke et al. (2008) from a Bayesian viewpoint with different types of priors assumed for unknown parameters, in which the service station is unreliable. Choudhury and Tadj (2009) studied the steady state behavior of an M/G/1 queue with an additional second phase of optional service subject to random breakdowns at any instant while serving the customers and delayed repair. Hajji et al. (2011) considered joint production control and product specifications decision making in a failure prone manufacturing system.

To avoid the halt of the manufacturing process due to sudden failure of the system, the organization has to be equipped with skilled repair facility. The repair of the inoperative system can be done in phases depending on the nature of the breakdown; whether it is minor or major. Ching (2001) considered the manufacturing systems of m identical unreliable machines producing one type of product. The operating time of each machine is assumed to be exponentially distributed and the repairing process of a machine required more than one phase. Ke and Lin (2008) modeled a manufacturing system consisting of a number operating and spare machines under the supervision of a group of technicians in a repair facility. The machine failure was considered in Poisson fashion followed by a two phase tandem repair. A repairable queueing model with a two-phase service in succession, provided by a single server, was investigated by Dimitriou and Langaris (2010). In today's manufacturing environment, the system designer is much concerned about the incorporation of the policies which prove to be useful in reducing the idle time of the server and using it more efficiently. One of such policies is N-policy. It refers to the accumulation of N units in the queue to initiate the server to start the service. Various researchers have implemented the concept of N-policy while modelling the manufacturing systems mathematically. Medhi and Templeton (1992) studied a Poisson input queue under N-policy and with a general start up time. A bulk input queueing system with batch gated

service and multiple vacation policy was presented by Bacot and Dshalalow (2001). Krishnamoorthy and Deepak (2002) incorporated N-policy for an M/G/1 queue. Wang et al. (2005) performed maximum entropy analysis of the N-policy M/G/1 queueing system with server breakdowns and general startup times. A bulk quorum queueing system with N-policy and Bernoulli vacation schedule was suggested by Tadj et al. (2006). The maximum entropy approach for batch-arrival queue under N-policy with an unreliable server and single vacation was employed by Ke and Lin (2008). An M/G/1 retrial G-queue with preemptive resume and feedback under N-policy vacation subject to the server breakdowns and repairs was investigated by Liu et al. (2009). A near optimal buffer allocation plan (NOBAP) was developed by Aksoy and Gupta (2010) specifically for a cellular remanufacturing system with finite buffers where the servers follow N-policy.

In order to maintain the smooth functioning of the manufacturing system the arrivals in a queue should be controlled. This can be done by implementing F-policy by the system designer. In WIP inventory, F-policy may be employed to control the arrival of the material to be remanufactured. Wang et al. (2008) studied the optimal control of a finite capacity G/M/1 queueing system combined with the F-policy (for controlling arrival to a queueing system) and an exponential startup time before start allowing customers in the system. Wang and Yang (2009) presented the control policy of a removable and unreliable server for an M/M/1/K queueing system, where the removable server operates on F-policy. The so-called F-policy means that when the number of customers in the system reaches its capacity K (i.e. the system becomes full), the system will not accept any incoming customers until the queue length decreases to a certain threshold value F . Yang et al. (2010) analyzed the F-policy M/M/1/K queueing system with working vacation and an exponential startup time. The F-policy is used to deal with the issue of controlling arrivals to the queueing system. The startup time of the server before allowing customers to enter the system is also considered. In this study we have examined the time dependent performance of a remanufacturing system of WIP inventory working with (N, F) policy. The system is of finite capacity and is unreliable. The failed system can be repaired in two phases. The rest of the paper is organized as follows. In the next section 2, the model is justified by a practical example. Section 3 provides the requisite assumptions and notation for the mathematical formulation of the model. The transient equations governing the model have been formulated using the transition diagram in section 4.

These equations have been solved using Runge-Kutta 4th order method to determine transient probabilities and using these probabilities some important performance measures have been evaluated as discussed in section 5. Section 6 is devoted the numerical illustrations. Finally the conclusion is provided in section 7.

II PRACTICAL JUSTIFICATION OF THE MODEL

Consider a PET (Polyethylene Terephthalate) plastic recycling plant. PET is used as a raw material for making packaging materials such as bottles and containers for packaging a wide range of food products and other consumer goods. Examples include soft drinks, alcoholic beverages, detergents, cosmetics, pharmaceutical products and edible oils. PET is one of the most common consumer plastics used. The empty PET packaging is discarded by the consumer after use and becomes PET waste.

In the recycling industry, this is referred to as "post-consumer PET." The post consumer PET units are brought for recycling, which can be said to be WIP inventory here. The units to be recycled are queued up before getting entry into the treatment plant whose capacity is finite (say K). Once the N- units are accumulated for recycling these are sent to the plant. Firstly, the treatment process is done which includes crushing, washing, separating and drying. Recycling plant will further treat the post-consumer PET by shredding the material into small fragments. These fragments still contain residues of the original content, shredded paper labels and plastic caps. These are removed by different processes, resulting in pure PET fragments, or "PET flakes". PET flakes are used as the raw material for a range of products which include polyester fibers (a base material for the production of clothing, pillows, carpets, etc.), polyester sheets, strapping, or back into PET bottles etc. Once the plant becomes full, further arrival is not allowed till the queue length reduces to a pre-specified level F. The recycling plant is unreliable and may face random breakdowns. The plant is repairable and can be repaired in two phases depending on the intensity of the fault. The following figure portrays the mechanism of recycling plant.

III ASSUMPTIONS AND NOTATIONS

We consider a remanufacturing system involved in the recycling of the used commodities to produce the new one. The WIP inventory arrives at the remanufacturing system

for recycling in Poisson fashion with rate λ . On the accumulation of N units in the system, the server starts providing the service with the rate μ . The system capacity is finite (K). Once the system is full no arrival is allowed till the queue length decreases to a pre-specified level F. Other notations associated with the model are as follows:

- γ : start up time of the repairman
- α : breakdown rate of the server
- β : repair rate of the server
- $(1 - \delta)$: probability that the server is restored after 1st phase repair
- δ : probability that the broken down server moves to 2nd phase repair
- $P_{0,0}(t)$: probability that the system is empty and the server is idle
- $P_{0,n}(t)$: probability that there are n units in the system and server is busy
- $P_{0,k}(t)$: probability that the system is full and server is busy
- $P_{1,0}(t)$: probability that the server takes start up and no unit is present in the system
- $P_{1,n}(t)$: probability that the server takes start up and n unit are present in the system
- $P_{2,0}(t)$: probability that the server is in broken down state and no unit is present in the system
- $P_{2,n}(t)$: probability that the server is in broken down state and n units are present in the system
- $P_{3,0}(t)$: probability that the server is under 2nd phase repair and no unit is present in the system
- $P_{3,n}(t)$: probability that the server is under 2nd phase repair and n units are present in the system

IV THE GOVERNING EQUATIONS

The equations governing the model are constructed with the help of transition diagram which are as follows:

$$\frac{d}{dt} P_{0,0}(t) = -\gamma P_{0,0}(t) + \mu P_{0,1}(t) \quad (1)$$

$$\frac{d}{dt} P_{0,n}(t) = -(\gamma + \mu) P_{0,n}(t) + \mu P_{0,n+1}(t) \quad 1 \leq n \leq F \quad (2)$$

$$\frac{d}{dt} P_{0,n}(t) = -\mu P_{0,n}(t) + \mu P_{0,n+1}(t) \quad F+1 \leq n \leq K-1 \quad (3)$$

$$\begin{aligned} \frac{d}{dt} P_{1,0}(t) &= -(\lambda + \alpha) P_{1,0}(t) + \beta P_{3,0}(t) + (1 - \delta) \beta P_{2,0}(t) \\ &+ \gamma P_{0,0}(t) \\ \frac{d}{dt} P_{0,K}(t) &= -\mu P_{0,K}(t) + \lambda P_{1,K-1}(t) \end{aligned} \quad (4)$$

$$\begin{aligned} \frac{d}{dt} P_{1,K-1}(t) &= -(\lambda + \alpha + \mu) P_{1,K-1}(t) + \lambda P_{1,K-2}(t) + \\ &(1 - \delta) \beta P_{2,K-1}(t) + \beta P_{3,K-1}(t) \end{aligned} \quad \dots(5)$$

$$\begin{aligned} \frac{d}{dt} P_{1,n}(t) &= -(\lambda + \alpha) P_{1,n}(t) + \beta P_{3,n}(t) + (1 - \delta) \beta P_{2,n}(t) + \\ &\gamma P_{0,n}(t) + \lambda P_{1,n-1}(t) \end{aligned} \quad 1 \leq n \leq N-1 \quad (6)$$

$$\begin{aligned} \frac{d}{dt} P_{1,N}(t) &= -(\lambda + \alpha) P_{1,N}(t) + \lambda P_{1,N-1}(t) + (1 - \delta) \beta P_{2,N}(t) + \\ &\mu P_{1,N+1}(t) + \beta P_{3,N}(t) + \gamma P_{0,N}(t) \end{aligned} \quad (7)$$

$$\begin{aligned} \frac{d}{dt} P_{1,n}(t) &= -(\lambda + \alpha + \mu) P_{1,n}(t) + \lambda P_{1,n-1}(t) + (1 - \delta) \beta P_{2,n}(t) + \\ &\mu P_{1,n+1}(t) + \beta P_{3,n}(t) + \gamma P_{0,n}(t) \end{aligned} \quad N+1 \leq n \leq F \quad (8)$$

$$\begin{aligned} \frac{d}{dt} P_{1,n}(t) &= -(\lambda + \alpha + \mu) P_{1,n}(t) + \lambda P_{1,n-1}(t) + \\ &(1 - \delta) \beta P_{2,n}(t) + \mu P_{1,n+1}(t) + \beta P_{3,n}(t) \end{aligned} \quad F+1 \leq n \leq K-2 \quad (9)$$

$$\frac{d}{dt} P_{2,0}(t) = -(\lambda + \beta) P_{2,0}(t) + \alpha P_{1,0}(t) \quad (11)$$

$$\begin{aligned} \frac{d}{dt} P_{2,n}(t) &= -(\lambda + \beta) P_{2,n}(t) + \alpha P_{1,n}(t) + \lambda P_{2,n-1}(t), \\ 1 \leq n \leq K-2 \end{aligned} \quad \dots(12)$$

$$\frac{d}{dt} P_{2,K-1}(t) = -\beta P_{2,K-1}(t) + \alpha P_{1,K-1}(t) + \lambda P_{2,K-2}(t) \quad (13)$$

$$\frac{d}{dt} P_{3,0}(t) = -(\lambda + \beta) P_{3,0}(t) + \delta \beta P_{2,0}(t) \quad (14)$$

$$\begin{aligned} \frac{d}{dt} P_{3,n}(t) &= -(\lambda + \beta) P_{3,n}(t) + \delta \beta P_{2,n}(t) + \lambda P_{3,n-1}(t), \\ 1 \leq n \leq K-2 \end{aligned} \quad (15)$$

$$\begin{aligned} \frac{d}{dt} P_{3,K-1}(t) &= -\beta P_{3,K-1}(t) + \delta \beta P_{2,K-1}(t) + \lambda P_{3,K-2}(t) \end{aligned} \quad (16)$$

These equations have been solved using Runge-Kutta 4th order method and consequently the transient probabilities have been obtained. These probabilities have been used to determine the important performance measures related to the system in the subsequent section.

V PERFORMANCE MEASURES

For the model under consideration the following performance measures have been evaluated:

The queue length of the arriving WIP inventories is given by

$$\begin{aligned} E[N(t)] &= \sum_{n=0}^K n P_{0,n}(t) + \sum_{n=0}^{K-1} n P_{1,n}(t) + \\ &\sum_{n=0}^{K-1} n P_{2,n}(t) + \sum_{n=0}^{K-1} n P_{3,n}(t) \end{aligned} \quad \dots(17)$$

The throughput of the system is

$$TP(t) = \mu \sum_{n=N+1}^{K-1} P_{1,n}(t) + \sum_{n=1}^K P_{0,n}(t) \quad \dots(18)$$

- The expected delay of the entire system is given by

$$ED(t) = \frac{E[N(t)]}{TP(t)} \quad \dots(19)$$

- The probability of the server being busy is obtained as

$$P[B(t)] = \sum_{n=1}^K P_{0,n}(t) + \sum_{n=N}^{K-1} P_{1,n}(t) \quad (20)$$

- The probability of the server being under 1st phase repair

$$P[R_1(t)] = \sum_{n=0}^{K-1} P_{2,n}(t) \quad \dots(21)$$

- The probability of the server being under 2nd phase repair

$$P[R_2(t)] = \sum_{n=0}^{K-1} P_{3,n}(t) \quad \dots(22)$$

- The probability of the server being idle is obtained as

$$P[I(t)] = P_{0,0}(t) + \sum_{n=0}^{N-1} P_{1,n}(t) \quad (23)$$

VI NUMERICAL ILLUSTRATION

The remanufacturing system modeled here has been illustrated numerically to study the effectiveness of various parameters on the system's performance. The effectiveness is displayed in tabular as well as in graphical form. Table 1 displays the effect of λ , α and t on the probability of the server being busy $P[B(t)]$, probability of the server being idle $P[I(t)]$, probability of the server being under 1st phase repair $P[R_1(t)]$ and the probability of the server being under 2nd phase repair $P[R_2(t)]$. It is observed that as t increases $P[B(t)]$, $P[R_1(t)]$ and $P[R_2(t)]$ increase whereas $P[I(t)]$ decreases. As the arrival rate λ increases, it results in the increment of $P[B(t)]$ while $P[I(t)]$ comes down and there is no change in $P[R_1(t)]$ and $P[R_2(t)]$. The increasing value of α shows a decreasing trend in $P[B(t)]$ and $P[I(t)]$ whereas

there is an increment in $P[R_1(t)]$ and $P[R_2(t)]$. Table 2 depicts the effect of γ , α and t on $P[B(t)]$, $P[I(t)]$, $P[R_1(t)]$ and $P[R_2(t)]$. With the increasing values of γ and t , $P[B(t)]$, $P[R_1(t)]$ and $P[R_2(t)]$ increase while $P[I(t)]$ decreases. The effect of α on these probabilities is same as that observed in table 1. Fig. 2 (a), 2(b) and 2(c) display the behavior of queue length $E[N(t)]$ for the increasing λ , α and β respectively w.r.t. the increasing time t . From fig 2(a), it is noticed that $E[N(t)]$ rises sharply with both λ and t . Fig. 2(b) exhibit the queue length's increasing pattern with the increasing α and time t . the increment is significant with the increasing time whereas the increment is not much for the increasing values of α . From fig. 2(c), a remarkable rise in the queue length is evident with the increasing time t but as the β is increased, the queue size reduces.

The impact of λ , α and β on the throughput $TP(t)$ is portrayed in fig. 3(a), 3(b) and 3(c) respectively with the increasing time t . It is observed that $TP(t)$ rises with both λ and t ; the increment is much for higher values of λ . Fig. 3(b) displays an increasing trend of $TP(t)$ with the rising time however, it comes down with the increasing α . In fig 3(c) we observe that the $TP(t)$ rises slowly with the increasing time t , in addition a small increasing variation is noticed with the increasing values of β

VII CONCLUSION

In this paper an unreliable remanufacturing system for the WIP inventory is studied. The system provides the service to the arriving units according to N-policy, F-policy or both the policies simultaneously. Thus, the inclusion of the concepts of (N, F) policy and unreliability of the server makes the model more realistic. By performing the mathematical modeling of such a remanufacturing system by incorporating the above realistic concepts, the system designer may obtain favorable results beneficial to the concerned organization. On the basis of the results obtained from the numerical experiment, some important decisions can be made so that the queue size can be reduced and the throughput can be improved.

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ALLOCATION OF CHANNELS IN WIRELESS CELLULAR SYSTEM USING HYBRID GENETIC ALGORITHM AND SIMULATED ANNEALING

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Abstract-With the limited frequency spectrum, the channel assignment problem (CAP) i.e., to assign the calls to the available channels so that the interference is minimized while the demand is met, has become increasingly important. In this paper a hybrid technique of Genetic Algorithm and Simulated Annealing (HGASA) is applied for dynamic channel allocation. With this hybrid algorithm effort is made to reduce the search complexity of channel allocation while satisfying constraints of interference. The concept of Simulated Annealing (SA) is incorporated into Genetic Algorithm (GA) in order to avoid pre-mature convergence of the strings. Experimental results show that the proposed HGASA is a better method than GA and the average call blocking probability of the system decreases.

Keywords-*Genetic Algorithm, Simulated Annealing, Dynamic Channel Assignment, GSM Network*

I INTRODUCTION

With the rapid growth of cellular radio network, wireless mobile communication is developing extraordinarily. The fast growing in the number of users requires a major effort to enhance the performance of wireless communication system. Due to the current development in the communication system is extremely limited by the capacity constraints of the available frequency spectrum, proper utilization of channel allocation techniques which are capable of ensuring efficient channel allocation is essential in solving the channel assignment problem. The channel assignment problem is to allocate channels to each radio cell in cellular radio network. The channel assignment is NP hard problem. The role of a channel allocation scheme is to allocate channels to cells in such a way so as to minimize the probability that the incoming calls are blocked. To minimize this call blocking probability, the channel allocation scheme must satisfy electromagnetic compatibility constraints as well as demand of traffic. The electromagnetic compatibility constraints consist of two types: soft constraint and hard constraint. The hard constraints are co-channel interference, adjacent channel interference, and co-site interference. The soft constraints are packing condition, resonance, limiting rearrangement. There are three categories into which channel assignment problem is classified, Fixed Channel Assignment (FCA), Dynamic Channel Assignment

(DCA) and Hybrid Channel Assignment (HCA). FCA allocates channels to each cell permanently in a manner that maximizes frequency reuse. Hence in an FCA system, the distance between cells using the same channel is the minimum reuse distance for that system. In DCA, channels are allocated dynamically as call arrives and has higher degree of randomness but involves complex algorithms. FCA is simpler and outperforms DCA under heavy load conditions, but FCA does not adapt to changing traffic conditions. HCA scheme combines benefits of both FCA and DCA. In HCA one set of channel is allocated as in FCA and the other set is allocated as in DCA.

II PREVIOUS WORK

Shinde[1] proposed a hybrid channel allocation model using an evolutionary strategy with an allocation distance to give efficient use of frequency spectrum. The problem of determining an optimal allocation of channels to mobile users that minimizes call blocking and call-dropping probabilities is emphasized. A new hybrid algorithm combining the genetic with the simulated annealing algorithm is introduced in [2] for Selecting the routes and the assignment of link flow in a computer communication networks which is an extremely complex combinatorial optimization problem. Bhattacharjee[3] maximized the channel allocation of the active subscribers within the cognitive radio network(CRN). There are numbers of heuristics approaches being suggested to overcome the channel assignment problems based on fixed reuse distance concept such as neural networks (NNs) in [4], particle swarm optimization (PSO) in [5], and Tabu search (TS) in [6]. These type of algorithms can be used to solve complicated optimization task, such as optimal-local, multi-constrained and NP-complete problems. Lima [7] investigated in his research, the dynamic channel assignment (DCA) in mobile communications systems using genetic algorithm (GA). The performance of the proposed GA was evaluated in a 49 hexagonal cell arrangement operating under uniform and no uniform traffic distributions.

III PROBLEM STATEMENT

Channel assignment scheme helps to increase the networks capacity by efficiently distributing channels across the network

There are three types of interference namely co-channel constraint (CCC), adjacent channel constraint (ACC), and co-site channel constraint (CSC). CCC is due to the allocation of the same channel to certain pair of the cells within the BTS distance or reuse distance simultaneously. ACC is caused by the allocation of the adjacent channels to certain pairs of the cells simultaneously and CSC is due to the separation is less than some minimum spectral distance when channels are allocated in the same cell. These EMC constraints are known as hard constraints. There are soft constraints to help in reducing the call blocking probabilities besides the hard constraints. They are the resonance condition, packing condition, and the limitation of reallocation. The resonance condition maximizes the use of channels within the same reuse scheme by allowing the same channels to be assigned to cells that belong to the same reuse scheme. This would greatly reduce the call blocking probabilities. On the other hand, the packing condition allows the use of minimum number of channels each time upon new call requests. The channels assigned in different cells need to be separated by a reuse distance which is sufficient enough to reduce the CCC interference to a tolerable level. This ensures that each channel can be reused many times without affected by the CCC interference. The reuse distance is the minimum distance required between the centers of two cells which are using the same channel to maintain the desired signal quality.

IV PROPOSED MODEL

(a) HGASA Scheme

GAs search by simulating evolution, starting from an initial set of solutions or hypotheses, and generating successive "generations" of solutions. GA is a useful approach in searching for an optimum solution in the channel assignment problem. GAs are search techniques for global optimization in a complex search space. The performance of GA can be improved by introducing more diversity among the strings so that pre-mature convergence can be eliminated. This can be achieved by replacing weaker strings i.e. the strings having low fitness value with the strings having higher fitness value. Simulated annealing is a branch of iterative improvement algorithms in which the basic idea is to start with an initial configuration (solution) and make modifications to improve its quality. Thus, the SA aims to achieve a global optimum by slowly convergence to a final solution, making downwards moves with occasional upwards moves and thus hopefully ending up in a global optimum. First of all, if we take a cell, say first and find its channel requirement by calculating the difference of allotted channel and previously assigned channel. If this cell requires a channel then we use HGASA to find the most appropriate

channel that must be assigned to this cell.

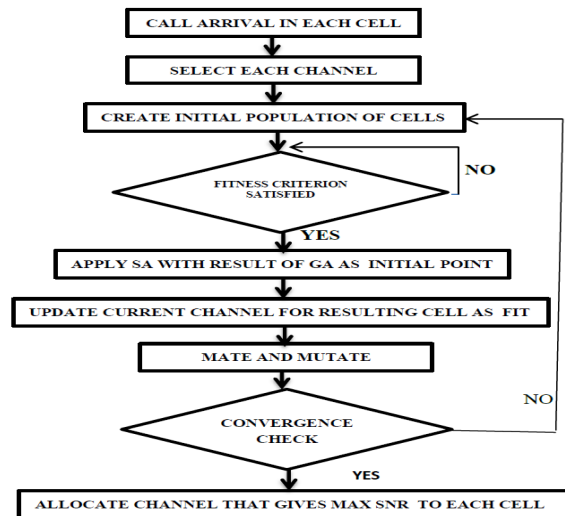


Figure 1 : Flowchart of HGASA

(b) Optimization through Genetic Algorithm

- (i) Initial Population-The algorithm starts by randomly generating an initial population of possible solutions. For our problem, the population is the randomly generated cells. We can select a cell, say cell one and if this cell requires a channel, we start from channel one to last and search for the best to allocate.
- (ii) Evaluation phase-The quality measure to decide how fit one individual is among the whole generation is called the fitness. In our application, we can compare the frequency reuse distance and SNR of all the cells created in initial population. The fitness function is the value of both distance and SNR to maintain least interference between co channel cells.
- (iii) Selection phase-The chromosome with better fitness will be selected, and the others will be eliminated. This will help improve the total fitness of the population. After this we sort the other cells that satisfy the condition of allocation of channel one, on the basis of highest SNR.
- (iii) Crossover phase-After the selection step, the eliminated individuals are added by applying crossover to the selected individual. The selected cells can be used to create another cells having better fitness criterion. .
- (iv) Mutation phase-The mutation process is carried out by changing a random bit of the new genes. These new genes (cells) now become the next candidate to be assigned with channel one but only if they satisfy the fitness criterion. The cycle goes on until all the channels are scanned and the channel requirement of the cell is fulfilled.

(c) Optimization through Simulated Annealing

- (i) Initialize temperature T to a particular value.

- (ii) Initialize the iteration parameter n equal to 1 to be iterated till M .
- (iii) Create two random channels and find their SNR.
- (iv) Select the channel whose difference of SNR from the previous channel selected by GA is higher.
- (v) Find the minimum difference SNR value (best) among the M best channels.
- (vi) If best channel is not changed over a period of time, find a new channel using temperature.
- (vii) Accept the new channel as best with probability as $\exp(-\Delta E/T)$, even though current position is worse. Here ΔE is the difference between current best channel's SNR and new channel's SNR value reduce T .
- (viii) Terminate if the maximum number of iterations is reached or optimal value is obtained.
- (ix) The resultant channel is allocated to the desired cell for which we wanted the channel. The algorithm repeats for all the cells that require a channel.

V SIMULATION & RESULTS

There are 70 channels available in this model to be allocated for incoming calls. The cellular topological model consists of 64 hexagonal cells, with equal number of cells along both axes. The simulation call traffic distribution can be either uniform or nonuniform distribution. Uniform cellular traffic distribution indicates that every cell has the same traffic load or demand. On the other hand, nonuniform cellular traffic distribution indicates that there is different traffic load in each cell. In our model non uniform traffic is implemented as shown in fig.2. Each of the value represents the average call arrival rate per minute for the corresponding cell. The average call holding time is 180 seconds. Mating iterations are taken 25, mutation iterations are 2 and simulated annealing iterations are taken 25. The simulation is performed on MATLAB 7.10.0.499(R2010a). Channels are allocated to the cells satisfying the CCC constraints as shown in fig.3 and fig.4.

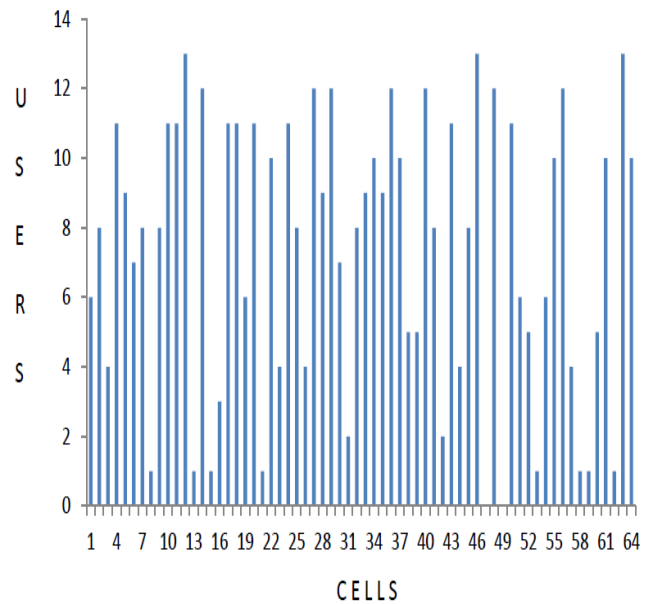


Figure 2: Non Uniform Traffic Distribution

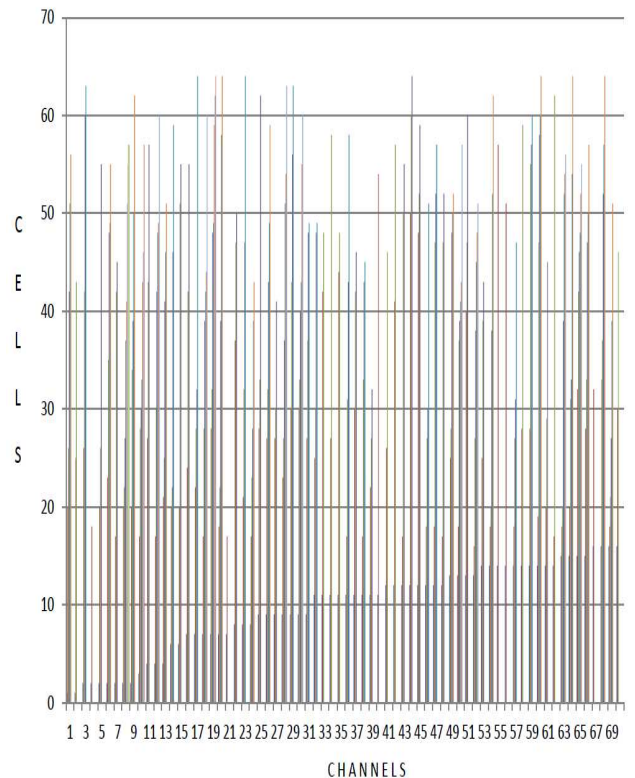


Figure 3: Channels Allocated to cells. Each channel is allocated in five to six cells that are far apart satisfying the constraints.

