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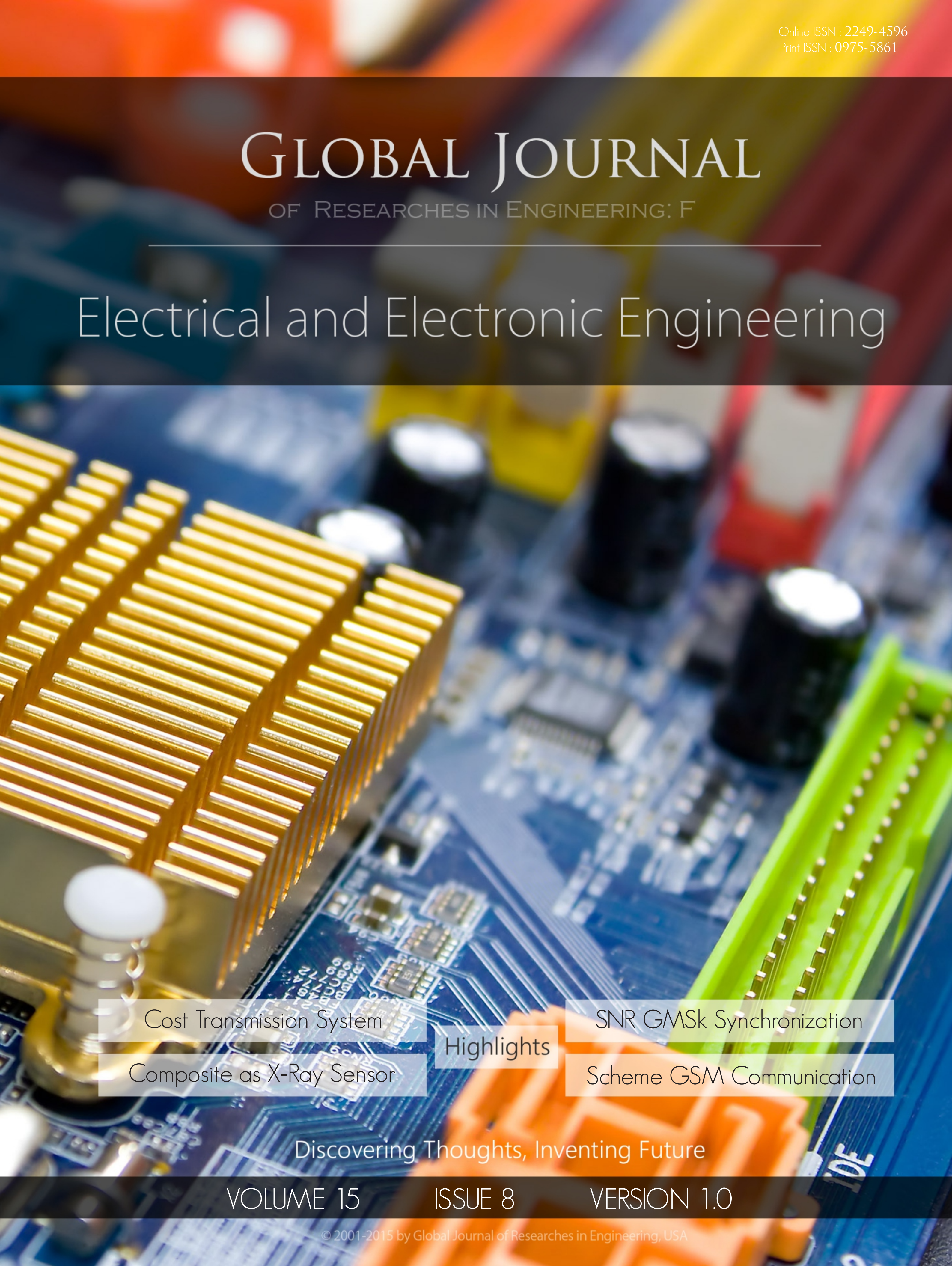

Highlights

Cost Transmission System

Composite as X-Ray Sensor

SNR GMSk Synchronization

Scheme GSM Communication

Discovering Thoughts, Inventing Future

VOLUME 15 ISSUE 8 VERSION 1.0

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PMMA-CdI_2 Composite as X-Ray Sensor

By Meena Kumari, Suman Singh, Priyanka Tyagi & Kulvinder Singh
University of Delhi, India

Abstract- With the development of digital x-ray sensing devices, demand for stable and highly sensitive material is continuously increasing. Various solid state materials have been discovered like mercuric iodide, lead iodide, potassium di chromate etc. These materials are used both in single crystal form and polycrystalline form. Most of the materials are found to have limited stability. In search of highly stable material, composite materials using polymers are searched. In present study cadmium iodide in PMMA is subjected to the study for their X-ray sensing properties. For these their electrical conductivity measurements were made both in absence and in presence of radiations (X-Rays and low intensity Gamma Rays). Results, obtained are analyzed in the light of photocurrent generated by high energy radiations. These composites are found to have high efficiency and stability for X-ray sensing. However x-ray switching response is limited.

Keywords: *Composites, Poly-methyl methacrylate, High energy sensors, Electrical properties, High energy radiations, X-rays.*

GJRE-F Classification : *FOR Code: 090605, 299903*

PMMACDICOMPOSITE ASXRAYSENSOR

Strictly as per the compliance and regulations of :

PMMA-CdI_2 Composite as X-Ray Sensor

Meena Kumari [α], Suman Singh [σ], Priyanka Tyagi [ρ] & Kulvinder Singh [ω]

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Keywords: Composites, Poly-methyl methacrylate, High energy sensors, Electrical properties, High energy radiations, X-rays.

I. Introduction

In recent years there is continuously increasing digitalization in every field affecting human life. In diagnostics, use of X-ray computed tomography (CT) or computerized axial tomography scan (CAT scan) and digital X-ray imaging are now routine activities [1-4]. These techniques require the digital data which can be processed by a computer. Normally this data is obtained by X-ray detector. In earlier versions of such machines, cesium iodide crystals were used as scintillation detectors. Later in 1980s use of high pressure Xenon gas ion chambers were used [5]. In modern machines scintillation materials like rare earth oxide ceramics are in use. These materials absorb X-rays and re-emit the absorbed energy in the form of light. Light signals are then converted into electrical signals by photodiode and processed. However there is a possibility of direct conversion of X-ray signals into electrical signals with help of solid state X-ray detectors. These are basically semiconductor materials like silicon or germanium doped with lithium. X-rays passing through these materials are absorbed and are converted to electron-hole pairs to create electrical signals. For proper sensitivity, operations of such detectors require liquid nitrogen temperature. This helps in minimizing thermally generated electron hole pairs. In 1990s many solid state detector materials were explored like alpha-selenium, poly cadmium zinc telluride, mercuric iodide [6], lead iodide etc. Basis for a good solid state detector material is based on the following major properties:-

1. Material should have high band gap. This helps in minimizing thermally generated noise.
2. Constituent atoms should have high atomic number. This is for maximum absorption of X-ray energy.
3. Mobility-life time product of the material should be high. This helps in better charge collection.
4. Operating electric field should be low. It helps in keeping electronics involved simple.
5. Operating temperature likely to be room temperature for ease in operation.
6. Response time should be small for faster data processing.
7. Fabrication of detector should be simple with flexibility of design, shape and size.
8. Highly stable or have low degradation.

Every solid state detector material has some the above properties but lacks in some other properties. One of the important issues is flexibility in design. X-Rays are high energy radiations. When they interact with these materials they are partially reflected and partially refracted through the material. Limited portion is absorbed by the material. If detector is properly shaped, it is possible to maximize the absorption of X-rays. Single crystalline material gives limited flexibility in designing the shape of detector. Keeping this in mind, it was planned to develop composites detectors. To have better spectrum of physical and chemical properties it was planned to blend an inorganic material (cadmium iodide) with organic polymer (poly-methyl methacrylate). Cadmium iodide molecule contains elements having high atomic masses (cadmium-112.4u and iodine-126.9u). This helps in good absorption of X-rays. Further electronic band gap of cadmium iodide is high (3.3-3.1e.V.)[7]. this is especially helpful in reducing the dark current due to thermal agitation at room temperature. Poly-methyl methacrylate (PMMA) is well known polymer. It is selected due to its following properties [8-10].

1. Low linear mould shrinkage (0.003-0.0065 cm/cm)
2. Good mechanical properties {Hardness (63-97 Rockwell,M) and Tensile strength (47-79 MPa)

Author α σ: Research Scholars, Singhania University, Pacheri Bari-333515, Rajasthan, India.
Auhtor ρ: Research Associate, L'Orgueil Physics Centre, 205-206 RohitkunjMkt, Pitampura Delhi-110034, India .
Author ω: Associate Professor (Physics), Deen Dayal Upadhyaya College, University of Delhi-110015, India.
e-mail: kulvinder.physics@gmail.com

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3. Most resistant to direct sunshine exposure.
4. Low water absorption (0.3-2%) makes it very suitable for electrical device making.
5. Very low electrical conductivity (10^{-14}-$10^{-15}\Omega^{-1}.cm^{-1}$)
6. High dielectric strength (17.7-60kV/mm)

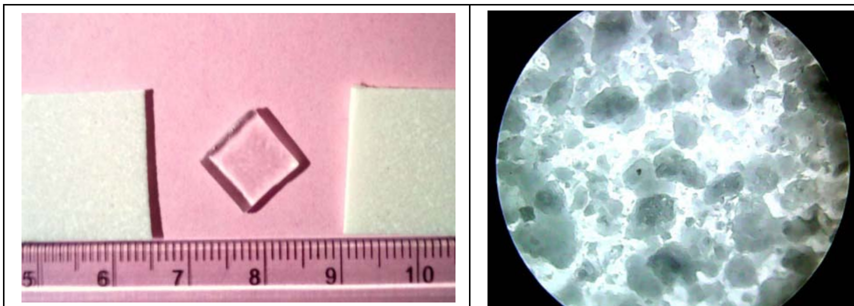
II. EXPERIMENTAL

Cadmium iodide (99%, Loba Chemie) is used as base material. White crystalline powder is fine grinded using agate mortar and pestle to a fine powder. No additive is used during this process. Due care is taken to keep the powder dry. PMMA granules were dissolved in chloroform (99% Fisher Scientific India) and mixed with fine powder of cadmium iodide. Uniform mixture is then kept to settle down for 48 hours in vibration free atmosphere. No further hot pressing is done to prevent any mechanical damaging to the sheets. After this fine sheets of PMMA-CdI_2 composite were obtained. They were cut in square sizes of 1cmX1cm for further study. Sheets, without air bubble are used for the study. Sheets were polished for smooth surfaces and coated with silver paste. Coated sheets were kept for drying for nearly two hours. Coated sheets were subject to electrical studies for determination

1. Electronic band gap determination
2. Voltage- Current variation study under
   a. Dark conditions (No radiations)
   b. In presence of Low intensity Gamma Radiations(Cs-137 source 67k Bq)
   c. Under X-Rays (Cu-Target)

III. EXPERIMENTAL RESULTS AND DISCUSSIONS

Composite sheets are found to be whitish in colour (Fig. 1(a)). These sheets are nearly 1mm in thickness and are flexible. When observed under low power optical microscope, small air bubbles are found to be trapped in some these sheets. Optical micrograph (Fig. 1(b)), taken under polarized white light shows the formation of crystallites of cdI_2. Crystallite size is measured to be of the order of micrometer. It can be seen that small crystallites are suspended in PMMA matrix. Sheets with three concentrations (by mass) were prepared i.e. 9.71%, 13.95% and 19.09%. Micrographs of these sheets clearly indicate that PMMA gaps decreases with increase in concentration and increasing the filler contacts between cadmium iodide crystallites.