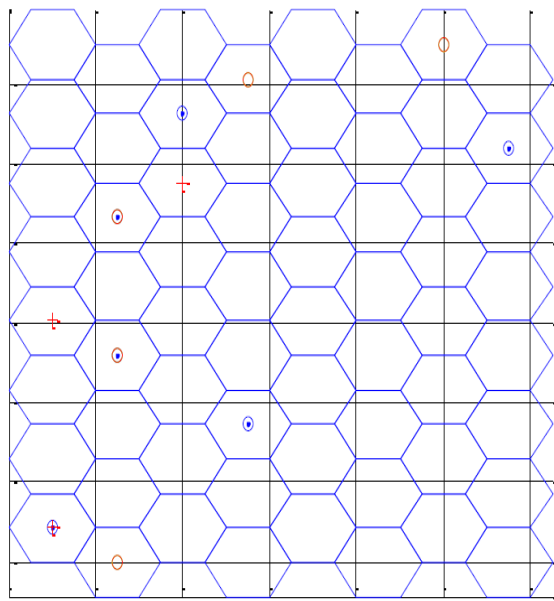


Figure 4 : Channels Allocated in Hexagonal Structure .Four Channels are taken in the figure to demonstrate the frequency reuse concept as one channel appear once only in a cluster.

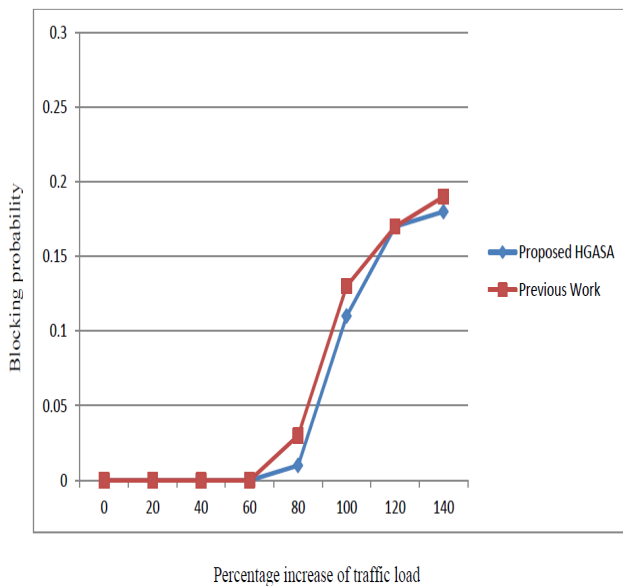


Figure 5: Comparison of the proposed HGASA algorithm in terms of blocking probability with previous work

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DYNAMICS OF JOB-SATISFACTION AND TEACHING-COMPETENCY AMONG SECONDARY SCHOOL TEACHERS A CASE STUDY

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Abstract-This paper provides an overview of Job-satisfaction and Teaching competency of secondary school teachers in districts Bhopal and Raipur of Madhya Pradesh. Firstly, the paper tries to find out different dimensions of job satisfaction of teachers like professional, domestic and inter-personal etc. Secondly, the paper scrutinizes the relationship between job-satisfaction and teaching-competency of secondary school teachers. It is also designed to find out the reasons for differences in teaching-competency of sec. school teachers particularly with references to sex and demographics. The underlying factors of job satisfaction and teaching-competency are domestic satisfaction, individual satisfaction, emotional satisfaction, job-security, etc. The present study was conducted on 200 sec. school teachers of Bhopal region. On the basis of random sampling technique, out of 200 sec school teachers 100 were rural (50 male and 50 female) and 100 urban (50 male and 50 female). General Teaching Competency Scale by Passi and Lalitha and a self-designed job satisfaction questionnaire were executed in this study. The data was subjected to mean, S.D. and t-value of statistical treatment. Evidences suggest that there is a significant difference in job-satisfaction and teaching competency among sec. school teachers. The findings of the research also conclude that there is a positive relationship between job satisfaction and teaching competency.

Keywords-Job satisfaction, teaching-competency

I INTRODUCTION

It is an established fact that education is the most powerful instrument whose effective and efficient utilization deserves the strength of will, want and dedication and above all sacrifice.

Teaching-learning process is a positively directed action, for which teachers need to be highly satisfied with their job and having a sound teaching-competency can only make a teacher can be technically effective, inventive and competent. He becomes able to use a range of strategies and

invent new strategies and techniques. Highly satisfied and competent teachers are able to establish dialogues, rapport and interaction supported by deeds with the students. These teachers are always willing and able to break from the routine when the situation calls for change. In other words such teachers become "situational-psychologists" i.e., they accept the need of understanding the students in general - patterns common to particular ages, culture, social class, geography and gender. Such teachers see students against a backdrop of sociological and psychological generalizations about groups and maintains the pace just right to keep students learning.

(a) Job Satisfaction

It brings to the surface the degree of agreement between an employ's expectations of the job and the rewards the job provides. However, the term job satisfaction when applied to work context of teaching seems to refer to the extent to which a teacher can meet individual, domestic and professional needs as an employee (Strauss, 1974).

(b) Teaching-competency

Teaching-competency is conceived as a matter of degree. Those of knowledge, abilities and beliefs a teacher possess and brings to the teaching "situation" becomes feed back to influence future performance. According to Edward this improvement in satisfaction is because of employees feeling that they are receiving rewards in proportion to their performance. Have a significant relationship with job satisfaction.

(C) **Earlier Studies** Using teacher effectiveness scale by Pramod and Mutha. The Major findings of the study were:-

- (a) There was no difference in teacher effectiveness among teachers working in Govt and private schools.
- (b) There was no significant difference in teacher effectiveness between Male and Female Teachers.

- (c) There was no significant difference in Teacher effectiveness under the joint influence of sex of teacher and type of schools to which they belong.

II OBJECTIVES

The following objectives were formulated for the present study:

- To study and compare male and female sec. school teachers on their teaching-competency.
- To study and compare rural and urban sec. school teachers on their teaching-competency.
- To study and compare male and female sec. School teachers on their job-satisfaction.
- To study and compare rural and urban sec. School teachers on their job-satisfaction.
- To compare high and low competent sec. School teachers on their job-satisfaction.

III SELECTION OF THE SAMPLE

The present study was conducted on (200) secondary school teachers of two districts, district Bhopal and district Riasen(Div. Bhopal). On the basis of random sampling with demographic and gender composition as shown in table 1

District	Nature of District	No. of teachers	Male	Female
Riasen	Rural	100	50	50
Bhopal	Urban	100	50	50
Total	2	200	100	100

Table 1: Graphical Representation of Sample Configuration

IV TOOLS USED

(a) GTCS

The data for the present study was collected with the help of GTCS (Gen. Teaching Competency Scale) as suggested by B.K.Passi and M.S.Lallita.

The GTC Scale is generally used for measuring teaching competency of a teacher individually by a reliable observer or a group of observers making direct observations of his classroom behavior for the entire teaching period. satisfaction and make assessment on GTC scale < >. Either by marking frequencies or write verbal descriptions against each item which would help him in giving ratings more objectively.

G.T.C.S. has 21 items to be rated on seven point scale the sum of ratings against all the items constitute the sum of scores. The maximum score possible is 147 and the minimum 21

The scale ensured content validity since at every stage of its development discussions were held with teachers and educators with regard the different teaching skills included and their behavioral Job-Satisfaction TOOL.

(b) Job-Satisfaction questionnaire

The Job-Satisfaction questionnaire consisted of three option provided against each item " (a) yes,(b) no,(c) not certain". A clear instruction was given to the respondents to express their opinion by putting a tick mark against the response category to which they are consented with. 100 rural) in and around the Bhopal The scale was provided with the demographic data sheet.The investigator made strong endeavor to secure complete and wholesome co-operation of all secondary school teachers. The teachers were related according to their responses on job-Satisfaction questionnaire.

The investigator personally visited each institution and administered these questionnaire for the teachers. were requested not to leave any item of the questionnaire. Most of the teachers responded on the spot and handed-over the tools to the investigator. Thus the tool collected and scores were analysed according to the statistical procedure.

V DATA ANALYSIS AND INTERPRETATION

The responses scored according to the key and against each item of the questionnaire of Job-Satisfaction. In respect of Job-Satisfaction for all positive items scores given from 3 to 1 for the responses viz. yes(Y), no (N) and not certain(NC) for all the 25 items (i.e. job satisfaction 25 items)whereas weightage awarded in reverse order for all negative items. Basing on the above scoring procedure the tool was scored

and designed the statistical profiles presented in the analysis of data. After the scoring of GTSC and Job-Satisfaction Questionnaire (JSQ), were completed, the data was subjected to statistical analysis by applying Mean, S.D. and 't'-test in order to get an understanding of teaching competency and job-satisfaction of rural and urban Sec. school teachers. Bar-graph and Line graph were plotted in order to make the results transparent.

VI DELIMITATION OF THE STUDY

This study is limited to the teachers working in secondary schools in and around Bhopal district and Riasen district of Bhopal city. To measure the opinion of teachers regarding their teaching-competency and job-satisfaction, GTCS and self-rating scale was used. Of many dimensions of teaching competency only "planning, presentation, closing, evaluation and managerial aspects were taken into account. Similarly, out of many dimensions of teacher's job-satisfaction" professional, teaching-learning, innovation and interpersonal relations" were taken into account.

VII CONCLUSION

On the basis of the study following meaningful conclusions have been drawn in respect of secondary school teachers at Bhopal and can be applied to any other cities of MP.

- (a) Male sec. school teachers in comparison to female sec. school teachers are more competent on teaching competency.
- (b) Rural sec. school teachers in comparison of urban sec. school teachers are low competent on teaching competency.
- (c) Male sec. school teachers in comparison of female sec. school teachers are well satisfied on individual, inter-personal and emotional dimensions of satisfactions, whereas male and female sec. school teachers show same satisfaction on domestic and professional dimensions of job satisfactions.
- (d) Rural sec. school teachers in comparison of urban sec. school teachers show or display more satisfaction problems on domestic, individual and emotional dimensions of satisfaction, whereas rural

sec. school teachers show same satisfaction on inter-personal and professional dimensions of satisfactions.

- (e) High competent sec. school teachers in comparison of low competent sec. school teachers show better or high overall satisfaction than low competent sec. school teachers. High competent in comparison to low competent sec. school teachers display better domestic satisfaction.
- (f) High competent in comparison to low competent sec. school teachers show better individual satisfaction.
- (g) High competent in comparison to low competent sec. school teachers show high level of inter-personal satisfaction.
- (h) High competent in comparison to low competent sec. school teachers show better emotional satisfaction.
- (i) High competent in comparison to low competent sec. school teachers show better professional satisfactio

EFFECT OF ADDITION OF TITANIUM DIOXIDE ON THE PROTON CONDUCTIVITY OF POLYSTYRENE MEMBRANE FOR FUEL CELL APPLICATIONS

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Abstract-Proton conducting polymer electrolyte membrane is the most important component of polymer electrolyte membrane fuel cells (PEMFC). The positive effect of addition of oxo-clusters of Ti, Zr, W and hydrophilic additives like SiO₂, TiO₂ and ZrO₂ on the proton conductivity characteristics of Nafion membranes have been reported earlier. Here we report the effect of additive titanium dioxide on the proton conductivity of polystyrene membrane in aqueous solution. The enhancement of proton conductivity was observed to be increase for titanium dioxide (by factors of 4.63). This showed that the proton conductivity was increased on addition of titanium dioxide in polystyrene membrane. The proton conductivities were calculated from the pH values measured at room temperature using an electrochemical cell and pH meter, on the basis of a proton transport model for porous membranes in aqueous solution. The membranes were characterized by FTIR, SEM and the observed results are explained in terms of the hydrophilicity of the additive.

Keywords-Fuel Cell, Proton Conducting Membrane, Polystyrene, Titanium dioxide, Hydrophilicity

I INTRODUCTION

Hetero-poly-acids (HPA) like phospho-tungstic acid (H₃PW₁₂O₄₀.nH₂O), silicotungstic acid (H₄SiW₁₂O₄₀.nH₂O) and phospho-molybdic acid (H₃PMo₁₂O₄₀.nH₂O) have been used as additives to Nafion and other polymer proton conducting membranes to improve proton conductivity[01-04]. These membranes showed a strong performance enhancement that increased with increasing temperature. However, upon heating HPA dehydrate and the conductivity drops sharply. HPA is highly water soluble and eventually leeches out from the polymer electrolyte membrane. Other drawbacks are their high cost and the adverse effects on the mechanical strength

of the membrane. The positive effects of addition of oxo-clusters of Ti, Zr, W on the proton conductivity characteristics have been reported earlier, where it was postulated that these oxo-clusters act as cross-linkers between the sulphonyl groups of Nafion membranes [5]. A lot of work has been done in Nafion membranes doped with hydrophilic inorganic additives like SiO₂, TiO₂ and ZrO₂ [06-07]. It has been clearly established that these hydrophilic additives are very helpful in increasing the proton conductivities of Nafion membranes. We felt that the role of hydrophilic inorganic additives could also be studied along with solid acid additives. We chose TiO₂ instead of the others because of its many interesting characteristics. It is known to have a much higher hydrophilicity than SiO₂ because of its higher affinity to hydroxyl groups and it is also used as a photocatalytic agent in the oxidation of hydrocarbons in aqueous media [08-15].

II EXPERIMENTAL

(a) Preparation of Membranes

The membranes were prepared using the phase inversion method. Initially polystyrene granules were dissolved in DMF (dimethyl formamide) obtained from Qualigens Fine Chemicals (Product No. 23157) and then TiO₂ (Qualigens Fine Chemicals Product no 28375) in the weight ratio given in Table (01) were added to the polystyrene+DMF solution and continuously stirred using magnetic stirrers for one hour. To ensure better crosslinking in the membrane DVB (Divinyl Benzene, Sigma Aldrich, Catalog No 41,456-5) was added at 2.5 % by weight to the total weight of the polystyrene and additives. At the end of one hour of stirring at temperature 40° C, a uniformly viscous liquid solution containing polystyrene in dissolved form and the additives in suspended form was obtained. Then this casting solution was spread onto a glass surface with a controlled thickness using a doctor

blade. The glass with the wet film on top was then immersed in a nonsolvent bath (de-ionised water at room temperature). The solvent diffused into the precipitation bath, whereas the nonsolvent diffused into the cast film. After a time in which the solvent and the nonsolvent were exchanged, the polymer solution (wet film) became thermodynamically unstable and demixing took place. Finally, a solid polymer membrane formed with an asymmetric structure and peeled off from the glass. This membrane had two surfaces: the glass side surface and the water side surface. In general, pores close to the waterside surface were much smaller than those close to the glass side surface for an asymmetric membrane. The membranes prepared by the above phase inversion method were washed several times using deionised water to remove traces of DMF as also the loose additive particles sticking to the surface of the membrane. Then the membranes were dried in a desiccator at room temperature for 72 hours. The details of the weight compositions of the different constituents of the membranes prepared by us are given in Table 01.

Membrane	Wt% of Constituents of the Membrane		
	Polystyrene	Di-vinyl Benzene	TiO ₂
Ps	97.5	2.5	-
Ps + TiO	87.5	2.5	10

Table 1: Weight Composition Of The Different Constituents Of The Membranes

III RESULTS AND DISCUSSION

(a) Analysis of FTIR Spectra

The entire document should be in Times New Roman or Times font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes. Recommended font sizes are shown in Table 1. The IR absorption spectra for the membranes are shown in Figures (01-02). The spectra are useful in finding out the nature of chemical bonds among and within the different constituent molecules. They are also helpful in detecting the presence of hydrogen bonds in association

with water molecules and hydroxyl groups which are the major factors helpful in proton conductivity.

The following IR absorption bands indicate the presence of water and hydroxyl groups:

~3400-3600 cm⁻¹ strong wide and deep absorption bands arising from -OH stretching. A sharp medium band at 1635 cm⁻¹ is attributed to aquo (H-O-H) bending. We analysed the FTIR spectra of the membranes on the basis of the above two absorption bands. The pure Ps membrane FTIR spectrum was used as the standard against which the comparisons were made of the FTIR spectra of other membranes. Our analysis is summarized in Table 02.

Bands	Ps	Ps+TiO
~3400-3600 cm ⁻¹ band relative to 2923 cm ⁻¹	3447 cm ⁻¹ broad but less deep; indicates presence of OH group	3448 cm ⁻¹ Broad but deeper; indicates more OH than (1)
1635 cm ⁻¹ band	Present and distinct; indicates H ₂ O	Present, broader, distinct; indicates more H ₂ O than (1)
Other differences observed		652 cm ⁻¹ (Ti-O-Ti); 1117 cm ⁻¹ (O - di - substituted benzene); 3439 cm ⁻¹ (TiO ₂ -OH)
Remarks	Pure Ps standard spectrum with some water	Presence of hydrophilic TiO ₂ has increased water content

Table 2: Summarized Analysis of FTIR Spectra Of Membranes

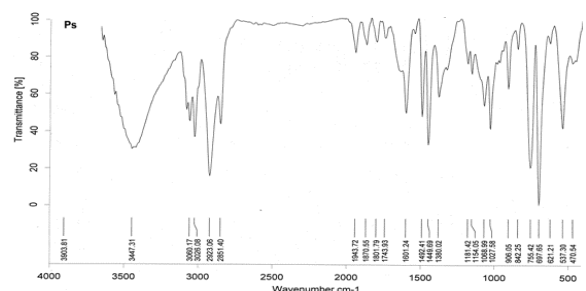


Figure 01. IR Spectrum Of Ps Membrane

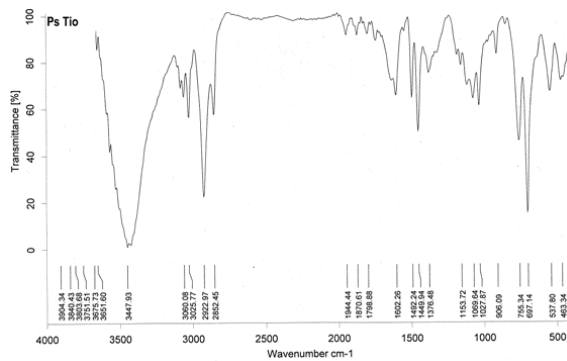


Figure 2: IR Spectrum Of Ps + TiO Membrane

(b) Analysis of SEM Results

The membranes display asymmetric character in terms of porosity. The water side of the membrane surfaces show dense character with the size of the pores much smaller compared to the other surface – the glass side of the membrane surfaces – which have a much more porous nature with larger size pores. The water sides are somewhat less smooth and undulating, whereas the glass side of the membranes are smoother and plainer. In the case membranes having additives, the additive particles sometimes are seen to lie inside the pores, obstructing/narrowing the pores. This depends largely on the diameter sizes of the additive particles. In our case we crushed the precipitates of the additives using mortar and pestle and then sieved them with a 150 μm sieve. The SEM images (Figures 03-04) show that the additive particle sizes are 50-60 μm maximum.

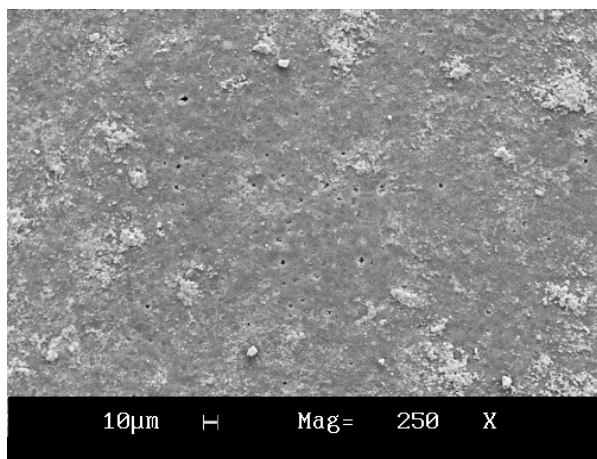
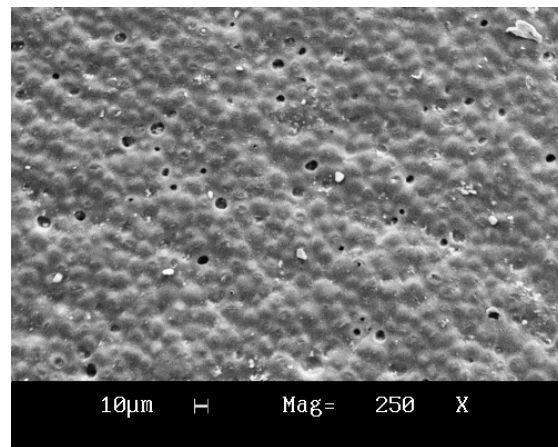


Figure 4: Water Side



(Glass Side)

Figure 4: SEM Surface Image Of Ps+TiO Membrane

(c) Thickness, Water Uptake, Porosity

From the experimentally determined thickness of the wet membranes and the weights of the dry and the wet membranes measured at room temperature ~30 oC, the water uptake and porosity of the membranes were calculated. The area of the membranes was taken as the area of the membranes exposed to the acid solution in the electro-chemical cell used for measuring proton transport. The results are summarized in Table 03.

Membrane	Wet Thickness	Area	volume of feed cell	Water Uptake	Porosity
	l cm	A cm ²	V cc	u %	Por %
Ps	0.025	3.02	15.9	242.86	71.83
Ps + TiO	0.020	3.14	15.9	220.34	71.79

Table 3: Water Uptake and Porosity of Membranes These results show that the water uptake and porosities of the membranes prepared by us were quite satisfactory. The SEM characterization also supports the highly porous nature of the membranes.

(d) Proton Diffusivity and Conductivity

To study the effect of additives on the proton conductivity of membranes, we started with pure Ps membranes with no functional groups like sulfonyl, phosphonyl etc.. in it. The advantage here is that, in pure Ps membrane proton transport will be basically bulk-like in character and hardly any surface conduction effect will be observed. Thus on adding an additive, there will be an extra contribution due to the surface conductivity of the additive. This will be easier to observe in a neutral membrane like Ps. Proton diffusivity D was calculated as $D = Pl$, where P is the permeability coefficient and l is the membrane thickness. P was experimentally determined by using an electrochemical cell in which one cell contained feed solution (HCl conc.1M, Qualigens Fine Chemicals, Product No.-29145) and the other cell the stripping solution (distilled water at time $t = 0$).

The following equation written in terms of the proton concentration in the feed cell, based on Fick's Law of Diffusion describes the permeability coefficient of proton (P , $\text{cm}^3 \text{cm}^{-2}\text{s}^{-1}$):

$$-\ln \left[\frac{C_a(t)}{C_{a0}} \right] = (AP/V) t$$

Where C_{a0} (mol/litre) is the initial concentration of the feed solution, $C_a(t)$ (mol/litre) is the feed concentration calculated from the concentration of the stripping solution $C_w(t)$ at time t (s) [16].

$$C_a(t) = C_{a0} - C_w(t)$$

V is the feed volume (ml) and A is the actual membrane area (cm^2). The plots of $-\ln (C_a(t) / C_{a0})$ versus time t , from which P were calculated, are shown in Figures 05-06.

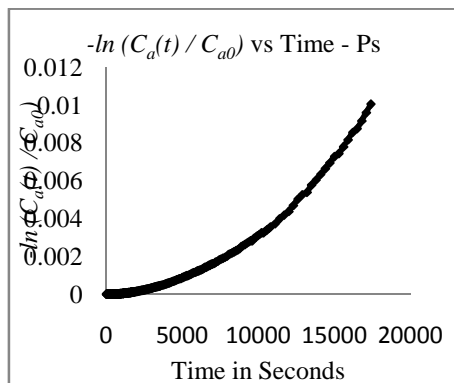


Figure 5: The Plot Of $-\ln (C_a(t) / C_{a0})$ Versus Time For Calculating The Proton Diffusivity Of Ps Membrane.

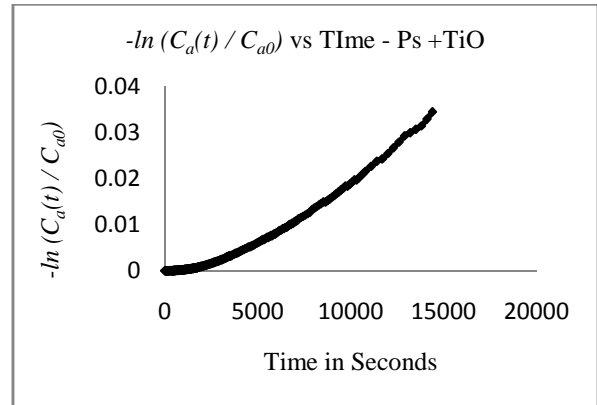


Figure 6: The Plot Of $-\ln (C_a(t) / C_{a0})$ Versus Time For Calculating The Proton Diffusivity Of Ps+TiO Membrane.

This value of D was then used to calculate proton conductivity according to Nernst-Einstein equation $\sigma = (F^2/RT)D$, where F is Faraday constant and R is the gas constant. Since the different membranes have differing porosities, we divided the conductivity values obtained from the Nernst-Einstein relation by the respective porosities. This way the effect of porosity was offset, so that the differences could now be attributed to solely the nature of the additives.

The values of proton conductivity for the different membranes studied by us are given in Table 04.

Membrane	Proton Diffusivity $D = \text{slope} \cdot V / A$	Proton Conductivity $\sigma = (F^2/RT)D$	σ / Por S/cm	Relative (σ / Por)
	cm^2/sec	S/cm		
Ps	4.24×10^{-08}	1.57×10^{-08}	2.18×10^{-08}	1.00
Ps + TiO	1.96×10^{-07}	7.26×10^{-08}	1.01×10^{-07}	4.63

Table 4: Proton Conductivity in Membranes

The table shows that the values obtained by us for the conductivities of the membranes are a few orders of magnitude lower than those reported in literature for sulfonated membranes such as Nafion. This is not surprising, since we have not used sulfonated/phosphonated membranes in our studies.

Whatever variations that are observed in the conductivities of the different membranes are thus

purely due to the additives present in the membranes. The following features may be noted:

The effect of adding TiO₂ to the membranes in all cases is to raise the conductivities of the membranes. In the case of pure Ps, its addition caused the conductivity to raise by nearly five times. FTIR spectra of TiO₂ membranes show higher hydrogen-OH and hydrogen-H-O-H bond absorption pointing to higher hydrophilicity of TiO₂. Thus hydrophilicity of additives seems to play a very important role in proton conductivity. Similar effects were observed in the case of Nafion and other sulphonated membranes by others [05,16]. The same effect was noticed in Nafion for the case of a similar hydrophilic additive SiO₂ previously [17,18]. Our results show that substantial improvements in proton conductivity can be achieved by using TiO₂ as additive in the case of polystyrene membranes as well.