(a) (b)

Fig. 1 : Optical photographs of sheets. (a) Sheets with cdI_2 (Side Sheets) Central sheet is of Pure PMMA
(b) Transmission optical micrograph of PMMA-CdI_2 Sheet (Magnification 100)

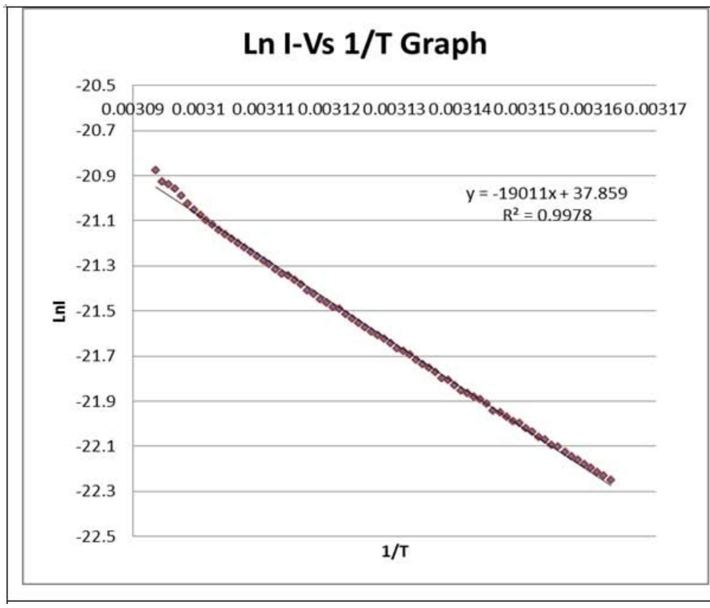
Electrically these sheets have very high resistance (3-4 X $10^{11}\Omega$) at room temperature. Two probe methods are used to study their electrical conductivity. Composite sheets with silver paste on both sides were griped by two spring loaded electrodes. This assembly is kept in a PID controlled oven. Regulated power supply is used to provide voltage and current is measured by picoammmeter which is calibrated by Kethley 6485. All measurements for band gap determination are done at low voltage (18V). Temperature is kept below 60^0C, as glass softening temperature of PMMA is 100^0C. When subjected to change in temperature these sheets show semiconducting behavior (Fig. 2).

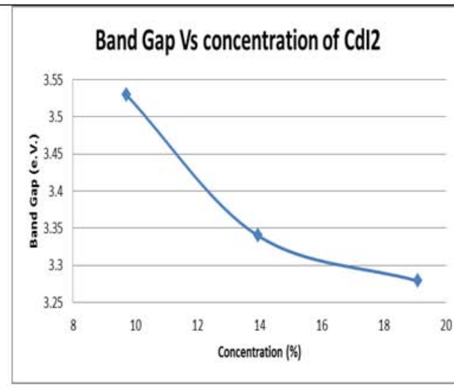
Conductivity of such hybrid structures can be given by combining Mott Variable Range Hopping equation (For PMMA) and basic Arrhenius Equation for semiconducting materials (CdI_2).

$$\sigma = \sigma_m \exp^{-(\frac{T_0}{T})^{1/4}} + \sigma_a \exp^{-(\frac{E_g}{2kT})}$$

Here σ_m is mott conductivity coefficient and T_0 constant, σ_a is Arrhenius conductivity coefficient, T is absolute temperature, E_g is band gap and k is Boltzmann constant. Electrical conductivity of PMMA is negligible (10^{-14}-$10^{-15}\Omega^{-1}.cm^{-1}$) in comparison to the conductivity of cadmium iodide (2.5 X 10^{-9} $\Omega^{-1}cm^{-1}$ [11]). Cadmium iodide is a layered compound. I-Cd-I layers are piled one over the other. There is strong electrovalent bond between cadmium and iodine atoms. However two layers of I-Cd-I are attached to each other by weak vander Waal's bonds. These weak bonds are responsible for various polytypes structures [12, 13] of the compound as well as high electrical conductivity in comparison to PMMA.

The term $\sigma_m \exp^{-(\frac{T_0}{T})^{1/4}}$ is negligibly small as compared to the term $\sigma_a \exp^{-(\frac{E_g}{2kT})}$. This means that conductivity variation with temperature will show Arrhenius behavior. Same is observed experimentally.





S.No.	Concentration (%)	Band Gap (e.V.)
1	9.71	3.53
2	13.95	3.34
3	19.09	3.279

Fig. 2 : LnI Vs 1/T variation is straight line indicating the semiconducting behavior of the material. Energy band is found to be decreasing with increasing concentration. Voltage is kept 18V

It is found that number of charge carriers passes through the sheets increases with rise in temperature. This can be understood as the polymeric chains of PMMA and cadmium iodide crystallites act as traps of charge carriers. With rise in temperature, phonon excitation increases. Phonon assisted hopping process helps in releasing the trapped charges. These charges using π -bond electrons move through the polymer molecules to the nearby cadmium iodide crystallite. Further these electrons drift under electric field through the cadmium iodide crystallites. Electric field applied to the sheet is of the order of 1 X 10^4 V/m sufficient enough to cause the drift. (Fig.3)

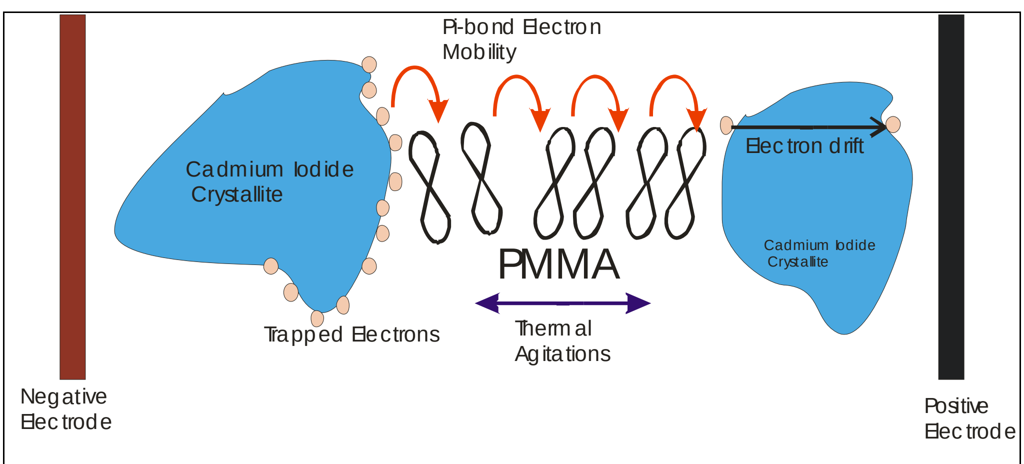


Fig. 3 : Schematic diagram showing the phonon assisted hopping mechanism of charge transmission through the PMMA-CdI$_2$ composite sheets

Also when exposed to gamma radiations, voltage vs current variations shows a very small change in the variations of current with voltage. Similar variations are observed in all the sheets with different concentrations. It is found that there is small increase in the resistance of the sheet in presence of the gamma radiations. When gamma source is removed and again the variation of voltage and current is taken, small increase is further observed in the resistance. (Fig4). Following inferences can be drawn from the study:

1. These sheets are almost transparent to the low intensity Gamma radiations as very small changes are observed. This is primarily due to less thickness of sheets (thickness of 1mm).
2. Although interaction of Gamma radiations is limited, yet they are able to create some damage to the bonds and cause some additional trap centers.

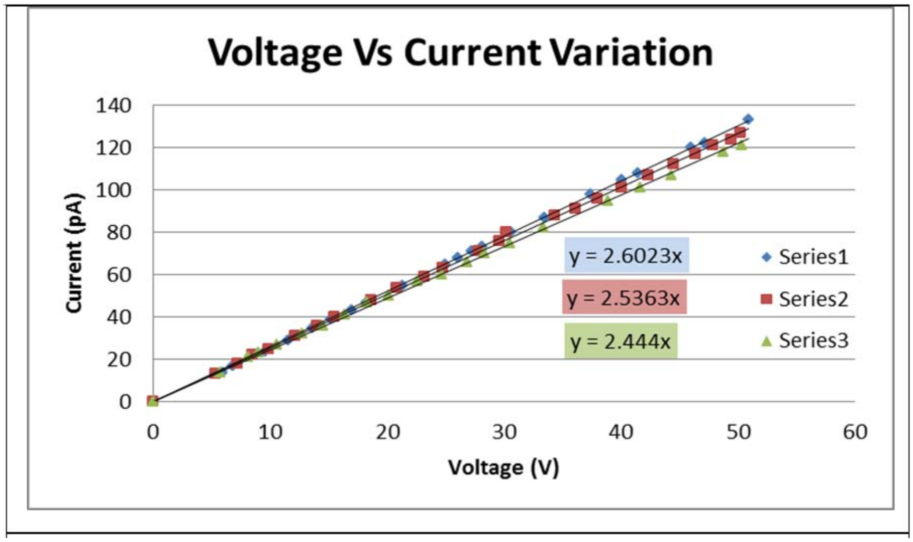


Fig.4 : Voltage Vs Current variation for Raw samples ((Series1) resistance= 3.84X10$^{11}\Omega$), During exposure with gamma rays ((Series 2) resistance=3.94 X10$^{11}\Omega$) and after exposure ((Series 3) resistance is4.09 X10$^{11}\Omega$)

Sheets were exposed to X-rays (Cu target 30KV, 10 mA plate current) parallel to electrode plates (Fig.5). X-ray intensity to which sheets were exposed is of the order of 10^{-2}W/cm^2. It was found that photo current increases by a factor of 230.7 in comparison to the dark current (Fig.6 (a)).