IV CONCLUSION

Our experimental results show that the addition of titanium dioxide has a very dramatic and positive effect on proton conductivity. Perhaps this is due to its much higher hydrophilicity as observed in the FTIR characterisations where ~3400-3600 cm⁻¹ band is seen to be strikingly enhanced for titanium dioxide added membranes.

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EFFECT OF MOBILE NUMBER PORTABILITY ON CUSTOMER RETENTION IN MADHYA PRADESH CIRCLE OF BHARAT SANCHAR NIGAM LIMITED A STATE OWNED TELECOMMUNICATION COMPANY

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Abstract-The Government announced the guidelines for Mobile Number Portability (MNP) Service in the country on 1st August 2008¹ and has issued a separate license for MNP service from 20.03.2009. As per these guidelines Mobile number Portability states implementation of facility for porting of mobile number from one service provider to another which is operating in same circle. This analytical study enables BSNL in understanding trend of customer retention and defection as per prevailing socio-economic conditions in Madhya Pradesh. Most of the population in Madhya Pradesh is sustained by agro income or derive their living from similar source. Hence emphasis is to be paid in studying the trend of customer defection pertaining to this class of people. Data as collected from TRAI² and BSNL³ till date is analyzed to understand correlation between Mobile Number Portability and Customer retention. The data as collected and published by TRAI, available in public domain, is used for understanding the general trend followed by customers in Madhya Pradesh⁴. Analytical study of correlation of MNP facility with customer retention is made. This analysis states hypothesis which can be used by state owned company BSNL which will enable it in better customer satisfaction and retention. The major factors applicable to Madhya Pradesh keeping in view the socio economic conditions are Offered Service Quality, Economic Status of Customer, Offer by Service Providers and to a large extent Mobile Number portability which enable customer to switch between operators without having to care about change in mobile number.

Keywords-Mobile Number Portability, Correlation, Offered Service Quality, Economic Status Of Customer, Porting.

I INTRODUCTION

Telecommunication industry especially mobile communication has been developing since 21st century. India is the second most populated country in the world. Hence there is huge opportunity for mobile telecom operators for

providing services to them. The TimeLine regarding development of Telecommunication sector in India can be summarized in following few lines. In 1975, the Department of Telecom (DoT)⁵ was separated from Indian Post & Telegraph Department⁶. DoT was responsible for telecom services in entire country. On 28th February, 1986 Mahanagar Telephone Nigam Limited⁷ (MTNL) was carved out of DoT to run the telecom services of Delhi and Mumbai. The policy of liberalization in the 1990s helped the Indian Telecom sector to grow rapidly. With liberalization private companies were allowed to manufacture telecom equipment as well as provide value added services, paging and cellular mobile services. In 1994, the government formed the first National Telecom Policy (NTP)⁸. The Telecom Regulatory Authority of India was established on 20 February 1997 by an act of parliament called "Telecom Regulatory Authority of India Act 1997"⁹ to enable regulation of various telecom operators. In 1999 better liberalization policies led to the establishment of BSNL, Bharat Sanchar Nigam Limited a state owned company for providing telecommunication services to India. BSNL finally came into existence on 1st October 2000. Apart from BSNL at present there are around 15 service providers like Bharti, Reliance India mobile (RIM), Vodafone, and Idea Cellular etc. BSNL provides telecommunication facilities to all the states and Union Territories of India. Madhya Pradesh is among one of the states. Share of various telecom operators is pictographically represented in following pie-chart.¹⁰

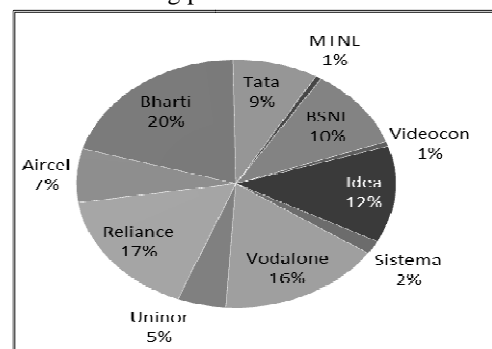


Figure 1 : Share of Telecom Operators in INDIA

Madhya Pradesh mostly constitutes rural and semi-urban population which derives their living mainly from agriculture and agro-industries. As per data collected by India Census 2011¹¹ the percentage of rural population in India is 68.84% whereas the percentage of rural population in Madhya Pradesh is 72.37%. Earlier most of the private player focused only on urban areas. Thus BSNL was the sole provider for most of the rural and semi-urban areas in Madhya Pradesh. But due to large market base in these areas recently private players have also started venturing into Madhya Pradesh. Moreover with the introduction of Mobile Number Portability it has become quiet easier for the customer to switch between telecom operators without worrying about change in mobile number.

Analytical study is conducted collecting data of mobile subscribers available on the site of TRAI for understanding the trend followed by customer opting for MNP. As per data from TRAI around 2 lakh subscribers had opted for MNP within 10 days of its introduction and later implementation. This emphasizes the impact of MNP on customer defection. Data as available till July '2012 stating net gain in number of subscriber by various telecom operators in India is given below.¹²

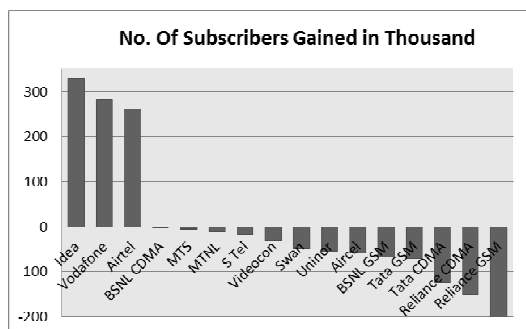


Figure 2 : Net Gain of subscribers on July'12 after launch of MNP

As evident from the figure net gain by BSNL_GSM is negative. Hence BSNL requires performing detailed analysis for the cause of customer defection.

II BSNL AND OTHER SERVICE PROVIDER OF MOBILE NETWORK IN MADHYA PRADESH

The major telecom service providers of mobile communication in Madhya Pradesh are Airtel, BSNL, Vodafone, Idea Cellular, Reliance Smart (GSM) and Tata Docomo and Videocon. Total number of mobile subscribers in Madhya Pradesh as on 30.07.2012 is 31,53,085¹³. Most of the private operator emphasize on providing services to urban population. This is due to availability of proper infrastructure and return on investment obtained while

providing services in urban areas. Due to lack of infrastructure huge investment is required for building, equipment installation and providing facility to customers for operating in rural areas. Hence most of the private subscribers use to operate only in urban areas of M.P.

III DETAILS ABOUT MOBILE NUMBER PORTABILITY AS INTRODUCED IN JANUARY 2011¹⁴

Mobile Number Portability was introduced in Hisar, Haryana on 25th November 2010. As per guidelines Mobile number Portability required providing services for customer so that they can switch operator without changing their mobile number from one service provider to another which were operating in the same circle. MNP was finally applied to all the states of INDIA in January 2011.

A central database of mobile number which is to be ported is kept which is accessed by all the telecom operators. India is divided into various zones and each zone has a database which is used for storing information about all the mobile number which is to be ported. The job of keeping zone wise database of porting mobile numbers cannot be assigned to any of the telecom operators. Hence this job was assigned to Telecordia¹⁵ and Syniverse¹⁶. Porting of mobile number is available irrespective of service provider and technology used like GSM/CDMA etc.

The process of applying for MNP is simple. The customer who wants to port his mobile number to some other operator has to send an SMS to 1900 in: PORT –(mobile number) format. The SMS reply to this request consists of a unique porting code. The customer then sends SMS to the preferred operator quoting the unique code. This code is valid only for a few days, and customer has to apply again if it expires. The existing operator of customer will check with new operator & if there are no dues then approval will be given for porting. The customer gets an SMS on the time and date when porting will take place. As per rules by TRAI the process has to be completed within 4 days of applying. After porting is completed the new operator sends SMS regarding the change of operator. The customer is not able to use his number for about 2 hours when the porting takes place. The process is kept simple so that the customer does not have to go through a lot of paperwork before switching operators.

IV MOBILE NUMBER PORTABILITY AS CHANGED IN NATIONAL TELECOM POLICY OF 2012¹⁷

As per National Telecom Policy Guidelines of 2012 mobile numbers portability is to be extended for the whole nation. Customer can now switch from one mobile operator/service to another irrespective of circle or state. One nation Mobile Number Portability would not be having significant impact on customer defection specifically to Madhya Pradesh. This is because most of the mobile subscribers of Madhya Pradesh do not move from one state to another frequently. Hence One Nation Mobile Number Portability is not going to affect them. This point will be visible in future data collected by TRAI.

V HYPOTHESIS CONCEPTUALIZED KEEPING IN VIEW SOCIO-ECONOMIC AND GEOGRAPHY OF MADHYA PRADESH

The major factors which are considered in this research for formulating hypothesis as applicable to Madhya Pradesh keeping in view the socio economic conditions are Offered Service Quality, Economic Status of Customer, offer by Service Providers and Mobile Number portability.

(a) Offered Service Quality-

Zeithaml et al (1996)¹⁸ has developed a conceptual model of service quality which affect customer satisfaction and hence retention. The service quality ensures whether customers will remain loyal or leave the provider. In case of mobile communication the availability of network to the subscriber plays a significant role. This is particularly applicable in rural areas where there is problem of signal reception due to lack of number of towers and associated equipment.

Hypothesis 1: Offered service quality specifically availability of mobile network by the service provider has a significant effect on customer satisfaction and hence retention.

(b) Economic Status of Customer –

Kollmann (2000)¹⁹ had stated the importance of price in telecommunication market specifically for the mobile telecommunication service providers. This is particularly applicable to Madhya Pradesh which has almost 50% less per capita income compared to India in general. Due to prevailing economic condition of customers in rural areas of Madhya Pradesh the price of services offered should be kept as low as possible. Moreover the bulk of consumers derive their living from agriculture and hence most of the subscribers would like to have lower tariff for voice communication.

Hypothesis 2: As per prevailing economic condition in Madhya Pradesh service providers should provide lower tariff for voice communication.

(c) Offer by Service Providers -

Mobile service providers mainly provide pre-paid and post-paid services to its customers. Analysis done by Chinnadurai and Kalpana (2006)²⁰ on increasing competition and changing preferences of the customer's all over the world shows the importance of promotional offer. The customer now would like to avail of promotional offer and change the service provider if the offer is not extended beyond a stipulated initial period keeping in view the facility of Mobile Number Portability. Madhya Pradesh mainly constitute of semi-literate people in the rural areas. The literacy rate is 63.7%. Hence a service provider has to advertise in a suitable way so that the customer is able to understand the essence of offer. Technical jargons creates barrier between service provider and customers.

Hypothesis 3: Promotional offers by service provider should be able to convey the essence of the offer in simpler terms and should have less technical jargons which are better suited to major population in Madhya Pradesh keeping in view of their socio-economic condition.

(d) Mobile Number Portability –

Previously before MNP was introduced the customer had to evaluate various pros and cons before switching operator. One of the factors effecting their decision to switch operator was change in mobile number. As the customer had to inform all of his contacts about change in mobile number. But due to introduction of MNP the customer now do not have to change his mobile number. Hence MNP has enabled customer to decide the change in service provider based on other factors. Hence all other factors have become a subset of this major factors affecting customer retention with service provider.

Hypothesis 4: MNP has succeeded because the subscribers do not have to change their mobile numbers.

V RESEARCH METHODOLOGY

MNP data available of website of TRAI was also used for understanding the general trend of customer defection in Madhya Pradesh. Data was also collected through questionnaire survey. 16 questions were given in the questionnaire. The person answering questions were given the option of stating their name in the first question. Next three questions were related to demographic variables which are age, gender and family monthly income. Rests of the question were given to understand Choice of Services Provider, Offered Service Quality, expenditure on Mobile services, understanding of promotional offers, and Mobile Number Portability.

VI Analysis of customer data collected – TRAI and BSNL.²¹

For understanding the trend followed by subscribers opting for MNP specifically to BSNL-M.P. Circle author has collected data from BSNL office. This data is presented in bar chart format for better understanding the port in and port out requests. Port in request are generated when mobile subscriber wants to subscribe for BSNL and Port Out request are generated when subscriber wants to leave BSNL and join some other subscriber network.

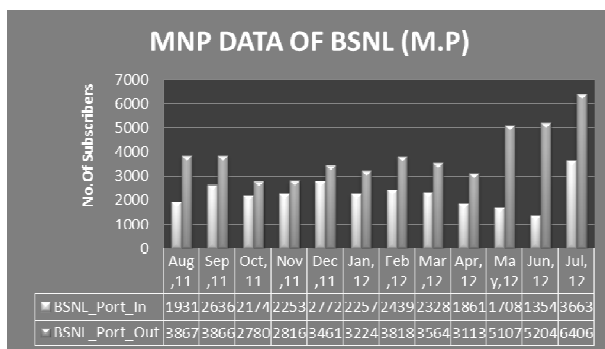


Figure 3: Mnp Request Of Port In And Port Out For M.P. Circle Of Bsnl From Aug'11 To Jul'12.

It is quite evident from the above bar chart that more number of subscribers is porting out of BSNL from May 2012 to July 2012. The data collected from August 2011 to July 2012 clearly state that more number of subscribers are porting out of BSNL. In October, November and December the number of subscriber porting In and Out of BSNL are comparable but the recent figure of May, June, July 2012 states that more number of subscriber are porting out of BSNL then the number of subscribers porting in. This trend depicts that subscribers of BSNL are not satisfied with the services provided to them.

VII DATA COLLECTION THROUGH SURVEY OF MOBILE SUBSCRIBERS.

For collecting data from mobile subscribers a total 150 questionnaire forms were distributed in Bhopal district of Madhya Pradesh. The total number of 109 people responded to the survey. Information about the respondents are provided in the following table

Variable	Total Number	Percentage (%)
Gender	Male	92
	Female	17

Age	Below 18 Years	7	6.4
	18-30 Years	100	92
	30-40 years	2	1.6
	Above 40 Years	0	0
Monthly Family Income	Below 10,000	52	47.71
	10,001-25,000	44	40.37
	Above 25,000	13	11.93

Table 4: Consolidated Information about respondents.

As per above data most of the respondents were male with age between 18-30 years having monthly income less than 25,000. This data is also verified by the author as the forms were distributed to employees of a call center. Only 6.42% of the mobile subscribers opted for BSNL as the service provider. Rests of the respondents were using some other service provider. 89% of the subscribers were satisfied with the quality of signal and 69% of these subscribers had not opted even once for MNP. Hence hypothesis 1 given above is true which states that signal quality or availability of mobile network at all places is one of the factor which helps in retaining the customer.

Around 94% of the respondents were using pre-paid service connection. And around 96% of them require lower tariff. This is as per hypothesis 2 which requires that lower tariff should be given to subscribers. It is hereby stated that lower tariff should also be given as incentive to subscribers who remain loyal to their service providers for longer duration. This will help in retaining the subscribers.

In the survey respondents were asked whether they are able to understand the advertisement or promotional offers by their service providers. Around 83% of the respondents replied in affirmative. And as per the MNP data of these respondents around 69% of these subscribers had never opted for MNP. Hence the hypothesis 3 holds true which states that subscriber remain loyal to the service provider if they are able to understand the offers by the providers.

Respondent were asked if they would switch service provider if they have to change their mobile number. 70% of the subscriber stated that they would not switch service provider if they have to change their mobile number. This is as per Hypothesis 4 which states that MNP has succeeded mainly as it enables customer in retaining the mobile number even after switching operator. As per the data collected from survey the entire hypotheses formulated have been verified.

VIII CONCLUSION

This analytical study regarding effect of mobile number portability states various hypotheses that are responsible for customer retention specifically to Madhya Pradesh. The hypotheses are mainly based on prevailing socio-economic and geographical location of subscribers in Madhya Pradesh.

The data analysis is centered on BSNL. Hence BSNL can use these hypotheses for formulating policies for providing better services to the customers. The main factors as conceptualized and predicted through hypothesis are to a certain extent proved by statistics and data of TRAI. The hypothesis states the effect of offered service quality or availability of mobile network, economic status of customer, promotional offer and mobile number portability on customer retention. This research can also help academicians and researchers in better performing analysis of telecommunication sector. The hypothesis formulated can also act as basis for performing further research for understanding subscriber's intention to switch operators keeping in view One Nation-Mobile Number Portability.

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DEVELOPMENT OF NEW RECYCLING APPROACHES AND TECHNOLOGY MANAGEMENT OF E-WASTE

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***Abstract**–Electronics, Communication, computers and IT devices(consumer electronics) have changed the human life styles tremendously comfortable with many advantages, but they have brought in some hazardous side effects on environment. Management and disposal of E-waste has become a major problem in the world and is growing at alarming proportions. The accumulation of e-waste causing biggest harm to environment is the dumping of hazardous materials. The aim of this concept research paper is to study, analyze, discuss existing E-waste recycling methodologies and conceptualize and propose some new approaches for recycling 100% of e-waste. In this paper an attempt is made to present and discuss some new recycling approaches and technology management of E-waste through which discarding of e-waste into environment is either nil or minimal. This method also envisages extraction of each and every material from e-waste. Increasing global trends of e-waste and implications of implementation of proposed methodology, commercial and societal are also included here.*

Keywords–Eco friendly Electronic Devices, E-waste, Recycling, Incineration, Land filling, Million Tonnes(MT)

I INTRODUCTION

Unwanted, obsolete or unusable consumer electronic products such as computers, computer peripherals, televisions, VCRs, DVD Players, stereo equipment, hand cell phones are commonly referred to as ‘electronic waste. Faster obsolescence and subsequent up-gradation, new electronic products are forcing consumers to discard old products, which in turn accumulate huge amounts of e-waste. E-waste contains hazardous materials [8] such as brominated flame-retardants, PVCs and heavy metals like lead, cadmium and mercury, which are known to cause harm to the environment and human lives. Hazardous substances are contained within components such as printed circuit boards, cables, wiring, plastics, casings, displays monitors, cathode ray tubes (CRT), batteries, capacitors, resistors, relays and connectors and so on the land filling of these hazardous materials risks the leaching of heavy metals like lead, cadmium and mercury into ground water or

evaporation of mercury into air. The E-waste is growing at an unsustainable rate and is the most toxic component of municipal waste. The e-waste growing trends are as shown in the table.

SI No	Country	2000 (M T)	2007 (MT)	2015 (M T)	2025 (M T)
1	India	0.48	0.685	4.1	8.0
2	Europe (EU-27)	5.9	8.1	10.53	18.0
3	China	0.82	2.3	10.68	21.0
4	USA	4.6	6.46	9.5	18.0
5	World	34.7	49.0	77.8	130.0

Table1: Growing trends of E-Waste

In 2012 world populations stands at 7.03 billion and by 2050 it is expected to stand at 12 billion. 70% of world population will be owning mobiles, laptops and TVs. With the current rate of production one can imagine the e-waste levels which are going to become unmanageable by 2050 if necessary measures are not initiated. Hence new approaches for recycling are necessary to minimise E-waste dumping in to the environment and prevent human health hazards.

(a) Historical Background and Existing Recycling Methodologies.

In general E-waste treatment and disposable methodologies prevailing are land filling, Incineration, recycling and reuse. In land filling and Incineration methodologies hazardous materials continue to release toxins in to environment causing human health hazards. Details of E-waste management in India and major parts of world are enumerated as follows. Land filling is one of the most widely used methods [3] for disposal of e-waste. The degradation processes in landfills are very complicated and run over a wide time span. Land filling of e-waste risks are as follows.

- (i) Teaching of hazardous materials into soil and water such as broken lead containing glass, cone glass of cathode ray tubes and cadmium. into soil and ground water.
- (ii) Cadmium and mercury are emitted in diffuse form or via the landfill gas combustion plant.
- (iii) Landfills are prone to uncontrolled fires, which can release toxic fumes.
- (iv) Incineration [3] is a controlled and complete combustion process, in which the e-waste is burned in specially designed incinerators at a high temperature at 900-1000 degrees Celsius. The disadvantages of incineration process are as follows.
- (v) Emission to air of substances escaping flue gas cleaning and large amount of residues from gas cleaning and combustion.
- (vi) E-waste incineration plants contribute significantly to the annual emissions of cadmium and mercury.
- (vii) Heavy metals not emitted into the atmosphere are transferred to slag and exhaust gas residues and can re-enter the environment on disposal.

Hence the e-waste incineration will increase these emissions it is very highly disadvantages and not a suitable method in disposal of e-waste. The land filling is not an environmentally sound treatment method for e-waste for substances, which are volatile and not bio-degradable. Therefore, there is a necessity to come up with a viable solution for e-waste recycling to make e-waste either nil or minimal.

(b) E-waste status in India

India is expected to generate about 4.1 million tonnes of E-waste [7] by 2015 and 08 million tonnes by 2025. In India e-waste is growing at the rate of 10% and constitutes 3% of municipal solid waste. At present recovery of useful components for reuse, recovery of precious metals such as gold, silver, copper and other metals, rest is discarded in to environment. Otherwise various methodologies used in India are decontamination, dismantling, hammering (pulverization), shredding and density separation using water. There are about 47 recycling companies accounting for only 27% of E-waste leaving 83% into environment.

(c) E-waste status in China

China is expected to generate 10.68 million tonnes of E-waste by 2015 and 21 million tonnes by 2025. There are about 500 villages in Guiyu, E-waste town in china recovering gold and silver and discarding 80% into environment, polluting ground water and creating human health hazards.

(d) E-waste status in USA/Europe world

Europe and USA are likely to generate 18 million tonnes of E-waste each by 2025. There are 500 recycling companies in USA alone but only 20% of E-waste is recycled and rest is discarded into environment. World is expected to generate 77.8 million tonnes of E-waste by 2015 and 130 million tonnes by 2025. World average stands at 20% of recycling of e-waste as of now.

Present recycling process involves dismantling and removal of different parts of E-waste containing dangerous substances, plastics, ferrous and non ferrous metals, their separation and segregation. Recyclers use strong acids to remove precious metals such as gold, silver and copper. The value of recycling from the element could be much higher if appropriate technologies are used. The recyclers working in open areas. Poorly ventilated enclosed areas without mask and technical expertise and machinery results in exposure to dangerous and slow poisoning chemicals. There is an urgent need to find suitable newer recycling and technology management methodologies for reducing of pumping of hazardous materials into environment to protect environment, ground water contamination and human lives.

II PROPOSED METHODOLOGY

Performance and profit making should not be the main criteria for any Electronics and Communication products. Also along with this the ill effects they bring after discarding into environment must be addressed to reduce hazardous materials causing harm to human lives. Disposing of E-waste such as computer peripherals, storage media, printers, monitors, consumer electronics, networking equipment and communication equipment should be such that it is efficient and effective at the same time with minimum or no impact on environment. This paper conceptualizes and proposes newer approaches for recycling and technology management of E-waste to address the future safety of environment and human lives. Also proposes further research for identification of machineries and industrialization sites for setting up of chain of small scale industries. Any major manufacturing facility is

generally has a chain of ancillary or small scale industries producing spares and accessories for the major facility. The E-waste contains hazardous and non hazardous materials. For example personal computer generally composes of 26% silica gel glass, 23% plastic, 20% ferrous metals, 14% Aluminium and 17% others like gold, silver, copper, lead, zinc, mercury and cadmium. The block diagram of the proposed E-waste recycling methodologies is as shown in fig. 1. The salient features of proposed recycling and technology management methodologies envisaged in this paper are as follows.

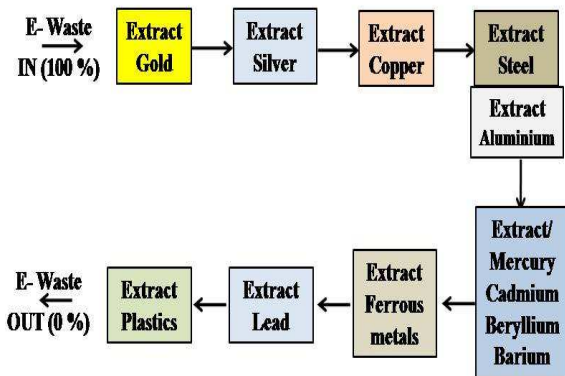


Figure1: Block Diagram of Chain of Ancillary (Small Scale) Industrial setup

- (i) Identify and Select the key cities which are generating large quantities of E-waste
- (ii) Identify suitable area near IT parks(consumer electronics industries) in those cities.
- (iii) Set up chain of ancillary or small scale industrial belts for extracting all the materials used and found in the E-waste.
- (iv) Extract the materials one by one with respective ancillary or small scale industrial set up. After extraction of gold the e-waste content moves to next stage where silver is extracted, then to copper, aluminium, lead, Barium, Mercury, Beryllium, Steel, zinc, cadmium, nickel, ferrous metals, plastics and so on.
- (v) There is a need to consider design of this chain of ancillary or small scale industrial set up for processing and extraction of materials suitably depending on the content and on their hazardous or non-hazardous nature.
- (vi) Most of the materials used are procured from existing bigger industries, hence they must set up mini models for extraction of respective materials for reuse.

(vii)E-waste needs to be centrally transported to these centres and inputted to the chain of ancillary or small scale industrial set up for processing and extraction of respective materials found in the E-waste.

(viii) The final out come from the ancillary or small scale industrial set up of this kind should be minimal from the E-waste or nil amount of materials so that no harm/minimal harm is envisaged to environment or for human lines.

III IMPLICATIONS OF PROPOSED METHODOLOGY

The proposed setting up of ancillary and small scale industrial for processing and extraction of E-waste at selected cities will give rise to the following factors which will have to be accepted.

- (i) Cost considerations for setting up of chain of ancillary/small scale industrial set up will certainly go high.
- (ii) There will be resistance from the respective bigger industries for this set up.
- (iii) Imposition of strong legislation attracts protests from designers/manufacturers because they need profits.
- (iv) The major advantage will be that E-waste discarded into environment would be either minimal or nil.
- (v)Another major advantage would be that it would generate employment.
- (vi) Even though large profits are not expected marginal profits are expected. But the service done to protect environment and greener earth and human lives goes a long way for human kind.

IV DISCUSSION

The inference from this research paper is that the issue of hazardous material discarded in to the world through E-waste is assuming alarming proportions. It is estimated that on global scale approximately 20 kg of this material is put into market every year per inhabitant and an estimated 50 million tonnes of E-waste is produced every year.

It is estimated that 80% of e-waste is put in to landfills where as 20% is re-cycled for reuse.

The best example to be quoted here is the Guiyu, the world's largest e-waste site in China's Guangdong province. Here e-waste processing business, often with primitive and hazardous methods has led to severe health problems to the township. It is expected that one tonne of computer e-waste contains more gold than 17 tonnes of gold ore. Due to this Guiyu township[4] has the unique way of gold and silver harvesting from e-waste where basic safety protocols are compromised and then the remaining e-waste is discarded in to landfills or so. Some of the land fills can be reclaimed decades later[5], but there are multiple issues involved. If the locations are concentrated with toxic materials, like this Guiyu as an example, we might have to wait for centuries before the land could be safe for human living. There is a strong lesson from this example for countries like India and the whole world to apply the concepts proposed in this paper as early as possible. The first such ancillary or small scale E-waste recycling industrial set up is required to be set up on war footing at the earliest at Guiyu, in China where toxic E-waste has assumed alarming proportions which can only be ensured by UNO. In India Ministry of Environment and Forests, Government of India is the nodal agency for policy, planning, promoting and coordinating environmental programme including e-waste [15]. An exclusive notification on e-waste (Management and Handling) Rules, 2010 have been made effective from 01 May 2012 to address the safe and environment friendly handling, transportation, storing, recycling and also to reduce the use of hazardous substances during manufacturing of electronics and electrical equipments. Central and state pollution control boards have also stepped in to effective management of e-waste. It is expected that these measures will be far away from effective addressing of the e-waste compared to recycling approaches presented in this paper.