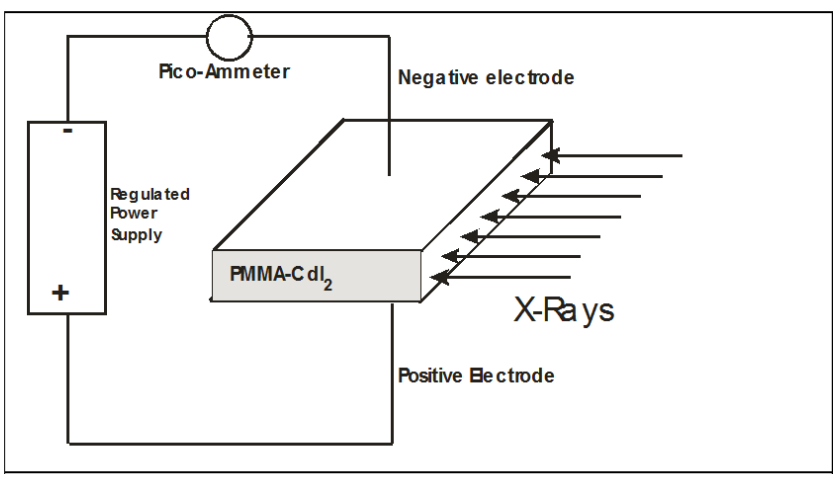


Fig 5 : Circuit diagram to measure photo amplification

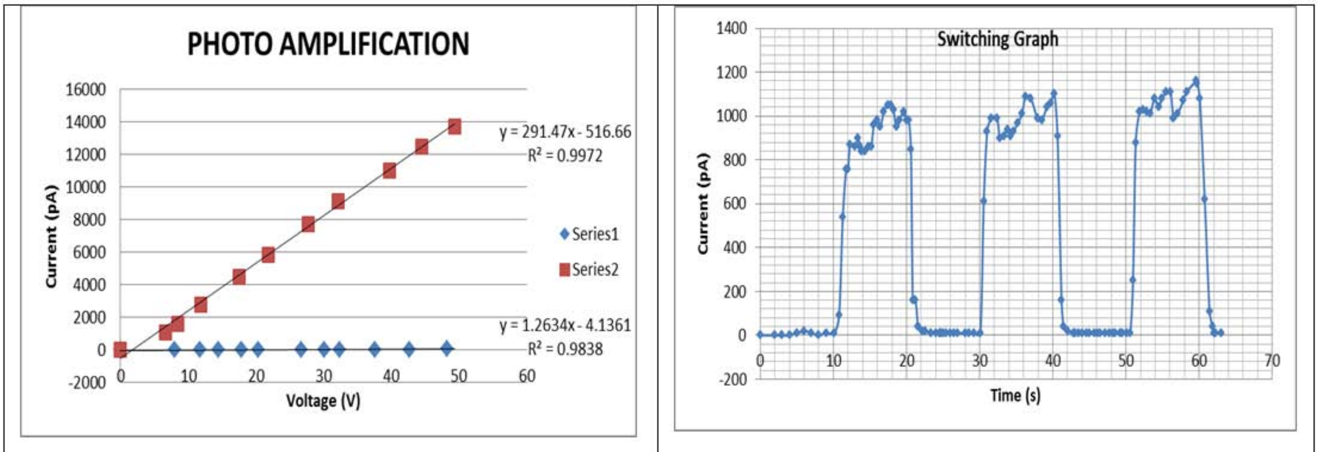
Under the X-rays illumination photocurrent generated (Ip) is directly proportional to five main parameters

1. Radiation term eI_x (e=Electronic Charge And I_x=Radiation intensity),
2. Performance factor of material $\eta\tau\mu$ (η=efficiency of conversion of radiations into charge carriers, τ=carrier life time i.e. average life time of carrier before recombination and μ=charge mobility),
3. Electric field applied (E),
4. Dimensional parameters like area to volume ratio of crystallite and
5. Temperature of material.

Material used as a sensor should have very low response time. To evaluate response time switching studies were conducted on these films (Fig.6(b)). Switching study revels following important findings:

1. Rise time and fall time is nearly 2 second for 10 second pulse on these films.
2. Photocurrent does not stabilize very fast. It shows

some zig-zag variation with time as seen in Fig.6 (b). This variation is expected as charge trapping occurs on the surfaces of cadmium iodide crystallite. At higher temperature stability is higher. This is due to quick release of trapped charges under thermal agitation. Such materials still require improvements before they can be used as X-ray Imaging Detectors [14, 15]. Similar results were obtained in all the sheets.



(a) (b)

Fig. 6 : (a) Photo current (series2) is 230.7 times the dark current (Series 1) at Room Temperature (32^{0}C) (b) Photo current switching curve

IV. Conclusions

PMMA-cadmium iodide is a good X-ray sensor as photocurrent amplification is quite high (of the order of 230.7 for 19.09% concentrated composite). Although these sensors are not good for fast data switching as rise time and fall time is high. However at temperature close to 40-50^{0}C stability of photocurrent is high. Such sheets are however transparent to low energy gamma rays.

V. Acknowledgment

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Low SNR GMSK Synchronization Scheme for GSM Communication System

By Samarth Kerudi & Dr. P Srihari
JNTU Hyderabad, India

Abstract- The high pace rise in the number of customers for communication systems and associated service provisioning has alarmed the requirement for certain optimal communication technique for optimal service of provisioning. The global system for mobile communication (GSM) has emerged as one of the most potential candidate to for communication systems. There is an inevitable need to enhance the key components of GSM systems such as, modulators and signal decoders. The assurance of these factors can lead low SNR communication in major application scenarios. Furthermore, ensuring efficient synchronization can be of great significance for GSM systems. In this paper, a highly robust and efficient system for low SNR, GMSK synchronization scheme has been developed for GSM system. The proposed joint synchronization scheme encompasses, symbol timing offset estimation, carrier frequency offset and carrier phase offset estimation scheme.

Keywords: GSM synchronization, GMSK modulation, symbol by symbol decoder, low signal to noise ratio.

GJRE-F Classification : *FOR Code: Sensor*

LOWSNRGMSKSYNCHRONIZATIONSCHEMEFORGSMCOMMUNICATIONSYSTEM

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Low SNR GMSK Synchronization Scheme for GSM Communication System

Samarth Kerudi [σ] & Dr. P Srihari [σ]

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Keywords: GSM synchronization, GMSK modulation, symbol by symbol decoder, low signal to noise ratio.

I. Introduction

In the last few decades, the high pace increase in communication system and the well known success of the Global System for Mobile Communication (GSM) has expanded its fin across globe to serve approximate 4 billion users globally (2010) [1]. GSM has emerged as a potential communication technology across industrialized as well as non-industrialized countries and it has established itself as a reliable solution for sophisticated 3rd generation and 4th generation communication systems. Interestingly, in numerous countries GSM is the only cellular network accessible till. The recently introduced enhanced GPRS (EGRPS) system, GSM can facilitate data rates of up to 1.2 Mb/s by means of enhanced modulation approached like 16 QAM and 32 QAM, and effective synchronization schemes etc. in general, the data retrieval of higher order modulation EGPRS signals at certain adequate SNR levels needs higher end radio frequency (RF) transceivers having very low noise figure [2] with effective channel equalization and respective demodulation mechanism at receivers [3]. To facilitate the low cost characteristic of 2G devices, the sophisticated and low complexity solutions are needed that might ensure efficient communication even at low SNR-levels and this is a key issue in the digital baseband of GSM based receivers. The efficiency of Gaussian Mean Shift keying (GMSK) based modulation technique has enhanced the GSM performance dramatically that enables it to deliver reliable solution even at lower SNR conditions with the input signal power level of -110 dBm that represents an SNR of approximate 7 dB.