The concept presented in this paper for recycling is certainly expected to solve and address the e-waste problem to the maximum extent possible not only for India but for entire world on implementation.

V CONCLUSION

The major contributed solution proposed in this paper is the idea of setting up of chain of ancillary and small scale industrial belt to ensure prevention of discarding of e-waste into the environment and society. At the same time entire e-waste is recycled for reuse which will be a profit making venture through employment generation.

The present methodology of usage of e-waste processing business, often with primitive and hazardous methods which has led to severe pollution and health hazards to the township of Guiyu in China's Guangdong province has to be treated as a lesson by other countries. They have to invest heavily in modern recycling facilities to process the e-waste the cleanest way possible as suggested in this paper.

It may not be very easy to invest in the beginning but the existing material industries have to be convinced for the cause of environment and society to safeguard the future.

This paper recommends that India has to start the ancillary or small scale industrial set up at most e-waste producing cities in the first phase considering the E-waste accumulation. They are Mumbai, Delhi, Bengaluru, Chennai, Kolkata, Ahmadabad, Hyderabad, Pune, Surat and Nagpur. Since number of IT parks has come up in these cities, it is a novel idea for setting up of E-waste recycling industrial set up next to these parks. In the second phase by 2030 India has to plan setting up of these ancillary/small scale industrial E-waste recycling set up in Indore, Bhopal, Coimbatore, Trivandrum, Mangalore, Mysore, Lucknow, Patna, Gauhati and visakapatnam, Jaipur, Jodhpur.

In addition to draw backs of present recycling processes, the existing dumping grounds in India and other countries are full and overflowing beyond capacity and it is difficult to get new dumping sites due to scarcity of land by 2025 and by 2050. Therefore, the methodology proposed in this paper for setting up of chain of small scale industries across the major cities for E-waste recycling is the best possible option, including for future needs.

The following points needed to be driven for protection of eco friendliness of E-waste recycling proposal suggested in this research paper.

(i) Consumer Electronics Manufacturers have to accept the hazards to environment leaving the desire for large profits alone and set up ancillary or small scale industrial set up.

(ii) Consumers also have to compromise on performance factor.

(iii) Extended producer responsibility must be encouraged whereby those who produce e-devices are responsible and to give helping hand for the setting up of ancillary industrial set up.

(iv) A strong standard legislation is required to be imposed on all concerned agencies.

(v) Discipline and ethics of all concerned and cooperation in recycling industrial set up goes a long way in ensuring environment pollution control.

VI FUTURE SCOPE

Future scope exists for further research for identification of comprehensive machinery and methodology for small scale industrial set up for effective e-waste recycling for environment pollution control. Scope also exists for development of suitable machinery and new extraction techniques for E-waste recycling.

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PROBLEMS IN EXISTING RFID SYSTEMS: USER-CENTERED DESIGN METHODS

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Abstract-RFID (Radio Frequency Identification) is an emerging identification technology having greater capability than bar codes. But, the use of these systems is being discouraged by certain practical problems associated with them. Such as, high costs, tag reader sensitivity, limited transmission distances etc. End users participation and designers expertise when combined, form the key ingredients of igniting improvements and innovation in any system. This paper proposes some user-centered approaches for the improvement in the existing RFID systems.

Keywords-Participatory, Design, RFID, Conceptual Mapping.

I INTRODUCTION

The magic of RFID is everywhere. The pace with which this technology is expanding its wings, as of now, it may sound futuristic but within next 10 years, we might witness fully automated homes, offices and markets and so on. Radio Frequency Identification (RFID) is an automated identification technology with greater identification capabilities than bar codes. This technology offers promising advantages like: (1) Read through obstacles (2) Read in hostile environment (3) Read in real-time by the RFID Reader [1]. Due to this attractive package, this technology is making its way into the bodies of consumers [4], and even introducing itself to the newly born ones by tagging mothers and their new borne babies to prevent mismatching later [3]. In the past, there have been several obstacles that have kept RFID from gaining full acceptance in consumer applications as well as in enterprises. Some of these obstacles included tag reader sensitivity, RF transmission distance, and the high cost of implementing RFID. It was observed that the end users feedback played an extremely important role in finding these obstacles and to some extent removing them [5]. Conceptual mapping is a structured conceptualization technique used to stimulate the generation of ideas. More often concept maps are used to communicate complex ideas. For example, it combines

group processes with a sequence of multivariate statistical analysis in multidisciplinary research teams (Maize, Soya beans and Swine) investigating market opportunities within the Global food system [2].

II USER PARTICIPATION IN RFID SYSTEMS

User participation becomes obvious in a world where day to day objects like garments, food and home appliances and so on carry RFID tags. By exploiting RFID tags, home appliances could operate in more sophisticated ways [6]. Some of these ways are very much suggested by users of these products like your refrigerator might warn you when a particular item in it has been expired and so on. Thus user needs may lead to creative innovations and of course may lead to improvements in the existing system. Hence user centered design demands for user engagement in the various design processes, ranging across the wide spectrum of requirement analysis to the working model with desired functionalities.

RFID are mostly used at Wall Mart Stores and Department of Defense. They demand from the supplier that goods should be attached with RFID tags so that they can uniquely identify and trace the goods when required. If some problem occurs with the quality then they can easily trace out the batch number, supplier and even the precise assembly line which held that flaw. The problems of tag reader sensitivity, RF transmission distances, high cost etc. discourages both customers and suppliers to adopt the RFID technology to a larger extent in spite of lucrative offers provided by the technology. The main focus of the paper is on describing these problems from the user's perspective and proposing their corresponding solutions. Since a picture is worth thousand words, concept maps have been used to communicate the idea.

II PROBLEMS AND SOLUTIONS

(a) Problem 1: Tag Reader Sensitivity

The RFID tag has no fixed location for pasting it on goods package. Hence a problem in determining where the tag is located relative to the RFID reader device. So if the RFID tag is not present in the main lobe of the Tag reader, then it can not be sensed by the reader or vice-versa. This problem is known as reader sensitivity. This is due to the fact that the antenna of tag reader or RFID tag itself comes in the dead zone. Also, since the RFID signal is not in the visible range of the user, the problem becomes more critical. The temporary solution suggested by the user is to rotate the goods, so that both the antennas should come out of the dead zone. But this leads to the inconvenience faced by the user in rotating the goods and especially the heavy ones. For example, when a user purchases a heavy item like a 20 kg floor packet and the RFID tag reader antenna comes in the dead zone of the RFID tag antenna, then it is not readable by the RFID Reader. Then it becomes difficult for the user to rotate the packet, so that it gets scanned by the RFID reader. Similarly the situations may become worse when we talk of more heavy and unmanageable items.

Solution: These reader sensitivity issues can be resolved by using a dual dipole antenna in the RFID Tag. These antenna are placed such that one signal transmitted by one antenna will overcome the dead zone for the other antenna. It will enhance the use of RFID for a broader range of applications making life of the user a little more convenient. The idea is being illustrated with the help of the concept map.

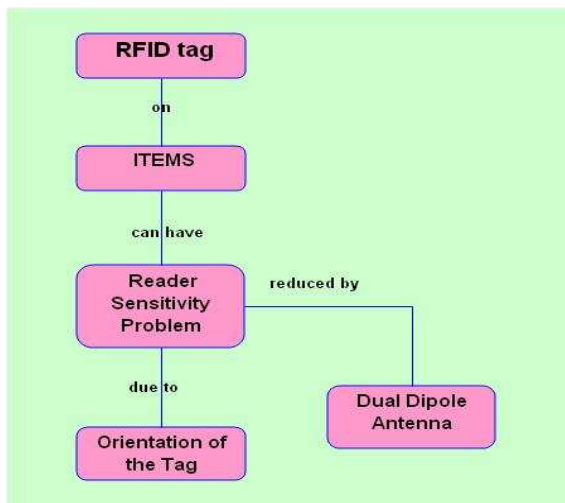


Figure 1: RFID Tag Reader Sensitivity Resolving Model

(b) Problem 2: RF Transmission Distance

There are two types of RFID tags Active and Passive. The problem associated with the users of both kinds of tags is with their transmission range. Their transmission ranges are very small. Mostly EPC class 4 type tags are used which have a very small transmission range capability [8]. The problems associated with it are many. For example, consider a big mall or showroom where each of the items is RFID Tagged and the customer wants to trace the goods with the help of sales person and sales person does not know the exact location of that product. Then he comes near to the tag reader, sends query signals to all RFID tags, receives acknowledgement and tries to find the location. But due to limited range capability of the RFID tag, he fails to locate it. One solution of the above problem is that he should have mobile tag reader, so that he walks and try to find the location of the product.

This problem of tracking goods which are kept at long distances is enhanced when a user of RFID wants to track a valuable entity like car, etc. For example, suppose user handed over the car to the parking staff to park the car in a highly crowded parking lot spreaded in big area. By the time user wants to get back to the car, then parking staff takes a lot of time to search it. Now, if the car were holding an RFID tag of higher range transmission capability, then it can be easily located with RFID Reader. When a user is interested in tracking mobile items, with existing RFID tag then the problem becomes even worse due to its limited range capability. A recent study says that 30% cars, laptops and mobiles are stolen every year. In most of the cases they are not traced at all and even if traced then also it becomes difficult for the police to find the actual owner of that item.

Solution: Noticing the above problem it is concluded that there is requirement of the RFID tag with the various range capabilities. The one solution is that we should have RFID tag with having a varying range capability. The designing of such RFID tags is highly complex and uneconomical. Another approach is that we can have separate RFID tags for the various range capability, so according to the need user can select it. For short range communication between RFID tag and RFID reader, RFID tags with HF waves are used. For medium range communication, RFID tags with UHF wave are required. Similarly for long distance (in few kilometers) communication, microwave can be used and more than that SAW can be used. The advantage of using SAW is that its signal does not deteriorate with the

environmental changes. This quality of the RFID tags with SAW can be utilized in the seizing the gray market, because missed or stolen things can be easily located by the owner or police even over long distances.

The proposed idea is illustrated with the help of concept map.

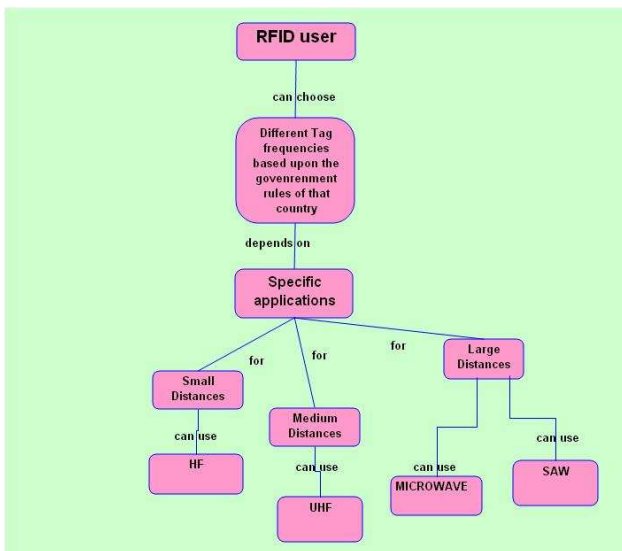


Figure 2: RFID Long Transmission Distance Model

(c) Problem 3: High RFID Cost

A recent study shows that the biggest users of RFID technology Wal-mart Stores and department of defense feel that the RFID cost is still a primary reason that RFID hasn't become common place [7]. A solution to this is to increase the manufacturing of the number of tags so that the cost should come down. But it further leads to upgrading the existing infrastructure to support RFID such as storage devices, new methods for searching database etc. To be precise, an RFID infrastructure needs a number of elements apart from the RFID Tag and Reader which includes additional servers, databases, middleware and applications. Further, the middleware and application layers need to support number of critical components such as device management, data collection data management and integration with the back-end system, collaboration with partners and customers and integration with data synchronization networks. And a result of doing all this will further increase cost and Risk.

Solution: The proposed solution is inspired by those products which are a part of daily needs of consumers,

precisely, with small life span and disposable packets (with pasted RFID Tags) such as milk carton. After selling such products there is no need to store information for a long time in the RFID database, since it leads to unnecessary overloading of the information in the database, causing a penalty in terms of searching time for other items. Therefore, one of the possible solutions to reduce the cost factor in RFID systems is Tag recycling which includes reprogramming of the RFID chip and updating the database entries. This should be implemented with proper instructions being issued to the customers and if special bonus schemes are incorporated, this idea can work wonders. The empty goods packet containing RFID Tags should be collected by the customers and sold to RFID street vendors (to be introduced in the system) which further are sent for reuse. The advantage of this idea is that there will be no need to increase in the production rate of the tags and existing RFID infrastructure. Hence, this can bring cost of RFID tags considerably down without inducing risky complexities in the RFID systems.

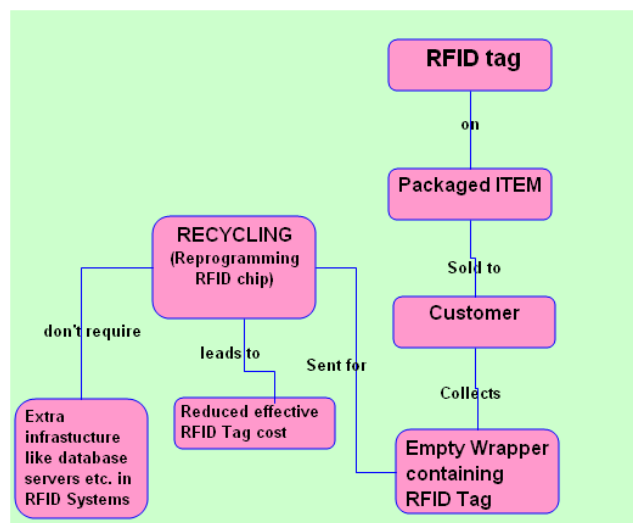


Figure 3: RFID Cost Reduction Model

III CONCLUSION

Recent research shows that user-centered design approach leads to great innovations in the existing systems. In the case of RFID systems also it has been observed that problem faced by the user works as catalyst in incorporating improvements. The advantage of using concept maps made the design procedure simple to illustrate and cost effective.

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ENHANCEMENT OF ORGANIZATIONAL COMPETITIVENESS THROUGH INNOVATIVE HUMAN RESOURCE PRACTICES: A CASE STUDY ON ROURKELA STEEL PLANT, ROURKELA, ODISHA, INDIA

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Abstract—An effective Management of Human Resources has an important role to play in the performance and success of organizations. In the present business environment, Human Resource is an important input for organizational effectiveness. Competitive pressures have encouraged organizations to be proactive in diagnosing HR practices since these were no longer a matter of trend, but rather of survival. The present study attempts to explore the relationship of three dimensions of innovative Human Resource practices: That is, the extent of introduction of Innovative HR Practices, their importance for organizational goal achievement and satisfaction with implementation of innovative HR Practices with organizational commitment. The present study examines the relationship between human resource practices, trust, job satisfaction, organizational citizenship behaviour organizational commitment, motivation and perceived organizational performance, namely respondent's perceptions of service quality, value for money and organizational effectiveness. Innovative HR practices build competencies and capabilities for superior and winning performances today and simultaneously create long term fertility for innovation of business ideas and strategies for future.

I INTRODUCTION

Innovative Human Resource (HR) Practices build up competencies and capabilities for performance of today to create long term investment for innovation of business ideas and strategies for the future. Work behaviour which goes beyond the reach of organizational measures of job performance holds assurance for long term organizational success because there types of action are to improve organizational. Efficiency and effectiveness. According to Katz and Khan 1978, employees who go extra mile by performing spontaneous behaviours which goes beyond their role prescriptions are valued by the management. This phenomenon is critical for organization

effectiveness. It is because managers cannot foresee all contingencies or fully anticipates the activities which they desire from the performance from the employees. The present study investigates the effects of HR practices and leadership styles on organizational commitment and citizenship behaviors. HR practices are more important than leadership style in predicting organizational commitment of valued Human Capital.

II SAMPLE DATA COLLECT

The sample of the present study is based on convenience sampling method and consists of 150 employees of RSP belonging to all the levels in the organization.

Primary data was collected through questionnaires, observations as well as interviews in the present study.

The following variables were identified for analyzing in the organization.

- a. Values
- b. Shared Vision
- c. Performance Appraisal
- d. Training & Education
- e. Career Development
- f. Responsive To Change
- g. Welfare
- h. Structural Flexibility (Adoptiveness)
- i. Service Orientation
- j. Ethnicity
- k. Reward system
- l. Motivation
- m. Empowerment
- n. Output/Excellence Orientation
- o. communication
- p. Team Work
- q. Role Clarity
- r. Mutual Support
- s. Shared Goals/Objectives
- t. Sociability

The questionnaires were specially designed by the researcher who gains inside into the various dimensions in the organization. The questionnaire was administered to managers, supervisors and workers as well. Respondents were asked to indicate against each question the extent to which they agree or disagree with the statement describing a particular dimension, on a 5-point scale. The responses were assigned values ranging from 1 to 5 where one referred to strong agreement and 5 to disagreement. Nearly 220 questionnaires were circulated despite persuasion only 150 responses were received back.

III SHARED VISION ANALYSIS OF DATA

(a) Shared Vision

The questionnaire contained a query whether the employees are aware of the vision and mission of the company in reply to which about 55.3% of Rourkela Steel Plant employees clearly agreed that they are

Organiz ation	Stron gly Agre e	A gr ee	Ag ree to So me Ext ent	Dis agre e	Stron gly Disa gree	Total	
R SP	Frequen cy	29	63	52	10	07	161
	Perccent age	18	39.1	32.3	6.2	4.3	100.0

Table 1: Shared Vision

aware of the vision and mission of their respective companies. A substantial 33.5% of Rourkela Steel Plant employees agreed only to some extent about such awareness whereas about 10% stated that they are not aware about the vision and mission of Rourkela Steel Plant.

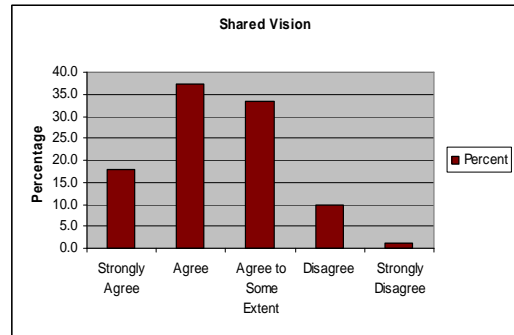


Figure 1: Shared Vision

(b) Performance Appraisal

In any organization there need to be a good performance appraisal system which is regular and impartial to be able to correctly assess the performance of its employees. It is not only essential that the performance of the employees appraised by the superiors but also by their peers, internal/external customers as well as superiors. Also, the system needs to be totally transparent one so that the motivation of the worker is not adversely affected on this count.

About 28% of Rourkela Steel Plant employees feel that performance appraisal system is transparent in their company and about 39% stating that there is no transparent performance appraisal system at Rourkela Steel Plant.

(c) Training and Education

Human Resource Development should be a continuous process in any organization and to achieve best it is

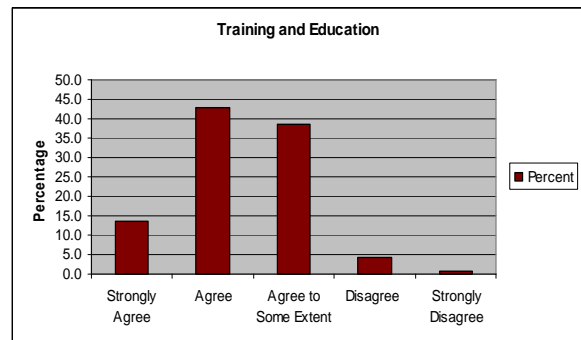


Figure 2: Training and Education

necessary that performance appraisal is used for employees training and development purposes. Also,

adequate preparation should be made in terms of education and training, more important, before any change in the programmed is introduced. Education and skill training should form a part of on going activity of the company with a long term vision for developing a qualified and competent workforce 56.6% employees agree that education and skill training is an ongoing activity in the company and forms part of a long term vision for developing a qualified and competent workforce. About 39% of employees agreed to this only to some extent.

(d) CAREER DEVELOPMENT

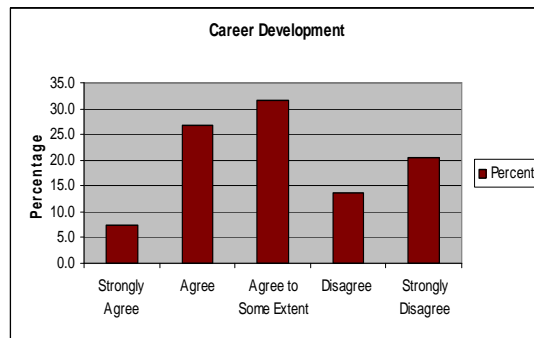
Organisation		Strongly Agree	Agree	Agree to Some Extent	Disagree	Strongly Disagree	Total
RSP	Frequency	30	51	42	21	17	161
	Percentage	18.6	31.7	26.1	13.0	10.6	100.0

Every employee attaches a lot of importance not only on the job he performs but also the prospect of having a sequence of good position and/or promotion during the course of his lifetime. The talents and abilities, motives and needs, attitudes and values, guide an employee’s career prospects besides the external factor. The organization plans on a regular basis for career development of its employees. About 34% of employees feel that their organization has plans for their career development and the approximately same percentage of employees feel that there is no such plan of Rourkela Steel Plant in place.

(e) Reward System

A well chalked out rewards system in an organization encourages co-operative efforts of the employees. When an employee is rewarded with promotion, pay raises and other form of recognition for his selfless contribution to the team, like sharing in crucial information with his team mates, helping resolve team conflicts and mastering new skills, the rest of the

employees are also encouraged to contribute in a similar manner in the process and developed a positive and responsive work culture. Majority of the employees of the plant (57.1%) agreed that employee suggestions are acted upon expeditiously and contributions rewarded promptly, whereas 32.3% of employees agreed to some extent.



Figurer No 3: Career Development

(f) Motivation

Motivation is the maintaining interest and efficiency of an employee. The degree of motivation is reflected in the amount of intrinsic satisfaction drawn from the work performed, the commitment to work and the loyalty to the job. A well designed motivational strategy of the organization that recognizes the diverse motivational requirements of professional and non-professionals by way of recognizing individual differences using goals and feedback system, participative decisions making, performance oriented reward system etc. may work wonders for developing a work culture.

Over 50.3% of Rourkela Steel Plant employees agree that good work by employees is always recognized by the management of the organization. Whereas 23.6% of the employees feel that good work is not recognized by the management.

IV CONCLUSION

Studies of liberalization and de-regulation in an emerging context are rare. Within this context, this study examined the relationship between innovative HR practices during the liberalization of one of the world's most populous emerging markets. A model,

rooted in conventional Western practices, found support and is largely consistent with results obtained in studies of HRM-firm performance conducted in different cultural and institutional environment. A contribution of the present study is to corroborate these results in the context of India's economic liberalization. The data analyzed were perceptively and measured HR practices within the organization in 2002 and also "5 years earlier" by a multi-rater respondent survey in a country undergoing macro-economic change process, so these results are highly relevant. The study contributes and adds to the general theme of HR-firm performance within an emerging market. The study adds to the literature of universalistic or the "best practice" perspective that certain independent-dependent variable relationships hold across whole populations of organizations - that is, some HR practices are better or more important than others (Colbert, 2004; Miles and Snow, 1984; Pfeffer, 1998) and these strategic (in this study "innovative") HR practices consistently lead to higher organizational performance, more dependent on the environment (Delery and Doty, 1996). The results add to the growing empirical evidence that people are key to achieving superior Performance.

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AN ARCHITECTURE FOR REALIZING TRANSMISSION FOR 2×2 MIMO CHANNEL

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Abstract- *The idea of using multiple receive and multiple transmit antennas has emerged as one of the most significant technical breakthroughs in modern wireless communications. Theoretical studies and initial prototyping of these MIMO systems have shown order of magnitude spectral efficiency improvements in communications. As a result, MIMO is considered a key technology for improving the throughput of future wireless broadband data systems MIMO is the use of multiple antennas at both the transmitter and receiver to improve communication performance. It is one of several forms of smart antenna technology. MIMO technology has attracted attention in wireless communications, because it offers significant increases in data throughput and link range without requiring additional bandwidth or transmit power. This is achieved by higher spectral efficiency and link reliability or diversity (reduced fading). Spatial multiplexing is a transmission technique in MIMO wireless communication to transmit independent and separately encoded data signals, so called streams, from each of the multiple transmit antennas. Therefore, the space dimension is reused, or multiplexed, more than one time. What mainly makes MIMO systems interesting is their potential ability to achieve an increase in system capacity or in link reliability without requiring additional transmission power or bandwidth (Goldsmith, 2005). In this paper, we focus on different receivers for 2x2 MIMO channel*

Keywords- *MIMO systems, wireless communications, Spatial multiplexing.*

I INTRODUCTION

(a) Spatial multiplexing

Spatial multiplexing is a transmission technique in MIMO wireless communication to transmit independent and separately encoded data signals, so-called *streams*, from each of the multiple transmit antennas. Therefore, the space dimension is reused, or multiplexed, more than one time. If the transmitter is equipped with N_t antennas and the receiver has N_r antennas, the maximum spatial multiplexing order (the number of streams) is

$$N_s = \min(N_t, N_r)$$

if a linear receiver is used. This means that N_s streams can be transmitted in parallel, ideally leading to an N_s increase of the spectral efficiency (the number of bits per second and per Hz that can be transmitted over the wireless channel). The practical multiplexing gain can be limited by spatial correlation, which means that some of the parallel streams may have very weak channel gains.

In the SM strategy (Tse & Viswanath, 2006), a single symbol stream is first demultiplexed and encoded into two separate and independent substreams. Each substream is then transmitted simultaneously over each transmit antenna and, at the receiver, an optimal joint decoder is employed for retrieving the original symbol stream. Since this strategy requires one single symbol stream, it can only be used for the transmission of a SD representation of the source.

(b) Types of MIMO

- **Space Time Transmit Diversity (STTD)** - The same data is coded and transmitted through different antennas, which effectively doubles the power in the channel. This improves Signal Noise Ratio (SNR) for cell edge performance.
- **Spatial Multiplexing (SM)** - the “Secret Sauce” of MIMO. SM delivers parallel streams of data to CPE by exploiting multi-path. It can double (2x2 MIMO) or quadruple (4x4) capacity and throughput. SM gives higher capacity when RF conditions are favorable and users are closer to the BTS.
- **Uplink Collaborative MIMO Link** - Leverages conventional single Power Amplifier (PA) at device. Two devices can collaboratively transmit on the same sub-channel which can also double uplink capacity.

(c) Benefits of MIMO Technology

MIMO channels provide a number of advantages over conventional SISO channels such as the array gain, the diversity gain, and the multiplexing gain. While the array and diversity gains are not exclusive of MIMO channels and also exist in single-input multiple-output (SIMO) and multiple-

input single-output (MISO) channels, the multiplexing gain is a unique characteristic of MIMO channels. These gains are described in brief below.

(d) Array Gain

Array gain denotes the improvement in receive signal-to-noise ratio (SNR) that results from a coherent combining effect of the information signals. The coherent combining may be realized through spatial processing at the receive antenna array and/or spatial pre-processing at the transmit antenna array. Formally, the array gain characterizes the horizontal shift of the error probability versus transmitted or received power curve (in a log-log scale), due to the gain in SNR.

(e) Spatial Diversity Gain

Diversity gain is the improvement in link reliability obtained by receiving replicas of the information signal through (ideally independent) fading links. With an increasing number of independent copies, the probability that at least one of the signals is not experiencing a deep fade increases, thereby improving the quality and reliability of reception. A MIMO channel with n_T transmit and n_R receive antennas offers potentially $n_T n_R$ independently fading links and, hence, a spatial diversity order of $n_T n_R$. Formally, the diversity gain characterizes the slope of the error probability versus transmitted or received power curve (in a log-log scale) in the high-SNR regime.

(g) Spatial Multiplexing Gain

MIMO systems offer a linear increase in data rate through spatial multiplexing, i.e., transmitting multiple, independent data streams within the bandwidth of operation. Under suitable channel conditions, such as rich scattering in the environment, the receiver can separate the data streams. Furthermore, each data stream experiences at least the same channel quality that would be experienced by a SISO system, effectively enhancing the capacity by a multiplicative factor equal to the number of substreams. In general, the number of data streams that can be reliably supported by a MIMO channel coincides with the minimum of the number of transmit antennas n_T and the number of receive antennas n_R , $\min\{n_T; n_R\}$.

II LITERATURE REVIEW

Because of its extraordinary increase in data throughput and link reliability without expending additional bandwidth and transmit power, MIMO systems have attracted a wide research

attentions in wireless communications since the last decade. Some of the researches conducted on the area of MIMO systems are reviewed below.

The first breakthrough to MIMO systems was made by Gerard J. Foschini and M. J. Gant in [1], where they used information theoretic approach to investigate the ultimate limits of the spectral efficiency achievable when using MIMO systems. Besides, they have hinted the need of inventing a new MIMO detection scheme to realize a hefty portion of the great capacity promised.

In [2], Gerard J. Foschini showed that enormous spectral efficiency up to 42 bps/Hz can be achieved when using MIMO systems with 8 antennas both at the transmitter and receiver, which is more than 40 times that of the SISO systems. However, he used D,BLAST (diagonal_BLAST) architecture which suffers from certain implementation complexities which make it inappropriate to realize in hardware.

P. W. Wolkiensky et al in [3] introduced V_BLAST (Vertical BLAST) which uses ordered successive interference cancellation (OSIC) as MIMO detection technique. In their laboratory test bed, they achieved spectral efficiency up to 40 bps/Hz at practical SNRs.

In [4, 5] the Zero Forcing (ZF) based V_BLAST of [3] was extended to MMSE based V_BLAST to improve system performance. However, the main drawback of MMSE V_BLAST is that it requires accurate estimate of the noise level in the system which is practically difficult to obtain. In [4] D. W. Benn et al obtained the same performance as MMSE V_BLAST using MMSE_SQRD which has lower complexity compared to MMSE V_BLAST. This also requires knowledge of statistical information of noise level within a system to maintain high performance.

The work of A. V. Zelst in [5] revised the above MIMO detection schemes and compared the performance results of these schemes with the Maximum Likelihood Detection (MLD) scheme. In this paper it was shown that MLD outperforms the other detection methods. Furthermore, the performances of these detection algorithms for broadband MIMO systems were analyzed in [7] where OFDM is coupled with MIMO systems to combat the ISI resulting from high data rate. In either case, the performance of the traditional MIMO detection schemes is far inferior to that of maximum likelihood detection method especially for higher MIMO sizes. However, the MLD scheme has a complexity which increases exponentially with the number of antennas and/or the constellation orders. Moreover, the performances of the traditional MIMO detection schemes deteriorates under ill-conditioned channels resulting from spatial correlations and

fall below acceptable threshold for certain applications requiring significant transmission accuracy [19].

The works reported in [8, 10] try to reduce the complexity of MLD by using approximations, but the complexity reduction they achieved is not satisfactory for higher modulation orders and large MIMO sizes. Sphere decoding algorithms introduced in [8,9,10] are the state_of_the art MIMO detection techniques which can substitute the MLD algorithm. These algorithms use iterative search based on a tree structure, either breadth first search or depth first search, to perform MIMO signal detection. In [8] B. Hassibi and H. Vikalo used sphere decoding to obtain MLD performance and Low Complexity MIMO_OFDM Receivers For Achieving Near Optimal Performance 5 reported that SDAs have, in general, variable complexity under different channel conditions and SNRs and hence, have variable computational throughput.

There are a lot of works done to improve the performance of k , best SD with negligible additional complexity as in [12,13]. In general, the performance of the k , best SD is poor especially when the k value is small. Even though there are plenty of works done in the literature to reduce the complexity and/or improve the performance of the two SD schemes separately, little attention has been paid to the combination schemes which can take the advantage of both schemes. To this end, authors in [15] introduced staggered SD where the search is simultaneously performed along the depth and breadth of the tree. However, this requires a number of independent processing units to perform the search along the different dimensions of the tree. Nevertheless, they claimed that they achieved better throughput than the pure depth first SD.

In [16], H. L. Chiang and S. G. Chen, incorporated DF SD into k , best SD to reduce its complexity. They also used MMSE, SQRD based layer reordering and obtained performance similar to the layer reordered k , best SD with reduced complexity. However, they used S, E enumeration of [6], which requires specific ordering of the tree branches according to their distance. In this thesis, the hybrid SD scheme, which collects the desirable features of the two SDAs, k , best and DF SDAs, is proposed to achieve performance very close to that of MLD. Moreover, initial radius setting technique, which can reduce the complexity without using any enumeration technique, is introduced.

III METHODOLOGY

In this paper we simulated the algorithms of the receivers for 2x2 MIMO channel using MATLAB.

Transmission for 2x2 MIMO channel

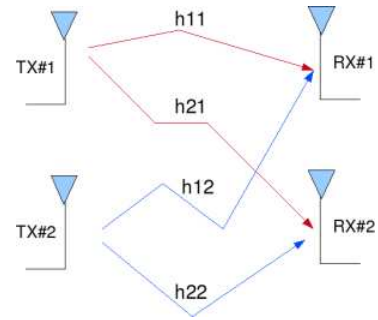


Figure 1: Transmit 2 receive MIMO channel

In a 2x2 MIMO channel, probable usage of the available 2 transmit antennas can be as follows:

- Consider that we have a transmission sequence, for example $X_1, X_2, X_3, \dots, X_n$
- In normal transmission, we will be sending X_1 in the first time slot, X_2 in the second time slot, X_3 and so on.
- However, as we now have 2 transmit antennas, we may group the symbols into groups of two. In the first time slot, send X_1 and X_2 from the first and second antenna. In second time slot, send X_3 and X_4 from the first and second antenna, send X_5 and X_6 in the third time slot and so on.
- we are grouping two symbols and sending them in one time slot, we need only $n/2$ time slots to complete the transmission
- This forms the simple explanation of a probable MIMO transmission scheme with 2 transmit antennas and 2 receive antennas.

IV IVRESULT AND DISCUSSION

There a multiple transmit antennas and multiple receive antennas resulting in the formation of a Multiple Input Multiple Output (MIMO) channel. In our paper, We will restrict my discussion to a 2 transmit 2 receive antenna case (resulting in a 2x2 MIMO channel). We will assume that the channel is a flat fading Rayleigh multipath channel and the modulation is BPSK. In this paper I have discussed six receivers for 2X2 MIMO channels and simulated the result using MATLAB.

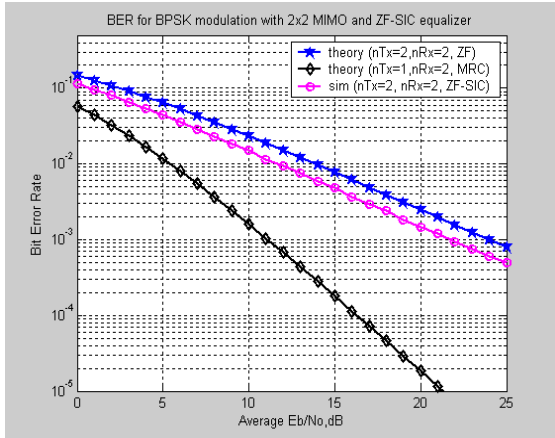


Figure 1: MIMO with Zero Forcing Successive Interference Cancellation equalizer

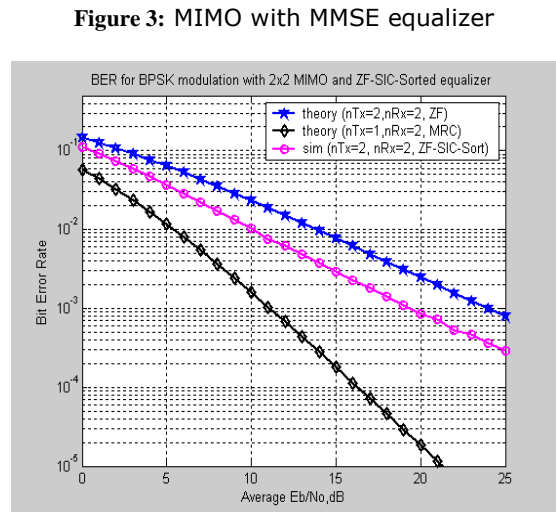


Figure 3: MIMO with MMSE equalizer

Figure 4: MIMO with ZF SIC and optimal ordering

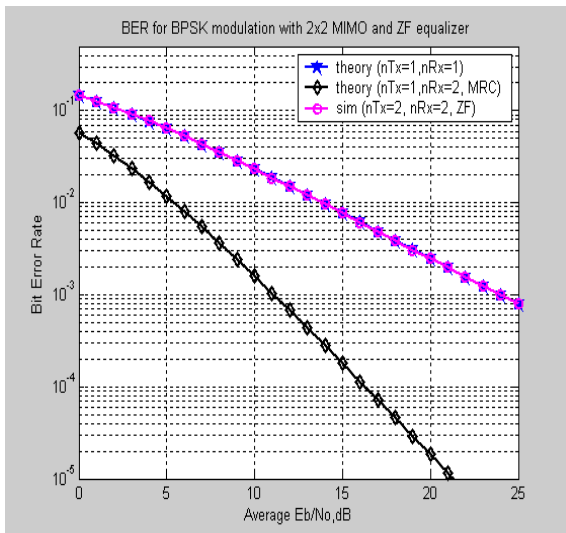


Figure 2: MIMO with Zero Forcing equalizer

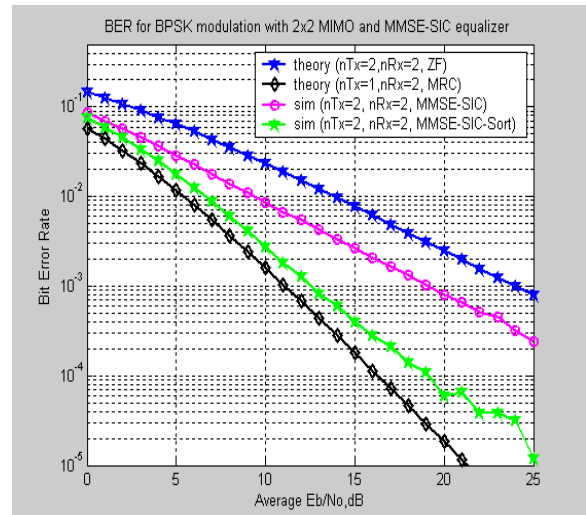


Figure 5: MIMO with MMSE SIC and optimal ordering

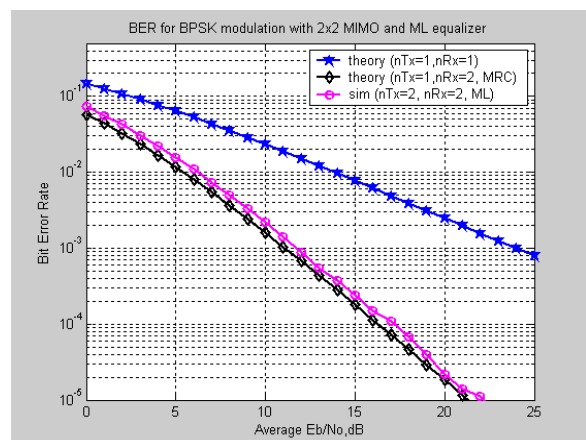
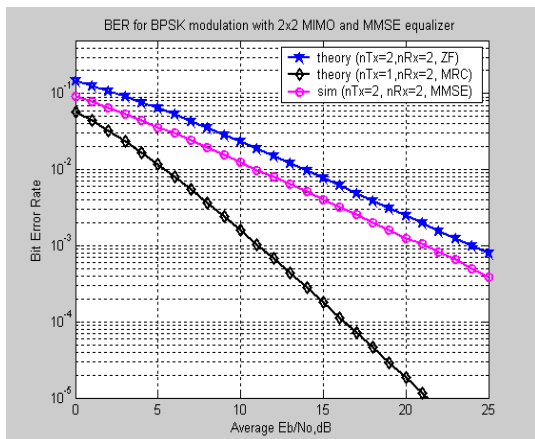


Figure 6: MIMO with ML equalization

V CONCLUSION

Several different diversity modes are used to make radio communications more robust, even with varying channels. These include time diversity (different timeslots and channel coding), frequency diversity (different channels, spread spectrum, and OFDM), and also spatial diversity. Spatial diversity requires the use of multiple antennas at the transmitter or the receiver end. Multiple antenna systems are typically known as Multiple Input, Multiple Output systems (MIMO). Multiple antenna technology can also be used to increase the data rate (spatial multiplexing) instead of improving robustness. In future, we can make a single integrated circuit that uses both methods combination.

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SOLVENT FREE SYNTHESIS OF SOME 4-OXO-THIAZOLIDINE DERIVATIVES OF PHENOTHIAZINE

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Abstract- A new series of *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(substituted phenyl)-4-oxo-5-[(substituted phenyl)methylidene]-1-iminothiazolidine, compounds 5(a-m) have been synthesized by microwave method. The cycloaddition reaction of thioglycolic acid with *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(phenyl)methylidene]-hydrazine, compounds 3(a-m) in the presence of anhydrous ZnCl₂ afforded new heterocyclic compounds *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(phenyl)-4-oxo-1-iminothiazolidine, compounds 4(a-m). The later product on treatment with several selected substituted aromatic aldehydes in the presence of C₂H₅ONa undergoes Knoevenagel reaction to yield, compounds 5(a-m). The structure of compounds 1, 2, 3(a-m), 4(a-m) and 5(a-m) were confirmed by IR, ¹H NMR, ¹³C NMR, FAB-Mass and chemical analysis. Compounds 5(a-m) have been screened for their antimicrobial and antitubercular activities, displayed satisfactory results.

Keywords- Microwave synthesis, 4-oxo-thiazolidine, phenothiazine.

I INTRODUCTION

Phenothiazine derivatives possess a wide spectrum of pharmacological activity and are clinically used as antibiologic [1], antibacterial [2,3], histamine release [4], neuroleptic [5] etc. The successful application in chemotherapy of the phenothiazine derivatives has determined the orientation of our research in this field towards the synthesis of new potential pharmaceutically active products with non traditional way. Phenothiazines are well known as antioxidative [6], antipsychotic agent [7]. Apart from this traditional medical usage in recent years phenothiazine derivatives have also been found to possess antimycobacterium activities [8]. Thiazolidines are the new

All chemical shifts were reported on δ scale. The FAB-Mass spectra were recorded on a Jeol SX-102 mass spectrometer. Elemental analyses were performed on a Carlo Erba-1108 analyzer. Microwave irradiation was carried out in open glass vessel. Modified synthetic microwave oven (800W) was used for the synthesis of compounds. The experiments were carried

class of antimicrobial agent with activity against broad spectrum of gram positive pathogens. Thiazolidine moiety is key pharmacophore and intermediate for synthesizing pharmaceutically active compounds. Thiazolidine and its analogs constitute the active class of compounds possessing wide spectrum of biological activities, such as antifungal [9], antimicrobial [10], anticonvulsant [11], antibacterial activities [12,13]. Thiazolidines derivatives are well famous for their anti-inflammatory activities [14]. Inflammation remains a common and, all too often poorly controlled clinical problem which can be life threatening in extreme form of allergy, autoimmune diseases and rejection of transplanted organs. Our recent research work based on the synthesis of phenothiazine and thiazolidine ring in single frame, we have been synthesized a new series of compounds 5(a-m) showed in Scheme. The structure of compounds 1, 2, 3(a-m), 4(a-m) and 5(a-m) were confirmed by IR, ¹H NMR, ¹³C NMR, FAB-Mass and chemical analysis. Final products, compounds 5(a-m) were screened for their antimicrobial and antitubercular activities.

II MATERIALS AND METHODS

(a) Experimental

Melting points were taken in open glass capillaries tubes and are uncorrected. Progress of the reaction was monitored by silica gel-G coated TLC plates in MeOH: CHCl₃ system (1:9). The spot was visualized by exposing the plate in an iodine vapours chamber. IR spectra were recorded in KBr disc on a Shimadzu 8201 PC, FTIR spectrophotometer (ν_{max} in cm⁻¹) ¹H and ¹³C NMR spectra were measured on a Bruker DRX-300 spectrometer in CDCl₃ at 300 and 75MHz respectively using TMS as an internal standard out at atmospheric pressure in standard glassware with a reflux condenser fitted through the roof of the microwave cavity. A thermocouple was used to monitor the temperature inside the vessel of the microwave. The analytical data of all the compounds were found to satisfactory. For column chromatographic purification of the products, Merck silica Gel

60 (230-400 Mesh) was used. The reagent grade chemicals were purchased from the commercial sources and further purified before use.

(b) Method for the synthesis of compound 1.

A solid supported mixture of phenothiazine and 1-bromo-3-chloroethane (1:1 mole) was mixed thoroughly in open glass vessel and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 4.30 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH₃OH: CHCl₃ (1:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 1.

(c) Method for the synthesis of compound 2.

A solid supported mixture of compound 1 and hydrazine hydrate (1:1 mole) was mixed thoroughly in open glass vessel and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 3.45 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH₃OH: CHCl₃ (1:9) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 2.

(d) Method for the synthesis of compounds 3 (a-m).

A solid supported mixture of Compound 2 and selected substituted benzaldehyde (1:1 mole) was mixed thoroughly in open glass vessel in the presence of 2-3 drops of glacial acetic acid and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 3.30-4.30 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH₃OH: CHCl₃ (2:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 3(a-m). Method for the synthesis of compound 4(a-m).

A solid supported mixture of compounds 3(a-m) and thioglycolic acid (1:1 mole) was mixed thoroughly in open glass vessel in the presence of ZnCl₂ and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 4.00-4.30 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine

vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH₃OH: CHCl₃ (2:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 4(a-m).

(e) Method for the synthesis of compound 5(a-m).

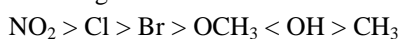
A solid supported mixture of compounds 4(a-m) and selected substituted benzaldehydes (1:1 mole) was mixed thoroughly in open glass vessel and subjected to the microwave irradiation at low power setting (25 %, 200 W) for 3.45-4.15 mins. The completion of reaction was monitored by silica gel-G coated TLC plate and visualized in the iodine vapors chamber. After the completion of the reaction, the reaction mixture was allowed to cool in an ice bath, filtered and the product was purified over a silica gel packed column chromatography using CH₃OH: CHCl₃ (2:8) solvent system. The product was recrystallized from ethanol at room temperature to yield compounds 5(a-m).

III RESULTS AND DISCUSSION

The reaction of 1-bromo-2-chloroethane with phenothiazine was carried out in the microwave irradiation to afford compound 1. The spectroscopic analyses of compound 1 showed absorption peaks for C-Cl at 770 cm⁻¹ in the IR spectrum. The IR spectrum confirms the formation of compound 1. This fact also supported by the disappearance of NH absorption of the phenothiazine in the IR spectrum at 3436 cm⁻¹. The compound 1 on the reaction with hydrazine hydrate yielded compound 2. In the spectroscopic analyses of compound 2, two absorption peaks found in IR spectrum for NH and NH₂ at 3340 and 3398 cm⁻¹ respectively while absorption of C-Cl has been disappeared. This fact was also supported by 1H and 13C NMR spectra because two signals appeared in the 1H NMR spectrum for NH and NH₂ at δ 8.53 and δ 5.59 ppm respectively. All the facts together were strong evidence for the synthesis of compound 2. Substituted benzaldehydes give the condensation reaction with compound 2 resulting the production of Schiff bases N=CH too k placed which was confirmed by IR, 1H NMR and 13C NMR spectra of compounds 3(a-m). In the IR spectra of compounds 3(a-m) absorption peaks found in the range of 1540-1580 cm⁻¹ while a strong signal appeared in the range of δ 8.56-8.94 and δ 152.7-159.8 ppm in the 1H NMR and 13C NMR spectra for N=CH of compounds 3(a-m) respectively. The facts also supported by the disappearance of the signal of NH₂ in the 1H NMR spectra. The compounds 3(a-m) on reaction with thioglycolic acid in the presence of ZnCl₂ gave the cycloaddition reaction and produced a five membered

thiazolidinone ring, compounds 4(a-m). The compounds 4(a-m) showed a characteristic absorption of the cyclic carbonyl group in the range of 1724-1759 cm⁻¹ in the IR spectra. The ¹H NMR spectra of compounds 4(a-m) aroused our attention and clearly indicate the presence of the active methylene group in the thiazolidine ring in the range of δ 3.39-3.69 ppm. The ¹³C NMR spectra of compounds 4(a-m) also supported the fact that cyclic carbonyl group present a signal appeared in the range of δ 170.5-177.5 ppm. These all fact also supported by the two evidences that are (a) disappearance of N=CH proton and (b) appearance of N-CH proton in the range of δ 5.11-5.21 ppm in the ¹H NMR spectra of compounds 4(a-m). The compounds 4(a-m) underwent the Knoevenagel condensation reaction with substituted benzaldehydes in the presence of C₂H₅ONa to afford compounds 5(a-m). In the ¹H NMR spectra of the compounds 5(a-m), we have found the disappearance of two methylene protons of compounds 4(a-m) and an appearance of a new signal for C=CH in the range of δ 6.42-6.79 ppm. In the ¹³C NMR spectra two new signals for C=CH and C=CH appeared in the range of δ 136.8-143.5 and δ 141.8-149.9 ppm respectively in the spectra of the compounds 5(a-m). These all above facts clearly confirmed the synthesis of all final products. Reaction time of compounds 3(a-m), 4(a-m) and 5(a-m) were given in Table 2.

The results of the all described activities (antibacterial, antifungal, and antitubercular) were summarized in Table 1. The results of the antimicrobial screening data revealed that all the compound 5(a-m) showed considerable and varied activity against the selected microorganism. A new series of N-[2-(10H-phenothiazinyl)ethyl]-2-(substituted phenyl)-4-oxo-5-[(substituted phenyl) methylidene]-1-iminothiazolidine, compounds 5(a-m) were prepared and screened for their antimicrobial and antitubercular activity data (as shown in Table 1) revealed that all the synthesized compound 5(a-m) have a structure activity relationship (SAR) because activity of compounds varies with substitution. Nitro group containing compounds (5h, 5i and 5j) showed higher activity than chloro (5c, 5d), or bromo group containing compounds (5e, 5f). Chloro and bromo derivatives also have higher activity than other rested compounds. On the basis of SAR, concluded that the activity of compounds depends on electron withdrawing nature of the substituted groups. The sequence of the activity is following



The investigation of antimicrobial (antibacterial, antifungal and antitubercular) data revealed that the compounds (5c), (5d), (5e), (5f), (5h), (5i) and (5j) displayed high activity in the series, the compounds (5b), (5g) and (5m) showed moderate activity and rest compounds showed less activity against all the strains compared with standard drugs.

- *1-(2-chloroethyl)-10H-phenothiazine (1)*

Yield: 71%, m.p. 162-163°C; Anal. Calcd for C₁₄H₁₂NSCl: C,64.23, H,4.62, N,5.35%; found C,64.20, H,4.60, N,5.32%; IR (cm⁻¹): 684 (C-S-C), 770 (C-Cl), 1551 (C=C), 2938, 3029 (CH); ¹H NMR (δ): 3.51 (t, 2H, J = 7.60 Hz, CH₂-Cl), 4.01 (t, 2H, J = 7.60 Hz, N-CH₂), 6.31-7.75 (m, 8H, Ar-H); ¹³C NMR: 46.4 (CH₂-Cl), 49.9 (N-CH₂), 116.3, 121.2, 124.6, 127.5, 138.4, 144.5 (Ar); Mass (FAB): 262M⁺.

- N-[2-(10H-phenothiazinyl)ethyl]-hydrazine (2)

Yield: 83%, m.p. 147-149°C; Anal. Calcd for C₁₄H₁₅N₃SCl: C,57.42, H,5.16, N,14.35%; found C,57.40, H,5.12, N,14.31%; IR: 1232 (C-N), 3340 (NH), 3398 (NH₂); ¹H NMR: 3.22 (m, 2H, CH₂-NH), 3.76 (t, 2H, J = 7.58 Hz, N-CH₂), 5.59 (s, NH₂), 8.53 (s, 1H, NH), 6.44-7.73 (m, 8H, Ar-H); ¹³C NMR: 478.2 (CH₂-NH), 50.9 (N-CH₂), 115.7, 122.3, 124.7, 133.1, 141.6, 148.6 (Ar); Mass (FAB): 299M⁺.

- N-[2-(10H-phenothiazinyl)ethyl]-N'-(phenyl)methylidene]-hydrazine (3a)

Yield: 74%, m.p. 148-150°C; Anal. Calcd for C₂₁H₁₉N₃S: C,73.01, H,5.54, N,12.16%; found C,72.98, H,5.50, N,12.11%; IR: 1540 (N=CH), 3355 (NH); ¹H NMR: 3.26 (m, 2H, CH₂-N), 3.78 (t, 2H, J = 7.60 Hz, N-CH₂), 8.48 (s, 1H, NH), 8.58 (s, 1H, N=CH), 6.60-8.21 (m, 13H, Ar-H); ¹³C NMR: 44.6 (CH₂-NH), 56.3 (N-CH₂), 153.7 (N=CH), 119.9, 123.6, 127.5, 128.2, 129.8, 130.3, 132.4, 135.2, 148.7, 152.5 (Ar); Mass (FAB): 345M⁺.

- N-[2-(10H-phenothiazinyl)ethyl]-N'-(4-chlorophenyl)methylidene]-hydrazine (3b)

Yield: 75%, m.p. 169-171°C; Anal. Calcd for C₂₁H₁₈N₃SCl: C,66.39, H,4.77, N,11.06%; found C,66.33, H,4.72, N,11.01%; IR: 741 (C-Cl), 1565 (N=CH), 3372 (NH); ¹H NMR: 3.56 (m, 2H, CH₂-NH), 3.96 (t, 2H, J = 7.65 Hz, N-CH₂), 8.47 (s, 1H, NH), 8.84 (s, 1H, N=CH), 6.79-8.15 (m, 12H, Ar-H); ¹³C NMR: 48.7 (CH₂-NH), 61.3 (N-CH₂), 158.6 (N=CH), 121.3, 126.6, 127.5, 129.8, 130.7, 132.5, 135.3, 138.3, 145.8, 148.5 (Ar); Mass (FAB): 380M⁺.