This is the fact that in communication system, numerous modulation approaches depicts varied functional tradeoffs between the noise tolerances and cost in addition to other interferences as well as spectral efficiency etc. GMSK is one of the most employed modulation technique which is a type of the MSK modulation approach. In GMSK modulation technique, the phase of the carrier signal is varied constantly using a Gaussian filter shaped antipodal signal. Being a member of MSK modulation technique family, GMSK possesses the modulation index of 0.5. The implementation of the Gaussian filter emphasizes the energy, thus permitting lower band power output. The unvarying envelope permits GMSK modulation technique to be comparatively less vulnerable to the fading channel and hence an ideal mechanism for GSM communication. The symbol-by-symbol (SBS) demodulator [4] is considered to be a robust candidate for GMSK because of its robustness towards efficient decoding and less complex architecture as compared to Viterbi Algorithm (VA). To design an efficient demodulator, there is an inevitable need for perfect synchronization [4]. This paper intends to explore an efficient synchronization approach for GMSK modulation in GSM system.

Synchronization states a multi-parameter estimation issue that comprises the synchronization of key parameters such as symbol timing offset, carrier frequency offset and carrier phase offset. A number of researches have been done so far to enhance synchronization. In general, the approaches like maximum-likelihood or maximum-a-posteriori based joint estimation are of theoretical significance but are typically intricate in implementation [5]. Taking into consideration of the operational complexity and robust environment requirement in GSM communication system, fast synchronization algorithms permit low

Author α σ: e-mails: smke.sam@gmail.com, mail2pshari@yahoo.com

complexity. In this paper, we have emphasized on feed forward synchronization paradigm to alleviate the issues of hang-up problem that is common in major feedback based approaches [6]. An effort was made to implement complete feed forward scheme for joint carrier offset estimation and symbol timing offset estimation for MSK signals [6]. Unfortunately, it can't implement narrow-band GMSK signals due to poor performance [7]. An approach for joint frequency and timing recovery was suggested in [5] using MSK modulation technique that incorporated an estimation approach by combining multiple correlation functions having varied time lags. Unfortunately, this approach turns out to be much complicated for GSM implementation. One more effort was made in [8] where a combined time and phase synchronization approach was proposed, which was employed with MSK signals. Then while, the influence of the carrier frequency offset could not be examined. A well calibrated synchronization scheme for GMSK can facilitate optimal performance and can be a flexible alternative for digital implementation [9]. The existing systems for synchronization in GSM mobile communication are not sufficient while considering noise , power and mobility constraints. In this paper, a low SNR GMSK synchronization scheme has been proposed for GSM communication system. A brief of the implemented GSM system is given in the following section.

II. GSM Transciever: a Glance of System Model

This section discusses the implementation of GSM system and its synchronization. An overview of the proposed GSM model is presented in Figure 1.

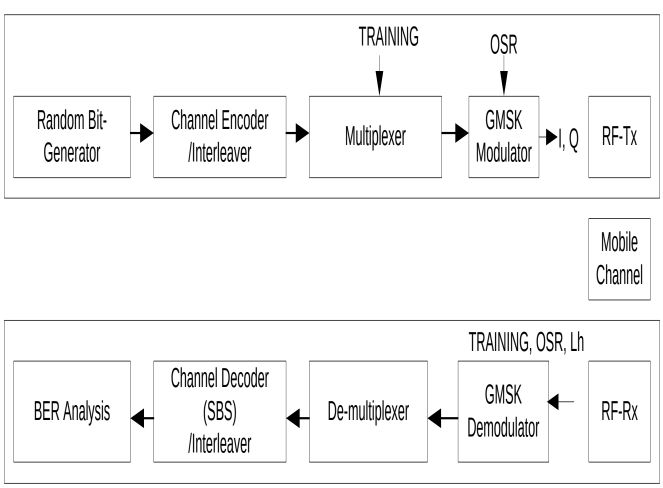

Figure 1 : Conceptual block diagram for a GSM transceiver

In this paper, we have used burst mode transmission for GSM simulation and a single GSM data block with 260 random bits has been generated. The generated random data bits have been feed as input data stream to the channel encoder and then interleaver. The interleaved data are then processed by a multiplexer (MUX) that splits the incoming sequence to form a GSM normal burst. Since, the burst type of input data requires certain training data sequence. In this model a 26 bit training signal has been introduced. Generating the GSM burst data the multiplexer returns it to the GMSK modulator that performs a differential encoding of the incoming burst to form a Non Return to Zero (NRZ) sequence, which is then subjected for GMSK modulation. The resulting signal is presented in terms of a complex baseband signal comprising real and imaginary signals, I and Q respectively. In our simulation model, the number of samples per data bit has been defined in terms of the oversampling rate (OSR). In our developed model OSR of value four (OSR=4) has been used. Considering realistic simulation environment, in our simulation Gaussian and Raleigh multipath fading channel has been used for simulation.

On the receiver side of the developed GSM model, three operational blocks have been developed. These are demodulator, demultiplexers, and channel decoder. As illustrated in Figure 1, the GMSK demodulator receives a GSM received burst by means of a complex baseband representation. On the basis of this data sequence, OSR, training sequence, and the desired length of the receiving filterL_h, the GMSK demodulator estimates the most probable bit sequence. Thus, the demodulated sequence is then employed as input to the demultiplexer where the bits are split in order to retrieve the actual data bits from the sequence. At this stage the other signal bits such as the control bits and the training sequence are released. Performing demultiplexing, the channel decoder has been done. In this paper the signal by signal (SBS) decoder has been implemented on the reconstructed sequence delivered by the channel decoder. This paper focuses on a joint synchronization paradigm for GSM system and has implemented SBS MAP decoder for data retrieval. The following sections focus on the implemented modulation, synchronization and decoding technique. The overall BER analysis has exhibited that the proposed joint synchronization approach enhances the performance of GSM system.

III. GMSK Modulator

Gaussian Minimum Shift Keying (GMSK) algorithm has been the most suitable approach of the continuous phase modulation (CPM) mechanism. The higher bandwidth efficiency and constant envelope modulation feature strengthens GMSK modulation for GSM systems (B=0.3) in mobile communication systems. Since last few decades CPM scheme has been explored to enable higher communication efficiency, better spectrum utilization and power efficiency. Primarily, CPM schemes are categorized into two broad types, called full response and partial response on the basis of the fact whether the modulation frequency pulse is of single symbol duration of longer. MSK is one of the popular types of a full response spectrally efficient modulation scheme. On the other hand, GMSK scheme is the most generic type of modulation scheme due to higher spectral efficiency and constant envelope modulation characteristics. GMSK modulation scheme has h=0.5 partial response CPM scheme originated from MSK with the addition of baseband Gaussian filtering implemented to the identically and distinctly distributed random rectangular pulse shaped input signal earlier to the frequency modulation of the carrier signal. The following section discusses the GSM receiver architecture and the proposed synchronization scheme at the GSM receiver.

IV. GSM Receiver Signal Model

In our implemented GSM model, the complex envelope of the received baseband GMSK signal is obtained as:

$$r(t) = e^{[2\pi vt+\theta]} s(t-\tau) + w(t) \tag{1}$$

where ν represents the carrier frequency offset, θ represents the carrier phase offset and τ states for symbol time offset. The noise component $w(t)$ states the complex valued Gaussian and Rayleigh fading channel noise with real and imaginary signal components, individually possessing two-sided power spectral density given by$\sigma^2 = N_0/2E_b$where E_b represents the received signal energy per symbol. The transmitted signal $s(t)$ is given by

$$s(t) = e^{j\psi\,(t;a)} \tag{2}$$

Where $\psi(t; a = \pi \sum_k a_k\, q(t-kT)$ represents the information bearing phase. Here, z=a_i refer the data symbols having the values of ± 1 with equal likelihood. The variable Trepresents the symbol period while $q(t)$ states the phase pulse of the modulator. It is in fact, the integration of the frequency pulse$g(t)$. In order to facilitate the estimation of symbol time offset, carrier frequency offset and carrier phase offset, $s(t)$ in the nth duration$(nT \leq t \leq (n+1)T)$ can be represented as follows [10].

$$e^{j\psi\,(t;a)} = exp\left(j\frac{\pi}{2}\sum_{k=0}^{n-2} a_k\right)\prod_{k=n=1}^{n} exp[j\pi a_k q(t-kT)] \tag{3}$$

$$\alpha_{0,n} = exp\left(j\frac{\pi}{2}\sum_{k=0}^{n-2} a_k\right) \tag{4}$$

and $\alpha_{0,n} = (ja_n)\alpha_{0,n-2}$.

Considering (2), it can be found that the baseband signal $s(t)$ can be represented in a linear form [10] as depicted below:

$$s(t) = e^{\psi\,(t;a)} = \sum\nolimits_{i=0}^{n} \sum_{k=n=2}^{n} a_{i,k}\, h_i(t-kT) \tag{5}$$

The probable values of the parameter $\alpha_{1,n}$ can be$(ja_n)\alpha_{0,n-2}$. In our developed model, we have initialized$\alpha_{0,-2} = 1$, without any loss of generality by considering that there is no data transmission to time $t = -T$ and$\alpha_{-1} = 1$. In our proposed model, the nonlinear GMSK signal $s(t)$ has been decomposed into sums of amplitude modulated (AM) pulses in two dimensions and the two pulse shaping filters $h_0(t)$ and$h_1(t)$have been employed. The impulse shaping filter has been obtained as[10] $h_0(t) = p(t-T)p(t-2T)$ for $t \in [0,3T]$ and $h_1(t) = p(t-2T)p(t+T)$ for$t \in [0,T]$, where the variable $p(t)$ refers

$$p(t) = \begin{cases} \cos(\pi q(t), & t \in [0,2T] \\ p(-t), & t \in (-2T,0) \\ 0, & |t| \geq 2T. \end{cases} \tag{6}$$

In case of the GMSK signals, $g(t)$, which is the frequency pulse represents the convoluted output of a low-pass Gaussian filter having a rectangular pulse in the duration of T and magnitude $1/(2T)$. Mathematically, it is represented as follows:

$$g(t) = \frac{1}{2T}\left\{Q\left[\frac{2\pi B}{\sqrt{ln2}}\left(t-\frac{3T}{2}\right)\right] - Q\left[\frac{2\pi B}{\sqrt{ln2}}\left(t-\frac{T}{2}\right)\right]\right\} \tag{7}$$

In (7), B represents the 3 dB bandwidth of the implemented Gaussian low-pass filter and$Q(x) = {}^{1}\!/_{\sqrt{2\pi}} \int_x^\infty e^{-t^2/2}\, dt$. In general, $g(t)$ is time truncated in the interval of$[0, LT]$, which is further normalized as$\int_0^{LT} g(t)dt = \frac{1}{2}$. In GSM system, the design parameter BT has been selected as 0.3 and L=2, as $g(t)$ is found to be approximate zero in case of$t \geq 2T$. Now, substituting $s(t)$ by means of its linear equation as presented in (5), the signal in its discrete form can be represented as follows:

$$r_{k,n} = e^{j}\left[2\pi v\left(kT + n\frac{T}{N}\right) + \theta\right] \times \sum_{i=0}^{1}\sum_{l=k-2}^{k} \alpha_{i,l} h_k\left((k-l)T + n\frac{T}{N} - \tau\right) + w_{n,i} \quad (8)$$