- N-[2-(10H-phenothiazinyl)ethyl]-N'-(3-chlorophenyl)methylidene]-hydrazine (3c)

Yield: 78%, m.p. 167-168°C; Anal. Calcd for C₂₁H₁₈N₃SCl: C,66.39, H,4.77, N,11.06%; found C,66.32, H,4.70, N,11.03%; IR: 745 (C-Cl), 1576 (N=CH), 3368 (NH); ¹H NMR: 3.63 (m, 2H, CH₂-NH), 3.90 (t, 2H, J = 7.65 Hz, N-CH₂), 8.38 (s, 1H, NH), 8.88 (s, 1H, N=CH), 6.74-8.16 (m, 12H, Ar-H); ¹³C NMR: 47.8 (CH₂-NH), 52.1 (N-CH₂), 157.9 (N=CH), 116.4, 119.2, 123.4, 124.8, 125.9, 127.3, 130, 132.4, 133.8, 135.1, 139, 147.1, (Ar); Mass (FAB): 380M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(2-chlorophenyl)methylidene]-hydrazine (3*d*)

Yield: 75%, m.p. 165-166°C; Anal. Calcd for C₂₁H₁₈N₃SCl: C,66.39, H,4.77, N,11.06%; found C,66.30, H,4.73, N,11.02%; IR: 749 (C-Cl), 1574 (N=CH), 3369 (NH); 1H NMR: 3.59 (m, 2H, CH₂-NH), 3.99 (t, 2H, J = 7.60 Hz, N-CH₂), 8.31 (s, 1H, NH), 8.87 (s, 1H, N=CH), 6.73-8.08 (m, 12H, Ar-H); 13C NMR: 48.3 (CH₂-NH), 59.3 (N-CH₂), 159.8 (N=CH), 112.4, 116, 120, 124.1, 126.4, 128, 130.5, 131, 134, 137.8, 141.2, 147.2 (Ar); Mass (FAB): 380M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(4-bromophenyl)methylidene]-hydrazine (3*e*)

Yield: 76%, m.p. 160-162°C; Anal. Calcd for C₂₁H₁₈N₃SBr: C,59.43, H,4.27, N,9.90%; found C,59.41, H,4.22, N,9.87%; IR: 636(C-Br), 1578 (N=CH), 3376 (NH); 1H NMR: 3.61 (m, 2H, CH₂-NH), 3.97 (t, 2H, J = 7.60 Hz, N-CH₂), 8.32 (s, 1H, NH), 8.83 (s, 1H, N=CH), 6.69-8.08 (m, 12H, Ar-H); 13C NMR: 48.8 (CH₂-N), 59.2 (N-CH₂), 159.8 (N=CH), 117.2, 124.5, 126.2, 127.4, 129.4, 133, 138.4, 140.3, 145.5, 150 (Ar); Mass (FAB): 424M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(3-bromophenyl)methylidene]-hydrazine (3*f*)

Yield: 73%, m.p. 161-163°C; Anal. Calcd for C₂₁H₁₈N₃SBr: C,59.43, H,4.27, N,9.90%; found C,59.40, H,4.25, N,9.85%; IR: 642 (C-Br), 1570 (N=CH), 3360 (NH); 1H NMR: 3.54 (m, 2H, CH₂-NH), 3.91 (t, 2H, J = 7.55 Hz, N-CH₂), 8.42 (s, 1H, NH), 8.79 (s, 1H, N=CH), 6.76-8.16 (m, 12H, Ar-H); 13C NMR: 49.2 (CH₂-N), 61.3 (N-CH₂), 156.6 (N=CH), 114.5, 119, 124.2, 126, 128.4, 129.3, 130.3, 134.2, 137.6, 140.1, 144.3, 151.1 (Ar); Mass (FAB): 424M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(2-bromophenyl)methylidene]-hydrazine (3*g*)

Yield: 72%, m.p. 161-162°C; Anal. Calcd for C₂₁H₁₈N₃SBr: C,59.43, H,4.27, N,9.90%; found C,59.48, H,4.35, N,9.84%; IR: 653 (C-Br), 1580 (N=CH), 3367 (NH); 1H NMR: 3.57 (m, 2H, CH₂-NH), 3.92 (t, 2H, J = 7.60 Hz, N-CH₂), 8.42 (s, 1H, NH), 8.78 (s, 1H, N=CH), 6.73-8.23 (m, 12H, Ar-H); 13C NMR: 47.3 (CH₂-NH), 58.2 (N-CH₂), 155.3 (N=CH), 112.4, 117.1, 121.7, 125.2, 127.5, 129, 133.3, 137.5, 142, 145.3, 149.1, 153 (Ar); Mass (FAB): 424M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(4-nitrophenyl)methylidene]-hydrazine (3*h*)

Yield: 76%, m.p. 169-170°C; Anal. Calcd for C₂₁H₁₈N₄SO₂: C,64.59, H,4.64, N,14.34%; found C,64.52, H,4.61, N,14.30%; IR: 844 (C-N), 3346 (NH), 1527 (N=O), 1558

(N=CH); 1H NMR: 3.55 (m, 2H, CH₂-NH), 3.98 (t, 2H, J = 7.55 Hz, N-CH₂), 8.45 (s, 1H, NH), 8.92 (s, 1H, N=CH), 6.74-8.19 (m, 12H, Ar-H); 13C NMR: 48.4 (CH₂-NH), 57.8 (N-CH₂), 158.7 (N=CH), 116, 119.4, 122.4, 124, 126.4, 132.5, 134.6, 137.5, 148.2, 153.1 (Ar); Mass (FAB): 390M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(3-nitrophenyl)methylidene]-hydrazine (3*i*)

Yield: 82%, m.p. 170-172°C; Anal. Calcd for C₂₁H₁₈N₄SO₂: C,64.59, H,4.64, N,14.34%; found C,64.52, H,4.62, N,14.31%; IR: 846 (C-N), 1542 (N=O), 1562 (N=CH), 3358 (NH); 1H NMR: 3.61 (m, 2H, CH₂-NH), 3.98 (t, 2H, J = 7.65 Hz, N-CH₂), 8.46 (s, 1H, NH), 8.94 (s, 1H, N=CH), 6.77-8.17 (m, 12H, Ar-H); 13C NMR: 46.6 (CH₂-NH), 59.8 (N-CH₂), 159.6 (N=CH), 114, 118, 121.4, 123.4, 126.2, 128, 130.3, 132.5, 137.2, 142, 145, 151 (Ar); Mass (FAB): 390M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(2-nitrophenyl)methylidene]-hydrazine (3*j*)

Yield: 81%, m.p. 168-169°C; Anal. Calcd for C₂₁H₁₈N₄SO₂: C,64.59, H,4.64, N,14.34%; found C,64.57, H,4.60, N,14.30%; IR: 848 (C-N), 1541 (N=O), 1564 (N=CH), 3354 (NH); 1H NMR: 3.56 (m, 2H, CH₂-NH), 4.01 (t, 2H, J = 7.60 Hz, N-CH₂), 8.38 (s, 1H, NH), 8.93 (s, 1H, N=CH), 6.85-8.22 (m, 12H, Ar-H); 13C NMR: 45.9 (CH₂-NH), 59.4 (N-CH₂), 158.7 (N=CH), 114.2, 118.3, 122, 124.6, 125.4, 127.5, 129.6, 132, 134.5, 138, 147.4, 152 (Ar); Mass (FAB): 390M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(4-methoxyphenyl)methylidene]-hydrazine (3*k*)

Yield: 75%, m.p. 158-160°C; Anal. Calcd for C₂₂H₂₁N₃SO: C,70.37, H,5.63, N,11.19%; found C,70.32, H,5.61, N,11.17%; IR: 1542 (N=CH), 2940 (OCH₃), 3358 (NH); 1H NMR: 3.28 (m, 2H, CH₂-N), 3.63 (s, 3H, OCH₃), 3.82 (t, 2H, J = 7.65 Hz, N-CH₂), 8.32 (s, 1H, NH), 8.78 (s, 1H, N=CH), 6.65-7.98 (m, 12H, Ar-H); 13C NMR: 48.5 (CH₂-N), 53.6 (OCH₃), 54.7 (N-CH₂), 154.6 (N=CH), 110.1, 113.5, 116.5, 121, 124.2, 127, 134.4, 145.5, 154.5, 162 (Ar); Mass (FAB): 375M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(4-methylphenyl)methylidene]-hydrazine (3*l*)

Yield: 72%, m.p. 149-151°C; Anal. Calcd for C₂₂H₂₁N₃S: C,73.50, H,5.88, N,11.58%; found C,73.45, H,5.82, N,11.52%; IR: 1543 (N=CH), 2920 (CH₃), 3341 (NH); 1H NMR: 2.23 (s, 3H, CH₃), 3.17 (m, 2H, CH₂-N), 3.76 (t, 2H, J = 7.55 Hz, N-CH₂), 8.42 (s, 1H, NH), 8.78 (s, 1H, N=CH), 6.62-7.93 (m, 12H, Ar-H); 13C NMR: 26.8 (CH₃), 47.5 (N-CH₂), 53.8 (CH₂-N), 152.7 (N=CH), 115, 119.6, 121.5, 124.5,

127.8, 130.1, 132.7, 136, 138, 145.3 (Ar); Mass (FAB): 359M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-*N'*-[(4-hydroxyphenyl)methylidene]-hydrazine (3*m*)

Yield: 74%, m.p. 164-166°C; Anal. Calcd for C₂₁H₁₉N₃SO: C,69.77, H,5.29, N,11.62%; found C,69.72, H,5.24, N,11.60%; IR: 3354 (NH), 3474 (OH), 1556 (N=CH); ¹H NMR: 3.37 (m, 2H, CH₂-NH), 3.94 (t, 2H, J = 7.50 Hz, N-CH₂), 4.38 (s, 1H, OH), 8.45 (s, 1H, NH), 8.56 (s, 1H, N=CH), 6.52-7.92 (m, 12H, Ar-H); ¹³C NMR: 47.6 (CH₂-N), 56.3 (N-CH₂), 158.6 (N=CH), 111, 114.9, 118.4, 121.5, 124, 129.5, 133.4, 142.5, 148.6, 157.3 (18C,Ar); Mass (FAB): 361M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(phenyl)-4-oxo-1-iminothiazolidine (4*a*)

Yield: 74%, m.p. 154-156°C; Anal. Calcd for C₂₃H₂₁N₃S₂O: C,65.84, H,5.04, N,10.01%; found C,65.81, H,5.01, N,9.95%; IR: 688 (C-S-C), 1737 (CO cyclic); ¹H NMR: 3.29 (m, 2H, CH₂-N), 3.45 (s, 2H, S-CH₂), 3.82 (t, 2H, J = 7.60 Hz, N-CH₂), 5.17 (s, 1H, N-CH), 8.41 (s, 1H, NH), 6.55-7.96 (m, 12H, Ar-H); ¹³C NMR: 37.2 (S-CH₂), 45.3 (CH₂-NH), 57.5 (N-CH₂), 63.5 (N-CH), 172.5 (CO cyclic), 117.5, 120.5, 121.1, 122.6, 123.7, 124.5, 127.2, 131.2, 143.3, 152.5 (Ar); Mass (FAB): 419M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-chlorophenyl)-4-oxo-1-iminothiazolidine (4*b*)

Yield: 78%, m.p. 178-180°C; Anal. Calcd for C₂₃H₂₀N₃S₂OCl: C,60.84, H,4.44, N,9.25%; found C,60.82, H,4.41, N,9.20%; IR: 721 (C-S-C), 769 (C-Cl), 1759 (CO cyclic); ¹H NMR: 3.31 (m, 2H, CH₂-N), 3.62 (s, 2H, S-CH₂), 3.73 (t, 2H, J = 7.60 Hz, N-CH₂), 5.21 (s, 1H, N-CH), 8.45 (s, 1H, NH), 6.64-8.05 (m, 12H, Ar-H); ¹³C NMR: 41.3 (S-CH₂), 43.3 (CH₂-NH), 55.6 (N-CH₂), 64.4 (N-CH), 176.5 (CO cyclic), 118.4, 122.4, 125.7, 126.8, 128.4, 131.5, 136.6, 137.6, 147.8, 152.8 (Ar); Mass (FAB): 455M⁺

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(3-chlorophenyl)-4-oxo-1-iminothiazolidine (4*c*)

Yield: 79%, m.p. 176-177°C; Anal. Calcd for C₂₃H₂₀N₃S₂OCl: C,60.84, H,4.44, N,9.25%; found C,60.81, H,4.40, N,9.23%; IR: 728 (C-S-C), 759 (C-Cl) 1758 (CO cyclic); ¹H NMR: 3.35 (m, 2H, CH₂-N), 3.69 (s, 2H, S-CH₂), 3.78 (t, 2H, J = 7.60 Hz, N-CH₂), 5.17 (s, 1H, N-CH), 8.38 (s, 1H, NH), 6.72-8.13 (m, 12H, Ar-H); ¹³C NMR: 42.8 (S-CH₂), 44.6 (CH₂-NH), 56.3 (N-CH₂), 64.9 (N-CH), 177.5 (CO cyclic), 114.7, 119.3, 123.7, 124.2, 126.3, 128.7, 131.2, 134.5, 139.3, 143.6, 146.7, 149.4 (Ar); Mass (FAB): 455M⁺

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(2-chlorophenyl)-4-oxo-1-iminothiazolidine (4*d*)

Yield: 78%, m.p. 172-173°C; Anal. Calcd for C₂₃H₂₀N₃S₂OCl: C,60.84, H,4.44, N,9.25%; found C,60.83, H,4.39, N,9.17%; IR: 722 (C-S-C), 774 (C-Cl), 1750 (CO cyclic); ¹H NMR: 3.37 (m, 2H, CH₂-N), 3.64 (s, 2H, S-CH₂), 3.84 (t, 2H, J = 7.60 Hz, N-CH₂), 5.16 (s, 1H, N-CH), 8.36 (s, 1H, NH), 6.63-8.12 (m, 12H, Ar-H); ¹³C NMR: 41.9 (S-CH₂), 45.3 (CH₂-NH), 57.6 (N-CH₂), 64.6 (N-CH), 175.6 (CO cyclic), 118.4, 119.7, 123.3, 125.6, 128.5, 130.2, 132.7, 135.1, 138.7, 142.3, 148.8, 152.4 (Ar); Mass (FAB): 455M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-bromophenyl)-4-oxo-1-iminothiazolidine (4*e*)

Yield: 80%, m.p. 168-170°C; Anal. Calcd for C₂₃H₂₀N₃S₂OBr: C,55.42, H,4.04, N,8.42%; found C,55.39, H,4.01, N,8.35%; IR: 719 (C-S-C), 752 (C-Cl) 1750 (CO cyclic); ¹H NMR: 3.36 (m, 2H, CH₂-N), 3.68 (s, 2H, S-CH₂), 3.81 (t, 2H, J = 7.60 Hz, N-CH₂), 5.18 (s, 1H, N-CH), 8.42 (s, 1H, NH), 6.69-8.18 (m, 12H, Ar-H); ¹³C NMR: 40.6 (S-CH₂), 43.3 (CH₂-NH), 57.6 (N-CH₂), 65.6 (N-CH), 176.6 (CO cyclic), 112.3, 117.4, 121.5, 127.7, 128.5, 131.2, 134.6, 137.7, 143.6, 147.5 (Ar); Mass (FAB): 498M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(3-bromophenyl)-4-oxo-1-iminothiazolidine (4*f*)

Yield: 68%, m.p. 171-173°C; Anal. Calcd for C₂₃H₂₀N₃S₂OBr: C,55.42, H,4.04, N,8.42%; found C,55.36, H,3.97, N,8.38%; IR: 715 (C-S-C), 752 (C-Cl), 1742 (CO cyclic); ¹H NMR: 3.34 (m, 2H, CH₂-N), 3.69 (s, 2H, S-CH₂), 3.83 (t, 2H, J = 7.60 Hz, N-CH₂), 5.12 (s, 1H, N-CH), 8.43 (s, 1H, NH), 6.75-8.21 (m, 12H, Ar-H); ¹³C NMR: 39.9 (S-CH₂), 46.2 (CH₂-NH), 58.5 (N-CH₂), 64.7 (N-CH), 174.8 (CO cyclic), 116.3, 121.8, 122.7, 124.5, 126.8, 129.2, 130.4, 133.7, 138.1, 141.5, 149.2, 151.5 (Ar); Mass (FAB): 498M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(2-bromophenyl)-4-oxo-1-iminothiazolidine (4*g*)

Yield: 76%, m.p. 175-178°C; Anal. Calcd for C₂₃H₂₀N₃S₂OBr: C,55.42, H,4.04, N,8.42%; found C,55.37, H,3.98, N,8.36%; IR: 712 (C-S-C), 751 (C-Cl), 1742 (CO cyclic); ¹H NMR: 3.32 (m, 2H, CH₂-N), 3.54 (s, 2H, S-CH₂), 3.85 (t, 2H, J = 7.60 Hz, N-CH₂), 5.11 (s, 1H, N-CH), 8.39 (s, 1H, NH), 6.75-8.14 (m, 12H, Ar-H); ¹³C NMR: 41.2 (S-CH₂), 48.4 (CH₂-NH), 59.8 (N-CH₂), 65.7 (N-CH), 174.4 (CO cyclic), 112.2, 119.4, 122.3, 125.1, 128.2, 132.6, 134.7, 137.8, 139.6, 143.2, 148.8, 155.6 (Ar); Mass (FAB): 498M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-nitrophenyl)-4-oxo-1-iminothiazolidine (4*h*)

Yield: 80%, m.p. 174-176°C; Anal. Calcd for C₂₃H₂₀N₄S₂O₃: C,59.46, H,4.33, N,12.05%; found C,59.43, H,4.30, N,12.02%; IR: 698 (C-S-C), 878 (C-NO), 1546 (NO), 1740 (CO cyclic); 1H NMR: 3.41 (m, 2H, CH₂-N), 3.62 (s, 2H, S-CH₂), 3.92 (t, 2H, J = 7.60 Hz, N-CH₂), 5.19 (s, 1H, N-CH), 8.35 (s, 1H, NH), 6.59-8.14 (m, 12H, Ar-H); 13C NMR: 41.6 (S-CH₂), 48.6 (CH₂-NH), 57.5 (N-CH₂), 63.6 (N-CH), 175.7 (CO cyclic), 110.5, 114.5, 120.4, 123.7, 125.7, 129.3, 135.7, 140.2, 144.5, 154.7 (Ar); Mass (FAB): 465M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(3-nitrophenyl)-4-oxo-1-iminothiazolidine (4i)

Yield: 82%, m.p. 173-175°C; Anal. Calcd for C₂₃H₂₀N₄S₂O₃: C,59.46, H,4.33, N,12.05%; found C,59.42, H,4.28, N,12.00%; IR: 695 (C-S-C), 875 (C-NO), 1541 (NO), 1742 (CO cyclic); 1H NMR: 3.39 (m, 2H, CH₂-N), 3.64 (s, 2H, S-CH₂), 3.92 (t, 2H, J = 7.60 Hz, N-CH₂), 5.21 (s, 1H, N-CH), 8.40 (s, 1H, NH), 6.68-8.24 (m, 12H, Ar-H); 13C NMR: 42.6 (S-CH₂), 47.2 (CH₂-NH), 59.3 (N-CH₂), 63.8 (N-CH), 175.6 (CO cyclic), 116.3, 119.3, 123.2, 127.2, 130.2, 131.6, 132.8, 133.7, 136.5, 143.8, 148.1, 157.2 (Ar); Mass (FAB): 465M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(2-nitrophenyl)-4-oxo-1-iminothiazolidine (4j)

Yield: 81%, m.p. 172-173°C; Anal. Calcd for C₂₃H₂₀N₄S₂O₃: C,59.46, H,4.33, N,12.05%; found C,59.43, H,4.30, N,12.01%; IR: 692 (C-S-C), 862 (C-NO), 1538 (NO), 1742 (CO cyclic); 1H NMR: 3.40 (m, 2H, CH₂-N), 3.67 (s, 2H, S-CH₂), 3.88 (t, 2H, J = 7.60 Hz, N-CH₂), 5.18 (s, 1H, N-CH), 8.37 (s, 1H, NH), 6.67-8.26 (m, 12H, Ar-H); 13C NMR: 40.6 (S-CH₂), 46.3 (CH₂-NH), 58.7 (N-CH₂), 64.3 (N-CH), 174.6 (CO cyclic), 116.5, 120.3, 123.1, 126.2, 127.3, 131.5, 132.8, 136.5, 139.3, 142.5, 148.9, 152.4 (Ar); Mass (FAB): 465M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-methoxyphenyl)-4-oxo-1-iminothiazolidine (4k)

Yield: 76%, m.p. 168-170°C; Anal. Calcd for C₂₄H₂₃N₃S₂O₂: C,64.11, H,5.15, N,9.34%; found C,64.07, H,5.11, N,9.30%; IR: 681 (C-S-C), 1062 (C-O), 1724 (CO cyclic), 2962 (OCH₃); 1H NMR: 3.37 (m, 2H, CH₂-N), 3.42 (s, 2H, S-CH₂), 3.85 (t, 2H, J = 7.60 Hz, N-CH₂), 3.56 (s, 3H, OCH₃) 5.12 (s, 1H, N-CH), 8.34 (s, 1H, NH), 6.64-7.99 (m, 12H, Ar-H); 13C NMR: 40.9 (S-CH₂), 44.6 (CH₂-NH), 53.3 (N-CH₂), 56.5 (OCH₃), 62.5 (N-CH), 173.5 (CO cyclic), 112.7, 117.3, 125.2, 128.3, 130.8, 132.2, 136.5, 146.7, 154.2, 161.2 (Ar); Mass (FAB): 449M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-methylphenyl)-4-oxo-1-iminothiazolidine (4l)

Yield: 78%, m.p. 159-161°C; Anal. Calcd for C₂₄H₂₃N₃S₂O: C,66.48, H,5.34, N,9.69%; found C,66.43, H,5.31, N,9.65%; IR: 675 (C-S-C), 1738 (CO cyclic), 2890 (CH₃); 1H NMR: 2.32 (s, 3H, CH₃), 3.35 (m, 2H, CH₂-N), 3.39 (s, 2H, S-CH₂), 3.77 (t, 2H, J = 7.60 Hz, N-CH₂), 5.14 (s, 1H, N-CH), 8.32 (s, 1H, NH), 6.57-7.90 (m, 12H, Ar-H); 13C NMR: 25.5 (CH₃), 36.5 (S-CH₂), 44.3 (CH₂-NH), 56.5 (N-CH₂), 63.7 (N-CH), 170.5 (CO cyclic); 114.6, 119.5, 122.5, 125.7, 127.2, 131.6, 135.1, 138.3, 142.1, 148.2 (Ar); Mass (FAB): 434M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-hydroxyphenyl)-4-oxo-1-iminothiazolidine (4m)

Yield: 72%, m.p. 168-169°C; Anal. Calcd for C₂₃H₂₁N₃S₂O₂: C,63.42, H,5.85, N,9.64%; found C,63.38, H,5.80, N,9.59%; IR: 682 (C-S-C), 1750 (CO cyclic), 3494 (OH); 1H NMR: 3.29 (m, 2H, CH₂-N), 3.39 (s, 2H, S-CH₂), 3.83 (t, 2H, J = 7.60 Hz, N-CH₂), 4.37 (s, 1H, OH), 5.15 (s, 1H, N-CH), 8.42 (s, 1H, NH), 6.56-7.92 (m, 12H, Ar-H); 13C NMR: 43.6 (S-CH₂), 43.2 (CH₂-NH), 54.6 (N-CH₂), 65.3 (N-CH), 176.5 (CO cyclic), 112.7, 115.2, 119.1, 123.4, 126.9, 129.5, 133.2, 136.2, 141.2, 158.7 (Ar); Mass (FAB): 436M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(phenyl)-4-oxo-5-(phenyl)methylidene-1-iminothiazolidine (5a)

Yield: 70%, m.p. 144-146°C; Anal. Calcd for C₃₀H₂₅N₃S₂O: C,70.97, H,4.96, N,8.27%; found C,70.92, H,4.93, N,8.25%; IR: 1598 (C=C), 2985 (C=CH); 1H NMR: 3.34 (m, 2H, CH₂-N), 3.82 (t, 2H, J = 7.60 Hz, N-CH₂), 5.10 (s, 1H, N-CH), 6.42 (s, 1H, C=CH), 8.45 (s, 1H, NH), 6.76-8.05 (m, 18H, Ar-H); 13C NMR: 46.6 (CH₂-NH), 58.1 (N-CH₂), 64.3 (N-CH), 136.9 (C=CH), 141.8 (C=CH), 112.3, 115.8, 118.2, 122.3, 124.3, 125.7, 126.2, 129.1, 130.4, 132.2, 134.1, 135.2, 140.5, 147 (Ar); Mass (FAB): 508M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-chlorophenyl)-4-oxo-5-(4-chlorophenyl)methylidene-1-iminothiazolidine (5b)

Yield: 72%, m.p. 158-160°C; Anal. Calcd for C₃₀H₂₃N₃S₂OCl₂: C,62.49, H,4.02, N,7.28%; found C,62.45, H,3.92, N,7.26%; IR: 762 (C-Cl), 1631(C=C), 3016 (C=CH); 1H NMR: 3.39 (m, 2H, CH₂-N), 3.85 (t, 2H, J = 7.60 Hz, N-CH₂), 5.22 (s, 1H, N-CH), 6.79 (s, 1H, C=CH), 8.56 (s, 1H, NH), 6.58-8.15 (m, 16H, Ar-H); 13C NMR: 46.1 (CH₂-NH), 55.4 (N-CH₂), 66.7 (N-CH), 140.5 (C=CH), 147.8 (C=CH), 111.8, 112.6, 115.2, 116.6, 118.4, 119.1, 123.8, 126.2, , 129.1, 131.2, 133.2, 135.2, 137.5, 148.5 (Ar); Mass (FAB): 577M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(3-chlorophenyl)-4-oxo-5-(3-chlorophenyl)methylidene-1-iminothiazolidine (5c)

Yield: 76%, m.p. 154-156°C; Anal. Calcd for $C_{30}H_{23}N_3S_2OCl_2$: C,62.49, H,4.02, N,7.28%; found C,62.47, H,3.97, N,7.21%; IR: 761 (C-Cl), 1630 (C=C), 3015 (C=CH); 1H NMR: 3.40 (m, 2H, CH_2-N), 3.89 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.21 (s, 1H, N-CH), 6.74 (s, 1H, C=CH), 8.49 (s, 1H, NH), 6.62-8.09 (m, 16H, Ar-H); ^{13}C NMR: 45.6 (CH_2-NH), 58.3 (N- CH_2), 67.2 (N-CH), 143.5 (C=CH), 146.9 (C=CH), 115.2, 117.9, 117.8, 120.5, 122.8, 123.1, 124.5, 125.4, 127.6, 128.4, 130.4, 131.2, 133.3, 136.2, 137.1, 142.5, 147.2, 152.1 (Ar); Mass (FAB): $577M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(2-chlorophenyl)-4-oxo-5-[(2-chlorophenyl)methylidene]-1-iminothiazolidine (5d)

Yield: 69%, m.p. 150-152°C; Anal. Calcd for $C_{30}H_{23}N_3S_2OCl_2$: C,62.49, H,4.02, N,7.28%; found C,62.42, H,3.95, N,7.22%; IR: 759 (C-Cl), 1626 (C=C), 3012 (C=CH); 1H NMR: 3.41 (m, 2H, CH_2-N), 3.90 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.24 (s, 1H, N-CH), 6.78 (s, 1H, C=CH), 8.48 (s, 1H, NH), 6.79-8.14 (m, 16H, Ar-H); ^{13}C NMR: 47.9 (CH_2-NH), 58.2 (N- CH_2), 64.6 (N-CH), 141.5 (C=CH), 145.8 (C=CH), 113.5, 114.3, 117.8, 119.2, 121.1, 122.3, 123.4, 126.7, 128.3, 129.1, 130.4, 132.2, 134.2, 135.7, 138.1, 140.5, 146.5, 159.2 (Ar); Mass (FAB): $577M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-bromophenyl)-4-oxo-5-[(4-bromophenyl)methylidene]-1-iminothiazolidine (5e)

Yield: 75%, m.p. 149-151°C; Anal. Calcd for $C_{30}H_{23}N_3S_2OBr_2$: C,54.14, H,3.48, N,6.31%; found C,54.11, H,3.42, N,6.25%; IR: 752 (C-Cl), 1611 (C=C), 2997 (C=CH); 1H NMR: 3.43 (m, 2H, CH_2-N), 3.95 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.19 (s, 1H, N-CH), 6.78 (s, 1H, C=CH), 8.44 (s, 1H, NH), 6.72-8.03 (m, 16H, Ar-H); ^{13}C NMR: 46.4 (CH_2-NH), 58.7 (N- CH_2), 67.5 (N-CH), 140.8 (C=CH), 146.8 (C=CH), 112.4, 114.6, 117.2, 118.2, 122.3, 125.4, 126.5, 127.2, 129.4, 131.5, 134.1, 137.3, 143.5, 147.4 (Ar); Mass (FAB): $665M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(3-bromophenyl)-4-oxo-5-[(3-bromophenyl)methylidene]-1-iminothiazolidine (5f)

Yield: 78%, m.p. 157-159°C; Anal. Calcd for $C_{30}H_{23}N_3S_2OBr_2$: C,54.14, H,3.48, N,6.31%; found C,54.09, H,3.44, N,6.28%; IR: 750 (C-Cl), 1583 (C=C), 2984 (C=CH); 1H NMR: 3.40 (m, 2H, CH_2-N), 3.93 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.17 (s, 1H, N-CH), 6.64 (s, 1H, C=CH), 8.50 (s, 1H, NH), 6.77-8.18 (m, 16H, Ar-H); ^{13}C NMR: 44.2 (CH_2-NH), 56.7 (N- CH_2), 66.1 (N-CH), 141.9 (C=CH), 146.8 (C=CH), 112.3, 113.8, 115.6, 117.1, 118.1, 121.4, 122.3, 125.5, 127.1,

129.5, 130.4, 133.1, 135.5, 136.6, 139.5, 141.3, 145.7, 150.4 (Ar); Mass (FAB): $665M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(2-bromophenyl)-4-oxo-5-[(2-bromophenyl)methylidene]-1-iminothiazolidine (5g)

Yield: 86%, m.p. 158-159°C; Anal. Calcd for $C_{30}H_{23}N_3S_2OBr_2$: C,54.14, H,3.48, N,6.31%; found C,54.08, H,3.40, N,6.24%; IR: 740 (C-Cl), 1592 (C=C), 2982 (C=CH); 1H NMR: 3.38 (m, 2H, CH_2-N), 3.85 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.13 (s, 1H, N-CH), 6.71 (s, 1H, C=CH), 8.51 (s, 1H, NH), 6.78-8.18 (m, 16H, Ar-H); ^{13}C NMR: 47.2 (CH_2-NH), 57.7 (N- CH_2), 68.1 (N-CH), 139.8 (C=CH), 146.8 (C=CH), 112.3, 114.4, 115.6, 117.2, 118.2, 120.5, 122.5, 124.5, 125.3, 127.7, 128.2, 130.5, 132.5, 135.3, 136.4, 143, 148.4, 152.2 (Ar); Mass (FAB): $665M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-nitrophenyl)-4-oxo-5-[(4-nitrophenyl)methylidene]-1-iminothiazolidine (5h)

Yield: 80%, m.p. 154-155°C; Anal. Calcd for $C_{30}H_{23}N_3S_2O_5$: C,60.28, H,3.87, N,11.17%; found C,60.23, H,3.84, N,11.12%; IR: 874 (C-NO), 1530 (N=O), 1585 (C=C), 3019 (C=CH); 1H NMR: 3.44 (m, 2H, CH_2-N), 3.94 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.20 (s, 1H, N-CH), 6.70 (s, 1H, C=CH), 8.54 (s, 1H, NH), 6.89-8.27 (m, 16H, Ar-H); ^{13}C NMR: 47.4 (CH_2-NH), 58.3 (N- CH_2), 68.8 (N-CH), 140.3 (C=CH), 149.6 (C=CH), 113.5, 115.6, 117.4, 119.8, 121.5, 123.9, 126.7, 128.2, 129.5, 132.2, 135.8, 137.3, 146.4, 148.7 (Ar); Mass (FAB): $598M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(3-nitrophenyl)-4-oxo-5-[(3-nitrophenyl)methylidene]-1-iminothiazolidine (5i)

Yield: 82%, m.p. 167-158°C; Anal. Calcd for $C_{30}H_{23}N_3S_2O_5$: C,60.28, H,3.87, N,11.17%; found C,60.24, H,3.85, N,11.12%; IR: 862 (C-NO), 1505 (N=O), 1592 (C=C), 3008 (C=CH); 1H NMR: 3.41 (m, 2H, CH_2-N), 3.93 (t, 2H, $J = 7.60$ Hz, N- CH_2), 5.12 (s, 1H, N-CH), 6.68 (s, 1H, C=CH), 8.45 (s, 1H, NH), 6.88-8.25 (m, 16H, Ar-H); ^{13}C NMR: 46.8 (CH_2-NH), 55.6 (N- CH_2), 67.5 (N-CH), 140.3 (C=CH), 145.5 (C=CH), 112.8, 114.2, 115.7, 117.2, 118.7, 119.2, 120.2, 123.4, 123.4, 126.3, 128.9, 130.4, 133.6, 136.5, 139.3, 144.8, 147.7, 151.4 (Ar); Mass (FAB): $598M^+$.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(2-nitrophenyl)-4-oxo-5-[(2-nitrophenyl)methylidene]-1-iminothiazolidine (5j)

Yield: 78%, m.p. 151-153°C; Anal. Calcd for $C_{30}H_{23}N_3S_2O_5$: C,60.28, H,3.87, N,11.17%; found C,60.21, H,3.85,

N,11.14%; IR: 878 (C-NO), 1502 (N=O), 1586 (C=C), 2989 (C=CH); ¹H NMR: 3.37 (m, 2H, CH₂-N), 3.85 (t, 2H, J = 7.60 Hz, N-CH₂), 5.17 (s, 1H, N-CH), 6.72 (s, 1H, C=CH), 8.42 (s, 1H, NH), 6.91-8.26 (m, 16H, Ar-H); ¹³C NMR: 46.5 (CH₂-NH), 58.5 (N-CH₂), 66.7 (N-CH), 140.6 (C=CH), 145.8 (C=CH), 113.7, 116.4, 119.2, 121.5, 123.6, 124.6, 125.7, 127.4, 128.4, 130.2, 132.2, 133.4, 134.7, 136.8, 141.5, 144.2, 146.5, 151.5 (Ar); Mass (FAB): 598M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-methoxyphenyl)-4-oxo-5-[(4-methoxyphenyl)methylidene]-1-iminothiazolidine (5k)

Yield: 74%, m.p. 147-148°C; Anal. Calcd for C₃₂H₂₉N₃S₂O₃: C,67.69, H,5.14, N,7.40%; found C,67.65, H,5.11, N,7.38%; IR: 1095 (C-O), 1595 (C=C), 2968 (OCH₃), 2998 (C=CH); ¹H NMR: 3.31 (m, 2H, CH₂-N), 3.70 (s, 6H, 2×OCH₃), 3.84 (t, 2H, J = 7.60 Hz, N-CH₂), 5.12 (s, 1H, N-CH), 6.69 (s, 1H, C=CH), 8.40 (s, 1H, NH), 6.65-8.02 (m, 16H, Ar-H); ¹³C NMR: 44.2 (CH₂-NH), 54.1 (N-CH₂), 65.0 (N-CH), 57.4 (2×OCH₃), 137.5 (C=CH), 146.8 (C=CH), 112.7, 114.7, 117.3, 119.2, 121.3, 123.7, 124.5, 126.2, 127.8, 132.9, 136.1, 137.3, 144.4, 148.8 (Ar); Mass (FAB): 568M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-methylphenyl)-4-oxo-5-[(4-methylphenyl)methylidene]-1-iminothiazolidine (5l)

Yield: 76%, m.p. 142-143°C; Anal. Calcd for C₃₂H₂₉N₃S₂O: C,71.74, H,5.45, N,7.84%; found C,71.71, H,5.40, N,7.83%; IR: 1578 (C=C), 2888 (CH₃), 2984 (C=CH); ¹H NMR: 2.34 (s, 6H, 2×CH₃), 3.29 (m, 2H, CH₂-N), 3.80 (t, 2H, J = 7.60 Hz, N-CH₂), 5.10 (s, 1H, N-CH), 6.49 (s, 1H, C=CH), 7.37 (s, 1H, NH), 6.72-7.94 (m, 16H, Ar-H); ¹³C NMR: 25.5 (2×CH₃), 45.6 (CH₂-NH), 54.3 (N-CH₂), 63.5 (N-CH), 136.8 (C=CH), 143.5 (C=CH), 114.5, 117.3, 118.7, 119.1, 121.5, 123.4, 125.8, 128.5, 131.4, 133.2, 138.8, 141.5, 146.7, 148.3 (Ar); Mass (FAB): 536M⁺.

- *N*-[2-(10*H*-phenothiazinyl)ethyl]-2-(4-hydroxyphenyl)-4-oxo-5-[(4-hydroxyphenyl)methylidene]-1-iminothiazolidine (5m)

Yield: 78%, m.p. 157-158°C; Anal. Calcd for C₃₀H₂₅N₃S₂O₃: C,66.76, H,4.66, N,7.78%; found C,66.72, H,4.64, N,7.75%; IR: 1610 (C=C), 2988 (C=CH), 3489 (OH); ¹H NMR: 3.27 (m, 2H, CH₂-N), 3.75 (t, 2H, J = 7.60 Hz, N-CH₂), 4.22 (s, 2H, 2×OH), 5.16 (s, 1H, N-CH), 6.58 (s, 1H,

C=CH), 8.44 (s, 1H, NH), 6.69-8.06 (m, 16H, Ar-H); ¹³C NMR: 43.7 (CH₂-NH), 55.7 (N-CH₂), 64.1 (N-CH), 140.2 (C=CH), 149.9 (C=CH), 113.4, 115.4, 116.3, 118.2, 119.4, 121.2, 123.2, 127.5, 128.5, 132.8, 136.3, 143.2, 148.7, 153.6 (Ar); Mass (FAB): 540M⁺.

IV CONCLUSION

In conclusion, we have developed a simple, efficient and solvent free method for the synthesis of compounds 1, 2, 3(a-m), 4(a-m) and 5(a-m) having phenothiazine nucleus. We also believe that the procedural simplicity, the efficiency and the easy accessibility of the reaction partners gives access to a wide array of heterocyclic frameworks equipped with a pendant phenothiazine unit. The application of microwave irradiation is used for carrying out chemical transformations of all above compounds, which are safe with higher chemical yields, pollution free and eco-friendly for syntheses.

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DESIGN OF Z-N TUNED PID CONTROLLER FOR HIGHER ORDER SYSTEM

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Abstract- This Paper presents the design of Z-N-Tuned PID Controller, to realize governor action in a power generation plant to improving the dynamic characteristics. Proportional-integral-derivative (PID) controllers are widely used in industrial control system because of the reduced number of parameters to be tuned. The PID control method is most flexible and simple method. This method is more popular among all control methods. The conventional PID controller is replaced by Z-N tuning PID controller, to make them more general and to achieve minimum steady-state error, also to improve the other dynamic behavior (overshoot). The self tuned proportional integral derivative (PID) controllers are designed for applications where large load changes are expected or the need for extreme accuracy and fast response time exists.

Keyword- Proportional-Integral-Derivative controls, PID hardware, Ziegler-Nichols Tuning, PID controllers design.

I INTRODUCTION

The determination of proportional (K_p), derivative (T_d) and integral (T_i) constant are known as tuning of PID controller. The most popular tuning technique is the Ziegler-Nichols method. However, besides being suitable only for system with monotonic step response, the compensated system whose controllers are tuned in accordance with the Ziegler-Nichols method have generally a step response with a high- percent overshoot. Ziegler and Nichols proposed the manual tuning of PID controller. The proceeding work is carried out of PID controllers on Z-N tuning that is based on Gain Phase margin tester method. The advantage of Gain Phase margin based-PID controller is that the tuning is also carried out for higher order systems thus the robustness of the system is increased. The performance of this PID controller is examine by MATLAB results.

The proportional integral and derivative (PID) controller is widely used in process industries to control the plant (system) for the desired set point. The PID control method is most flexible and simple method.

This method is more popular among all control methods. The determination of proportional (KP), derivative (KD) and integral (KI) constants are known as tuning of PID controller. Ziegler and Nichols give the manual tuning of PID controller. This is off line practical method of PID constants determination. In this method, the system is in open loop configuration. There is chance of system becoming unstable when it is in open loop configuration.

PID control is the proportion of error (P), integral of error (I), differential of error (D) control. In the analog control system, the analog PID control system is shown in Fig.1. The system consists of analog PID controller and the controlled plant.

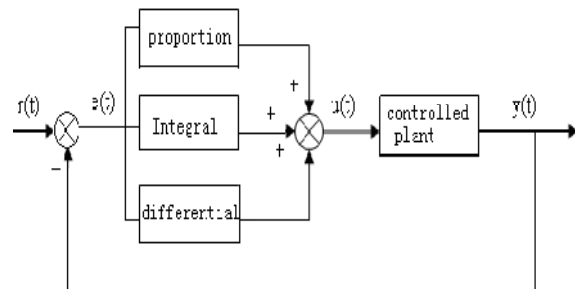


Figure 1: The analog PID Controller

PID controller is a linear controller; the error is given by the given value of $r(t)$ and the actual output $y(t)$.

$$e(t) = r(t) - y(t)$$

The control value is gained by composing linearly the proportion, integral and differential of the error, which control the controlled plant, so it is called as PID controller. The deviation of the ratio of integral and differential control, through a linear combination of composition control the amount of control on the plant, it called the PID controller. The control law is as follows. [6]

A PID controller is described by the following transfer function in the continuous s-domain

$$G_c = P + I + D$$

$$G_c = K_p + K_i/S + K_d S$$

$$G_c = K_p (1 + 1/T_i S + T_d S)$$

Where K_p is the proportional gain, K_i is the integration coefficient and K_d is the derivative coefficient. T_i is the integral action time and T_d is referred as derivative action time. These parameters in order to get best performance according to the design of the system. [2]

II TUNING SYSTEM

The proceeding work is carried out of PID controller's on line auto tuning that is based on Ziegler Nichols tuning method. The advantage of Z-N PID controller tuning is also carry out for higher order systems. Z-N PID Controller is controlling the plant or system by continuously monitoring plant output which is known as process value with the desired process value known as set point of the system. The PID controller manipulates on the difference between process value and set point called as error. In the conventional controlling method the transfer function of plant should be calculated in order to find out various parameters and the value of PID constants. But in this method there is no necessary to derive the transfer function of the system. Thus Z-N PID controller is monitoring the plant depending on set point and process value and irrespective of the nature of plant. [3][4]

Ziegler-Nichols tuning rule:

Ziegler-Nichols tuning rule was the first such effort to provide a practical approach to tune a PID controller. According to the rule, a PID controller is tuned by firstly setting it to the P-only mode but Adjusting the gain to make the control system in continuous oscillation. The corresponding gain is referred to as the ultimate gain (K_u) and the oscillation period is termed as the ultimate period (P_u). Then, the PID controller parameters are determined from K_u and P_u the Ziegler-Nichols tuning table.[1]

Type of controller	Parameters		
	K_p	T_i	T_d
P controller	$0.5K_{cr}$	∞	0
PI controller	$0.45K_{cr}$	$1/1.2P_{cr}$	0
PID controller	$0.6K_{cr}$	$1/2 P_{cr}$	$0.125 P_{cr}$

Table1: Controller Parameters for Ziegler-Nichols frequency method

The most employed PID design technique used in the industry is the Ziegler–Nichols method, which avoids the need for a model of the plant to be controlled and relies solely on the step response of the plant. The parameter setting, according to the Ziegler–Nichols method, is carried out in four steps.

- 1) Obtain the plant step response.
- 2) Draw the steepest straight-line tangent to the response.
- 3) Obtain the measurements
- 4) Set the parameters according to Table

The main features of PID controllers are the capacity to eliminate steady-state error of the response to a step reference signal because of integral action and the ability to anticipate output changes when derivative action is employed.

III POWER GENERATION PLANT

In a power plant, both active and reactive power demands continually vary the rising or falling trend. Power input must therefore be continuously regulated to match the active power demand; otherwise the machine speed will change with consequent change in frequency, which may be highly undesirable. Also the excitation of generators must be continuously regulated to match the reactive power demand with reactive generation, failing which the voltage at various system buses may go beyond the prescribed limits.

Parameter	Value
Turbine time constant	0.5 s
Governor time constant	0.2 s
Generator Angular Momentum	10Mjrad/s
Governor Speed regulation	0.05
Load change for frequency change of 1%	0.8%
$D = \Delta P / \Delta \omega$	0.8
Turbine rated output	250MW

Table2: Power generation plant parameters [7]

Ziegler Nichols frequency response method or Routh array criterion is used to determine the initial value of K_p , K_i & K_d .

Open loop transfer function (TF) of given plant is

$$G(s) = C(s)/U(s) = 1 / [(0.2s + 1)(0.5s + 1)(10s + 0.8)]$$

This TF is third order and has no integral term.
 The performance of the Z-N PID controller is shown by MATLAB results.

System Transfer function

$$G(s) = \frac{K_p}{(0.2s+1)(0.5s+1)(10s+0.8)+K_p}$$

The characteristic equation for the closed loop system is

$$S^3 + 7.08S^2 + 10.56 + (0.8 + K_p) = 0$$

By applying Routh Hurwitz criteria, we get

$$\omega = 3.25 \text{ rad/sec}$$

Hence the period of sustained oscillation

$$Pcr = 2\pi/\omega = 1.9323$$

Also we can determine K_p , T_i and T_d , using Ziegler Nichols frequency method.

We determine the K_p , T_i & T_d , Using Ziegler-Nichols Frequency method

$$K_p = 0.6 K_{cr} = 44.37$$

$$T_i = 0.5P_{cr} = 0.96$$

$$T_d = 0.125P_{cr} = 0.24$$

The Transfer Function of PID controller is then

$$G_c(s) = \frac{44.93(0.23S^2 + 0.966S + 1)}{S}$$

IV RESULTS

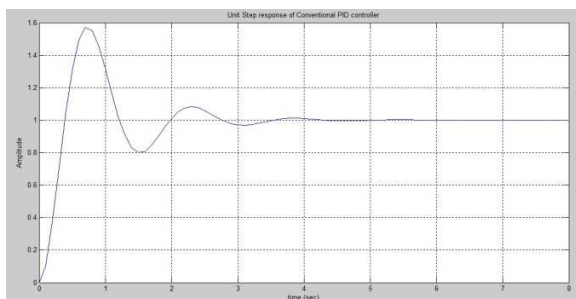


Figure 2: Time Response of Conventional PID Controller

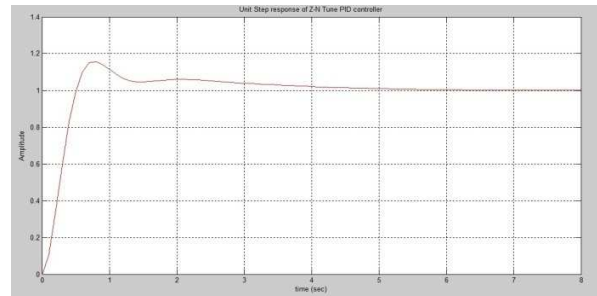


Figure 3: Time Response of Z-N Tuned PID Controller

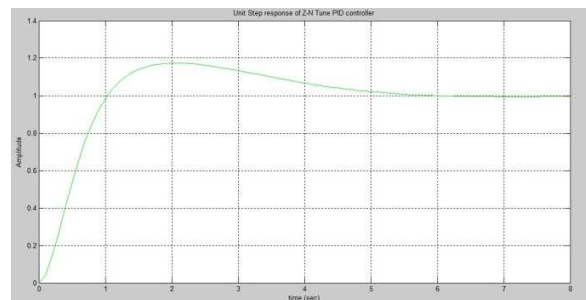


Figure 4: Time Response of Z-N Tuned PID Controller

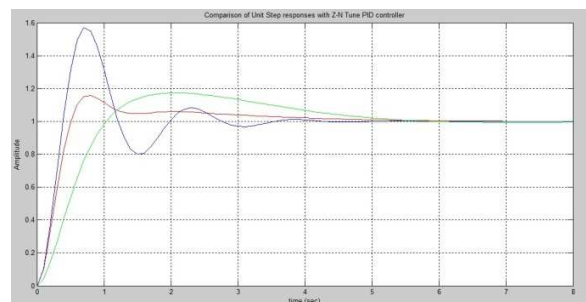


Figure 5: Comparison between PID and Z-N Tuned PID Controller

IV CONCLUSION

The conventional PID controller gives the high overshoot and settling time. In Z-N Tuned PID Controller, Initial controller parameters obtained using Ziegler-Nichols formulas are adjusted by numerical computational technique to get satisfactory performance. Z-N Tuned PID Controller gives zero steady state error and smaller overshoot than conventional PID controller. Z-N Tuned PID controller with simple approach can provide better performance comparing with the conventional PID controller.

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IMPACT OF SOCIAL NETWORKING SITES(SNS) ON THE YOUTH OF INDIA : A BIRD'S EYE VIEW.

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Abstract-This paper is focused to find out the answer whether the social networking sites are boon or bane for today's society.No doubt these SNS provides employment ,marketing ,personal growth ,sharing of information but the most prevalent danger through often involves online predators or individuals. These SNS has great impact on youth of India. One can easily see the entry gate of these social networking sites but it is unable to find exit for these SNS. One side these sites provide to communicate with our dear ones on the other side it creates platform for many cyber crimes. Everyone should be understood that The SNS is a "child of" computing "by computing" but" for the society ". So we focused on the fact that how SNS are implementing and used in an effective manner that is also beneficial for Indian society and what are the role of Indian youth .In this paper we focused on the positive as well as negative impact of these social networking sites on the Indian youth and what are the ethical responsibilities of the users of these sites.

Keywords-IEEE standards ,internet,WI-FI, elecommunication, , online ownership, online credibility. SNS(Social networking sites)

I INTRODUCTION

Social networking phenomenon has emerged over the past ten years. In that time, social networking sites (SNS) have grown from a niche to a mass online activity, in which tens of millions of internet users are engaged, both in their leisure time, and at work. However, there has been very little research on the socio-economic impact of these sites in the Indian context. In this paper we focused on the impact of these social networking sites on the youth of India in both positive as well as negative phase. Social networking is a phenomenon which has existed since society began. Human beings have always sought to live in social environments. The proliferation of social networking sites (SNS) and their pervasion in everyday practices is affecting how modern Indian youth societies manage their social networks. To a significant extent, SNS have shifted social networking to the Internet. In less than five years, these sites have grown from a niche online activity into a phenomenon through which tens of millions of internet users

are connected, both in their leisure time, and at work. There are various factors which have prompted us to consider the implications of these technologies for policy-making. One of these is the willingness of users to embrace SNS as a means of communication and social networking in everyday life. The increasing dependence on technology for basic communication also highlights the importance of analyzing how SNS are affecting daily processes. Sites like Face book, Friend ster and LinkedIn are influencing the way users establish, maintain and cultivate a range of social relationships, from close friendships to casual acquaintances.

II CHARACTERISTICS OF SOCIAL NETWORKING SITES

The basic characteristics of social networking sites can be explained with the help of following table-1

FEATURES	DESCRIPTION
Presentation of oneself	The basic level of entry in most SNS is the setting up of a 'profile': a personalized page developed by the user in which he/she presents him/herself to peers, through text, photos music and videos amongst others Functionalities. SNS allow users to mobilize and organize their social contacts and profiles in the way they want other members to see them.
Externalization of data	The externalization of networks is possibly one of the first times online users have been able to view their own online social networks, and share them with friends and the general public. Some SNS also support applications which allow users to describe the relation between themselves and other members.
New ways for community formation	Though notions of virtual communities have existed since the beginning of online applications, SNS support new ways for people to connect between themselves. Users of these sites may choose to communicate through various digital objects, such as tags and in-built applications within the SNS, such as the 'visual shelf' application in Facebook. Users may join a community of book readers, connecting through books they have liked ^[4] .

Bottom-up activities	SNS provide the ideal platforms through which users with similar values and interests can come together to collaborate effectively and cheaply. For instance, doctors can share and double check rare medical cases on health SNS such as Within3, or activists can organize a protest through sites like Care2 [5].
Ease of use	A major attribute of SNS' popularity is their simplicity. Anyone with basic internet skills can create and manage an online SNS presence. Prior to SNS, users gained an online presence by having a personal homepage [6]. The drawbacks were that these homepages are not easy to create and development and hosting of the site often incur costs. In contrast, SNS are free of charge and open for anyone to join. Most of them require registration, while others limit membership through an invitation from members who are already members of the site.
Reorganization of Internet geography	SNS support new points of entry to the internet: people's personal worlds. Until recently, people spoke of the internet in metaphors of places (cities, addresses, and homepages).

Table 1 [5].

Taking all these characteristics together, we can observe significant changes in how users network and operate their social contacts according to different social environments. In particular, SNS seem to be influencing and shaping the way we communicate between ourselves and how we manage our social contacts.

III SOCIAL IMPACT OF SNS ON INDIAN YOUTH

There has been significant interest and concern about the risks of online social networking because of access to personal information and the anonymity that the system allows. A number of public cases of bullying and identity theft have put this issue in the public arena. In the survey participants were asked whether they have ever had a bad social networking experience. A considerable number of respondents in a survey (28%) reported having had a negative online experience with adults aged below 30 the most likely to export this (60%). These participants were asked to provide further information about the negative experience. For most respondents the experience reflected unwanted contact or people posting in appropriate or upsetting information online. Some respondents specified having online bullying and provided examples such as abusive messages and harassment from someone of the opposite sex. The number of users using SNS according to age group can be explained with the help of the graph shown in figure 1.

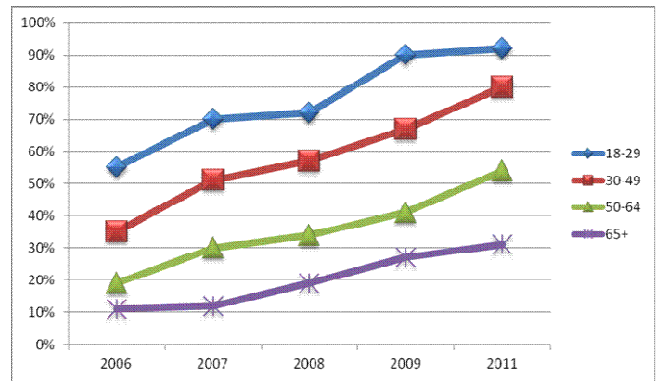


Figure 1: Graph 1 [2]

(a) Negative Impact of SNS on Youth of India

In considering the disadvantages, respondents identified a number of negative aspects of online social networking including:

- (i) the time-consuming nature of online social networking sites, Indian youth admitting that they waste a lot of time on these sites.
- (ii) Concern about access to personal information by others, with almost half of the youth worried that “non friends” may see their personal information.
- (iii) Concern that information posted may be used against them. The waste timing percentage of Indian youth on SNS can be explained with the graph shown in figure 2.

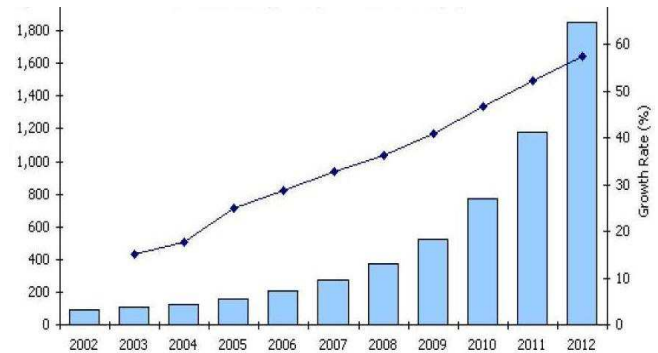


Figure 2: Graph 2 [3]

(b) Other Negative Impacts Of Sns

The negative effects of a new technology are never fully visible in the initial stages due the hype and excitement involved. However with time we observe the more time we spend online the more connected we get hence the urge to not miss out on anything this induces an invisible layer of stress

and pressure on the individuals. The very fabric of our societies is now beginning to take a new shape.

scientist has warned. Sites such as Face book, Twitter and Bebo are said to shorten attention spans, encourage instant gratification and make young people more self-centered.

(i) My fear is that these technologies are infantilizing the brain into the state of small children who are attracted by buzzing noises and bright lights, which have a small attention Span and who live for the moment.

(ii) A 2010 Case Western Reserve School of Medicine study showed hyper-networking (more than three hours on social networks per day) and hyper texting (more than 120 text messages per day) correlated with unhealthy behaviors in teens, including drinking, smoking and sexual activity. Hyper-networking was also associated with depression, substance abuse, poor sleep patterns, suicide and poor academic performance^[4].

(iii) While the above studies show actual correlations between social networking and negative consequences, others argue that many other negative consequences may exist that have not yet been studied. Some of the harmful effects people suggest social networking has that have not yet yielded conclusive study results include:

can also be positives. I guess there are no hard and fast rules when it comes to the effect social networks are having on us all in this day and age. It has never been easier to make friends than it is right now, mainly thanks to social networking sites. Just a few decades ago it was pretty tough to connect with people, unless you were the overly outgoing type able to make conversation with anyone at a party. The rise of *mobile phones* helped change this, connecting people in a new way, but then social networks sprang up and the whole idea of friendship changed once more and forever. It's entirely possible to have hundreds of friends on Face book. They may not be friends you know on a personal level and spend time with in the real world on a weekly basis. But they're friends nevertheless^[7]. There are several people I consider friends who I have never met – indeed, I may never meet them – but that doesn't lessen the connection we have thanks to social networks. Other major positive impacts are given as-

(d) Speedy Communication: Our time is being stretched thinner and thinner by work and family commitments, but social networking sites offer a chance to communicate in a speedy and efficient manner. Writing an update

(i) Social networking websites are causing alarming changes in the brains of young users, an eminent

(ii) Encouraging poor grammar, usage, and spelling Allowing the spread of misinformation that may be perceived as fact even in light of evidence to the contrary.

- Exposing children to online predators
- Creating a culture in which a single mistake such as a racy picture or poorly thought-out comment can cause irreparable harm to your reputation
- Decreasing productivity as workers habitually check social networking sites while they should be working.
- Providing information that increases the risk of identity theft.

(c) Positive Impact of Social Networking Sites

Social networking isn't for everyone, but it's now such a massive part of all our lives, whether we embrace or reject the notion, that it can no longer be ignored. But are social networking sites such as Face book, Twitter, and Google+ a force for good or evil? As with most questions there are multiple angles to approach this quandary from. Having already looked at the negative impact of social networking sites on society, I thought it only fair to redress the balance. Every ying has its yang, after all. Using the previous article as a loose template it's clear to see that what some people would conceive as negatives for Twitter takes all of 20 seconds and with cross-posting over other social networks switched on, that update reaches everyone you want it to reach (and probably more besides) in an instant^[5]. Social networking sites allow you to live a life unhindered by small talk.

(e) In Touch with the world:

It isn't just your inner circle of close friends and even closer family members that social networking sites allow you to communicate with easily and effectively, either. They open the world up to you, making it a smaller place than it has ever been before. So much so that I actually haven't a clue where many of my contacts reside. When it comes to social networks everyone is equal, regardless of location.

Family living abroad can be kept abreast of the latest happenings in your world as quickly as those living next door. Friends who you haven't seen since school, and who have since moved away, are able to keep in touch. *Location-based services* such as Foursquare and Gowalla emphasize your location but social networking as a whole means it has become

a lot less important. Social networking sites have made the world a smaller place.

(f) Building Relationships:

There is no doubting that social networking sites can lead to the breaking up of relationships. But there is another side to the tale, which is that people are moving onto other, perhaps better, relationships at the same time. Social networks can put you (back) in touch with those you have lots in common with, and that common ground is often the starting point for long-lasting relationships.

IV ETHICAL RESPONSIBILITY OF YOUTH USING SNS

The new digital social networking media are a frontier that is rich with opportunities and risks, particularly for young people. Through SNS technologies, young people are participating in a range of activities, including social networking, blogging, vlogging, gaming, instant messaging, downloading music and other content, uploading and sharing their own creations, and collaborating with others in various ways. Five key issues are at stake in the new social networking media identity, privacy, ownership and authorship, credibility, and participation^[8]. These issues decide the social and ethical responsibilities of the youth that using the services of social networking sites.

- (a) Every person that using the SNS should be aware about their rights and moral responsibilities.
- (b) We should respect the authentication and privacy of those members that are using SNS.
- (c) We should follow the ethics of online identity.
- (d) Create culture of disclosure.
- (e) Online, a number of strategies—including privacy settings, selective disclosure, code switching, and deception are used by youth to control the presentation of their identities and thereby manage their privacy. Most social networking sites have privacy settings that allow users to limit access to their profiles to a narrow audience of confirmed friends, and evidence suggests that many young people use them.
- (e) The online culture of disclosure holds important promises for young people, including empowerment of themselves and others, the creation of communities of support around shared struggles, and the development of a broad ethical sense of responsibility with respect to privacy.

(f) Promises of Ownership and Authorship Online.

(g) Maintain Credibility. So the youth of Indian can play an important role to reduce the negative impact of social networking sites such that it can be used in the beneficial way.

V CONCLUSION

No doubt that SNS has great impact on the Indian youth it has lot of challenges which we have to face .There are many questions arise when we think about the impact of these SNS that What does it mean to manage online privacy in an ethical manner? How do online spaces facilitate and undermine ethical thinking about privacy? How much personal information is reasonable to share online? Young people who share personal experiences online taking steps to protect their own and others' identities, and are these steps sufficient? Is it reasonable for young people to expect a certain measure of privacy when it comes to their online lives? Who is at fault when an unintended audience can read a young person's revealing blog or MySpace page? So we should focus on the ethical use of these SNS so that it serves our society in a right way and the youth can play an important role because SNS is a boob and curse both for the Indian society .In one hand it provides away to connect our dear ones on the other side it gives a platform that become danger for Indian heritage and culture.

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HYBRID FRAMEWORK USING ANT COLONY CLUSTERING AND K-MEANS GENETIC ALGORITHM (ANT-KGA) FOR OPTIMIZATIONS OF WEB USAGE PATTERN

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Abstract- *The web usage Mining (WUM) is the process of discovering hidden patterns from the web usage. The proper analysis of web log file is beneficial to manage the websites effectively for administrative and users' prospective. In this research paper, a hybrid framework is proposed Using Ant Colony Clustering and Linear Genetic Programming Approach (ANT-LGP) for optimizations of web usage pattern. The hybrid framework uses an ant colony optimization algorithm to cluster Web usage patterns. In this work, we investigate the performance aspect of proposed hybrid method with well famous K-means genetic algorithm (K-GA) based ant colony clustering method for web usage log pattern analysis. We present a comparative performance evaluation model of ANT-LGP versus ANT-KGA by means of an analytical approach. Quantitative measurements are performed using number clusters, error rate, number of iteration and execution time performance parameters in this research work. The results proposed framework offers a superior performance compared to existing L-GP based system.*

Keywords- *Web Usage Mining, Antcolony clustering ,K-Means, Linear Genetic Programming*

I INTRODUCTION

Web mining is primarily aimed at deriving actionable knowledge from the Web through the application of various data mining techniques [1]. Web mining is further divided into three broader classes such as Content Mining; Structure Mining; and Web Usage Mining [2]. Due to the continuous increase in growth and complexity of WWW, web site publishers are facing increasing difficulty in attracting and retaining users. In order to design attractive web sites, designers must understand their users' needs. Therefore analyzing navigational behavior of users is an important part of web page design. Web Usage Mining is the discovery of user access patterns from Web server access logs [2]. Web Usage Mining (WUM) is the application of data mining

techniques to web usage data in order to discover the patterns that can be used to analyse the user's navigational behavior. A WUM methodology is divided into three steps such as data preprocessing; pattern discovery; and pattern analysis [3,4,5]. These three steps or phases are sequentially connected to each other to form complete WUM methodology. Clustering is a natural way to group the similar objects based on some common properties (similarity measure). The elements of a cluster are more similar to each and have similar properties as well. Clustering is a prominent data mining technique and is used for various applications such as pattern discovery; data analysis; prediction; visualization; and personalization. Web session clustering is an emerging and common technique at preprocessing level of WUM [4,6], which not only extract the hidden behavior from web usage but also groups the sessions based on some common properties (Similarity). Web log analysis can be single level and multilevel. Multilevel log mining searches interesting relationship among the values from different levels in a log database. There are several possible challenges to explore efficient log mining of multiple-level including multiple scans of transaction database [21]. So for simplicity, this work revolves around single level log pattern analysis.

Nature inspired algorithms are problem solving techniques that attempt to simulate the occurrence of natural processes. Some of the natural processes that such algorithms are based on include the evolution of species [7,8]. Ant Colony Optimization (ACO) algorithm [9] belongs to the natural class of problem solving techniques which is initially inspired by the efficiency of real ants as they find their fastest path back to their nest when sourcing for food.

Early approaches in applying ACO to clustering [10,11,12] are to first partition the search area into grids or clusters but this may result in too many clusters as there might be missed or wrong calculated. Therefore, some other algorithms such as K-means, genetic, fuzzy are normally combined with ACO to minimize categorization errors [13]. More recently, variants of ant-based clustering have been proposed, such as using k-means genetic algorithm (K-GA), fuzzy-ACO, fuzzy k-means

with genetic algorithm etc. This paper proposes an improved ant colony cluster algorithm based on Linear Genetic Programming Approach (ANT-LGP) for optimizations of web usage pattern. It enables the ants to consult historical information when conveying objects by importing adjusting process and short period memory, and it also does iterative regulating to the cluster formed by the ants. Thus, it advances the convergence speed of the algorithm and the efficiency of the cluster. The rest of paper is organized as follows. In section 2, we present a review on existing web session clustering techniques. Section 3, introduction about ant colony. Section 4, explains the proposed methodology of WUM. Section 5 presents the experimental results of proposed methodology. Section 5 concludes the paper.

II LITERATURE SURVEY

A Hierarchical Cluster Based Preprocessing Methodology for Web Usage Mining” A framework for web session clustering is given by applying preprocessing level of web usage mining. The framework here cover the data preprocessing steps to prepare the web log data and convert the categorical web log data into numerical data. A session vector is obtained, so that appropriate optimization could be applied to cluster the web log data. The hierarchical cluster based approach here enhances the existing web session techniques for more structured information about the user sessions. The three different measures “Angular Separation”, “Canberra Distance” and “Spearman Distance” instead of “Euclidean Distance” are used. The PSO algorithm based on “Angular Separation” and “Canberra Distance” and then agglomerative to obtain hierarchical sessionization of sessions is applied. The results of AS and CD are providing more structured information as compare to Alam [5] ED and SD.

By Zahid Ansari, A. Vinaya Babu, Waseem Ahmed and Mohammad Fazle Azeem[15]” **A Fuzzy Set Theoretic Approach to Discover User Sessions from Web Navigational Data**” describe web navigational data using fuzzy logic through web usage mining. The session files are filtered to remove very small sessions in order to eliminate the noise from the data. But direct removal of these small sized sessions may result in loss of a significant amount of information especially when the number of small sessions is large. A ”Fuzzy Set Theoretic” approach is applied to deal with this problem. Instead of directly removing all the small sessions below a specified threshold, weights are assigned to all the sessions using a ”Fuzzy Membership Function” based on the number of URLs accessed by the sessions. After

assigning the weights a ”Fuzzy c-Mean Clustering” algorithm is applied to discover the clusters of user profiles.

By Weihui Dai, Shouji Liu and Shuyi Liang[16], **“An Improved Ant Colony Optimization Cluster Algorithm Based on Swarm Intelligence”** Proposed an improved ant colony optimization cluster algorithm based on a classics algorithm- LF algorithm. By the introduction of a new formula and the probability of similarity metric conversion function, as well as the new formula of distance, this algorithm can deal with the category data easily. It also introduces a new adjustment process, which adjusts the cluster generated by the carry process iteratively. Experiments show that the improved ant colony algorithm can form more accurate and stability clusters than the K-Modes algorithm, Information Entropy-Based Cluster Algorithm. They also describe the process and idea of the algorithm usage by a mobile customer classification case and analyze the cluster results. This algorithm can handle large category dataset more rapidly, accurately and effectively, and keep the good scalability at the same time.

By A. Azadeh, A. Keramati and H. Panahi[17], **“A hybrid GA-ant colony approach for exploring the relationship between IT and firm performance”** A hybrid Genetic Algorithm (GA) Ant Colony Optimization (ACO) approach is proposed for data clustering. This is because of the need for the application of meta heuristic algorithms parallel to deterministic approaches. This study discusses and analyses data from 90 companies in a unique supply chain. The data includes 26 indices about IT and 11 indices about performance. The companies are classified with respect to the IT and performance indices (indicators). Then, IT clusters and performance clusters are mapped to one another and, consequently, the relationship between them is explored. This is the first study which integrates ant colony approach and GA for exploring the relationship between IT and firm performance[18] .They improve the slow speed of the AntClass algorithm by proposed new algorithm named DBAntCluster. Firstly, the high density clusters are got in the dataset by using DBSCAN algorithm, and then these high density clusters are scattered in the grid board as a special kind of data object with other single data objects in the dataset. In DBAntCluster algorithm, the ants can avoid many unnecessary movements by using the data attribute of density and distribution well, and the speed is greatly accelerated.

III ANT CLUSTERING

The ant colony optimization algorithm (ACO) is a probabilistic technique for solving computational problems. In

the natural world, ants (initially) wander randomly, and upon finding food return to their colony while laying down pheromone trails. If other ants find such a path, they are likely not to keep travelling at random, but to instead follow the trail,

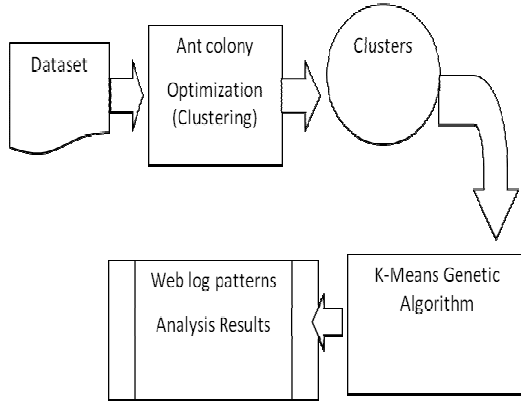


Figure 1: Proposed Hybrid Approach

returning and reinforcing it if they eventually find food. Over time, however, the pheromone trail starts to evaporate, thus reducing its attractive strength. The more time it takes for an ant to travel down the path and back again, the more time the pheromones have to evaporate. A short path, by comparison, gets marched over more frequently, and thus the pheromone density becomes higher on shorter paths than longer ones. Pheromone evaporation also has the advantage of avoiding the convergence to a locally optimal solution. If there were no evaporation at all, the paths chosen by the first ants would tend to be excessively attractive to the following ones. In that case, the exploration of the solution space would be constrained. Figure 1 shown the basic steps of ant colony algorithm.

```

    Procedure ACO
    While (not_termination)
      GenerateSolutions()
      AttractivenessCalculation()
      TrailLevelUpdate()
    End while
  End procedure
  
```

Figure 1: Ant Colony Algorithm

At each iteration of the algorithm, each ant moves from a state (x) to state (y), corresponding to a more complete intermediate solution. Thus, each ant (k) computes a set $A_k(x)$ of feasible expansions to its current state in each iteration. For ant (k), the probability p_{xy}^k of moving from state (x) to state (y) depends on the combination of two values (attractiveness η_{xy} of the move, and the trail level T_{xy} of the move). The trail level represents a posteriori indication of the desirability of that

move In general, the kth ant moves from state (x) to state (y) with probability:

$$p_{xy}^k = \frac{(T_{xy}^\alpha)(\eta_{xy}^\beta)}{\sum (T_{xy}^\alpha)(\eta_{xy}^\beta)}$$

Where α Is a parameter to control the influence of T_{xy} ($\alpha \geq 0$)

β Is a parameter to control the influence of η_{xy} ($\beta \geq 1$)

IV CLUSTERING ALGORITHMS WORK

Ant-based clustering algorithms are based upon the brood sorting behavior of ants. Its dissimilarity-based evaluation of the local density make it suitable for data clustering and it has subsequently been used web log analysis. Genetic programming (GP) is burning issue now days. It is able to produce accurate results without having much of analytical knowledge related to problem domain. GP does impose restrictions on how the structure of solutions should be formulated. So it is best suitable for enhancing formation of cluster and analysis of patterns in web log analysis. There are several variants of GP, some of them are: Linear Genetic Programming (LGP), Gene Expression Programming (GEP), Multi Expression Programming (MEP), Cartesian Genetic Programming (CGP), Traceless Genetic Programming (TGP). Proposed work try to introduced new variation with K-Means. It is represented by (KGA)

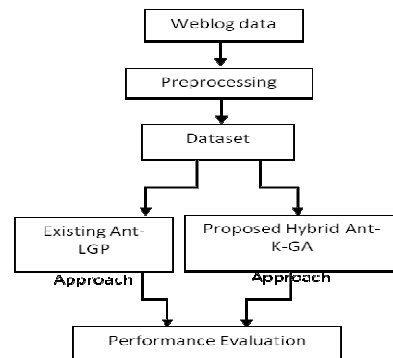


Figure 2: Proposed framework for web log analysis and performances evaluation

Throughout in this work. The structure of proposed hybrid approach is shown in figure 2. The hybrid framework uses an ant colony optimization algorithm to cluster Web usage patterns. In this research work KGA is associated with ant colony clustering algorithm for web log pattern analysis. This hybrid approach is represented by (Ant-K-GA). One of the benefits of this type of hybridization is the implicit re-use of

posteriori knowledge in the cluster formation. The Basic idea is that isolated items should be picked up and dropped efficiently at cluster where more items of that type are present. Proposed (Ant-K-GA) algorithm follows real antlike behaviors as much as possible.

In that sense, genetic behavior is incorporated into the web log cluster analysis system, avoiding randomly moving agents without interest. The proposed framework for web log analysis and performances evaluation is shown in figure 3.

Since trail movement is controlled by attractiveness (The probability to put item in correct cluster) so this is called transition probabilities and it depends on the spatial distribution of pheromone across the environment (behavior of users). The variation of genetic programming (KGA) is incorporated in this research work to effectively control the spatial distribution. There are two major factors that should influence any local action taken by the ant: the number of objects in his neighborhood, and their similarity. KGA strategy not only allows guiding ants to find clusters of objects in an adaptive way also develop short-term memories to overcome local minima. Proposed framework for web log analysis and performances evaluation is shown in Figure 3 and pseudo code of proposed (Ant-K-GA) approach is shown in figure 4.

Initialization

a. Set initial parameters: variable, states, function, input

b. Set initial pheromone trails value

c. Each ant is individually placed on initial state with empty memory.

While (not_termination)

a. Construct Ant Solution:

b. Calculate attractiveness of next move

c. Apply Local Search through KGA (Avoid local minima)

d. If there is an improvement-. Update Trails

e. calculate evaporation through genetic operators

f. select the population with a probability based on fitness.

End While

pseudo code of proposed (Ant-K-GA) approach

V EXPERIMENTATION AND RESULT ANALYSIS

To show this procedure we take live web log records of Maulana Azad National Institute of Technology, Bhopal, India, for processing our possible approach, first we parse these log records by the tool WebLogExpert [19], in Figure 5

show daily search phrases for the Maulana Azad National Institute of Technology, Bhopal, and server. For measuring performance, accuracy of the proposed method, we perform our operation on the 500 records of the MANIT, Bhopal, India log records. To support our methodology, we designed and implemented in MATLAB 7.8. This experiment is handled with null values efficiently in data preprocessing steps.

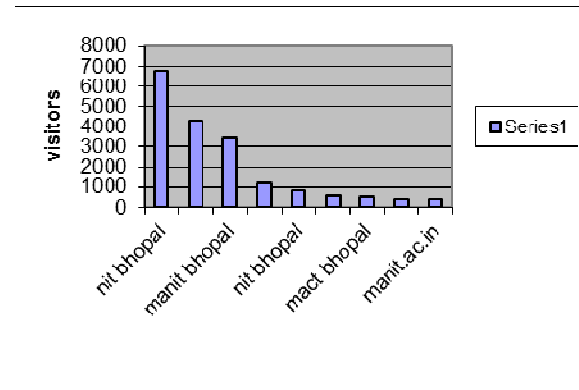


Figure 3: Top Search Phrases In MANIT Log Records.

We present a comparative performance evaluation model of ANT-LGP versus ANT-KGA by means of an analytical approach. Quantitative measurements are performed using number clusters, error rate, number of iteration and execution time performance parameters in this research work.

(a) Number of cluster

Method for choosing the number of clusters based on distortion, a quantity those measures the average distance, per dimension, between each observation and its closest cluster center. Our technique is computationally efficient and straightforward to implement. This approach is guaranteed to produce the correct answer provided the clusters do not overlap too severely. The more clusters the better quality (the smaller variance within cluster). The correct choice of k is often ambiguous, with interpretations depending on the shape and scale of the distribution of points in a data set. In addition, increasing k without penalty will always reduce the amount of error in the resulting clustering, to the extreme case of zero error if each data point is considered its own cluster (i.e., when k equals the number of data points, n). Intuitively then, the optimal choice of k will strike a balance between maximum compression of the data using a single cluster, and maximum accuracy by assigning each data point to its own cluster. There are several categories of methods for making this decision. One simple rule of thumb sets the number:

$$k \approx \sqrt{n/2}$$

Where

n : The number of objects (data points).

Proposed ant-KGA method gives more concise results. The less number of cluster generated by ant-KGA as shown in table 1 and table 2.

(b) Error rate

The true error rate (Err) is a measure of how accurately the classification, built with the learning sample, would be if they were applied to the whole universe. In this paper, we test the false positive rates in which a clustering is presented with a large number of samples that do not belong to any of cluster. Error rate is major factor for calculating performance. Ant-KGA shows better performance compared to Ant-LGP. Results are shown in table 1 and 2.

(c) Iteration

Clustering is a extensive iterative process. Algorithm must be design in such a way that it can fit in main memory. Normally hybrid approaches are resources consuming but proposed hybrid approach (Ant-KGA) give better performance in term of memory requirement. Ant-KGA gives the same performance in term of iteration as shown in table 1 and table 2. In other words, Ant-KGA does not show any performance degradation.

(d) Execution Time

Usually the efficiency or running time of an algorithm is stated as a function relating the input length to the number of steps. Run-time analysis is a theoretical classification that estimates and anticipates the increase in running time (or run-time) of an algorithm as its input size (usually denoted as n) increases. In term of execution time taken by algorithm, Ant-KGA gives better performance.

Implemented (Ant-KGA) algorithm executed on different threshold values to identify its scalability. We have executed it with two threshold values (0.23 and 0.50). Threshold value must be between 0 to 1. Results are shown in Table 1 and 2.

Parameters	Ant-KGA	Ant-LGP
Threshold :0.23		
Error rate	2.8	4.2
Number of iteration	7	7
Execution time	5.4	6.4
Number of clusters	5	6

Table 1: Performance comparison with threshold value 0.23

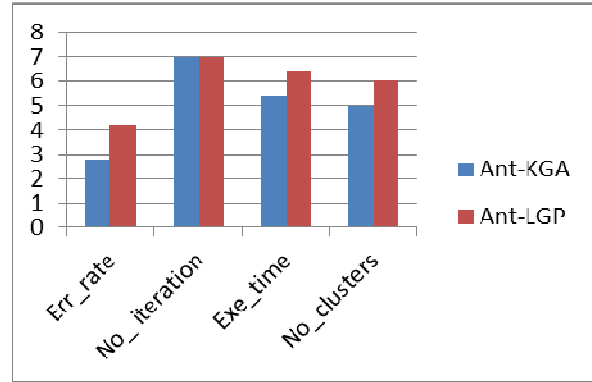


Figure 4: Performance comparison with threshold value 0.23

Parameters	Ant-KGA	Ant-LGP
Threshold :0.50		
Error rate	3.59	4.8
Number of iteration	6	6
Execution time	2.34	3.57
Number of clusters	3	4

Table 2: Performance comparison with threshold value 0.50

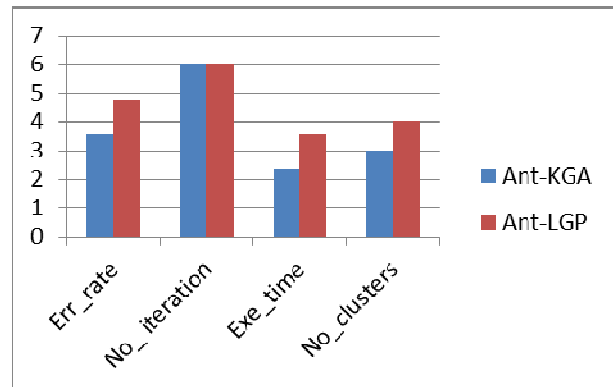


Figure 5: Performance comparison with threshold value 0.50

VI CONCLUSION

The proposed ANT-LGP model seems to work very well for the web log pattern analysis. In this paper, our focus was to develop hybrid approach to analyze the hourly and daily web traffic volume. The results also reveal the importance of using optimization techniques for mining useful information. The genetic nature of the algorithm makes it fairly robust to the effects of outliers within the data. A quantitative comparison has been given with various parameters to show performance improvement. The work show that proposed (Ant-KGA) approach is well applicable in real-world applications including web log pattern analysis. The objective of research was to enhance the web log visualization and structured

information for the next phases of WUM process. Proposed work gives following advantages:

1. More powerful pattern analysis than using conventional GP.
2. Efficient evaluation of cluster boundaries from the intrinsic feature exhibited by (Ant-K-GA).
3. Less complicated formulation of trail and attractiveness via the crossover and mutation genetic operators.

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