Here, the sampler of the received signal is denoted by $r_{k,n}$ while, $w_{n,i}$ represents the noise at time $t = kT + n\frac{T}{N}$, where N signifies the OSR value and $T_s = T$ sampling time. In fact, the linear presentation of the GMSK scheme is equivalent to the PAM modulation except with the inclusion of inter-symbol interference (ISI). In the case of no ISI, the signal may be reduced to the MSK signal. These features motivate us to develop certain enhanced synchronization scheme for GMSK by amalgamating these approaches for MSK so as to reduce noise of interference to a significant level. In this paper, we have proposed a joint synchronization paradigm to enhance BER performance. A brief of the proposed synchronization schemes for symbol timing, phase and frequency is discussed in the following sections.

a) Symbol Timing Offset Estimation

The MCM scheme is particularly developed for MSK scheme and in case of its implementation with GMSK; it depicts degraded results [11]. Then while, it has been found that the feedforward mechanism based timing recovery can be highly efficient in case of burst transmission. Since, in this paper, we have developed a burst transmission based GSM system, the feedforward mechanism can be of considerable significance. Here, we have introduced a modified time offset estimation algorithm to enhance GSM performance in mobile communication environment. The predominant concept behind the implementation of MCM scheme is to implement the nonlinear combinations of the delayed versions of the baseband signal comprising certain periodic signal components, which may be easily exploited for clock recovery. In general, to perform synchronization of the MSK signals, the following fourth-order nonlinear transform is employed.

$$z(t) = E\{[x(t)x^*(t - mT)]^2\} \quad (9)$$

where $E\{.\}$ represents the anticipation function, while the variable m refers an integer. In case $x(t) = r(t)$, the variable $z(t)$ can be represented as

$$z(t) = e^{j4\pi m v T} g(t - \tau) + n(t) \quad (10)$$

where $n(t)$refers noise and $g(t)$ refers the periodic signal. Thus, the periodic signal can be presented by

$$g(t) = E\left\{e^{j2[\psi(t;a) - \psi(t - mT;a)]}\right\} \quad (11)$$

$$= \prod_{k=-\infty}^{\infty} cos(2\pi[q(t - kT) - q(t - (k+m)T]) \quad (12)$$

Thus, considering equation (10), the timing information has been obtained.

For MSK signals, $m = 1$ is used as per suggestions for MCM scheme [11]. In order to enhance the performance of the proposed GMSK modulation technique, a number of periodic signals having distinct m have been combined to calculate the time offset [12], still this scheme suffers from higher computational complexity. Hence, in this paper, we have employed a simplified correlation function having $m = 2$. Our proposed scheme is equivalent to the MCM scheme which is applauded due to its flexible implementation with hardware. In our proposed approach, $r(t)$ has been filtered using a low-pass filter that results into enhanced SNR for time offset calculation. Here we have used the matched filter to enhance the SNR at the GSM receiver. In our proposed system, taking into consideration of the fact that $h_1(t) \ll h_0(t)$ [10], only one-dimensional matched filter $h_0(t)$ has been used that significantly reduces complexity. The result of the matched filter has been fed into the time offset estimator and hence the prime difference of our proposed system and others [11] [12] is the input to the nonlinear transform function. In the proposed system the $x(t)$ is obtained by

$$x(t) = r(t) \otimes h_0(-t) \quad (13)$$

Consider$x_{k,n} = x(t)|t = kT + nT_s$. Thus, the overall timing synchronization can be obtained by

$$\hat{\tau} = -\frac{T}{2\pi} arg \sum_{n=0}^{N-1}\left\{\sum_{k=0}^{L_T-1}\left[x_{k,n}{x^*}_{k-2,n}\right]^2\right\} e^{-j2\pi n/N} \quad (14)$$

where $arg(.)$ represents the phase processing, and *LT* represents the observation period for timing synchronization.

b) Carrier Frequency Offset Estimation

Performing symbol timing offset estimation; we have interpolated the received signals to get the sampler at the correct sampling time and the received signal which is already time synchronized is employed for carrier frequency offset estimation. In this paper, we have used preamble added or data added carrier frequency offset estimation scheme for synchronization. A well known frequency estimator is Fitz scheme [13] that employs the phase of the correlation associated with the delayed versions of the demodulated signals, then while its performance primarily depends on the delay. In order to enhance the estimation accuracy, a large delay is anticipated that might confine the synchronization range. On contrary, in GSM systems, the synchronization range is expected to be wider because of robust functional dynamicity and hardware characteristics. To reduce the delay, a maximum delay cap is introduced, which is obtained by

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$$D_{max} < \frac{1}{2|v_{max}|T} \tag{15}$$

Because of the shortcomings in D_{max}, the preciseness of the carrier frequency offset might be compromised in case of Fitz algorithm implementation. In this paper, the generic Fitz scheme has been enhanced to the sample level and thus the ultimate sampling of the demodulated signal has been obtained as follows

$$y(iT_s) = r(iT_s)s^*(iT_s - \hat{\tau}) \tag{16}$$
$$= e^{j[2\pi v(kT+nT_s)+\theta(iT_s)]} + n'(iT_s)$$

Where $k = \left\lfloor \frac{i}{N} \right\rfloor$ and$n = i - Nk$. Here,$\phi(iT_s)$ result from the timing estimation error and other variable $n'(iT_s)$ represents the zero-mean noise. In case of accurate time estimation, the impact of$\phi(iT_s)$ has been neglected and thus the carrier frequency offset, $\hat{v}$ has been obtained by

$$\hat{v} = \frac{1}{\pi D(ND+1)T} \sum_{m=1}^{ND} argR(m) \tag{17}$$

where D represents a parameter less than D_{max} and $R(m)$ represents

$$R(m) = \frac{1}{NL_{f-m}} \sum_{i=m}^{NL_{f-m}} y\left((iT_s)y^*(i-m)T_s\right) \tag{18}$$

Where L_f represents the observation period for carrier frequency offset estimation. Our proposed scheme functions at the sample level that might enhance the overall performance and it is because of the increased delay length at the sample level due to multiplication with the oversampling rate (OSR) *N*.

c) Carrier Phase Offset Estimation

The carrier frequency offset introduces certain phase rotation in $y(iT_s)$ (16) that can be significantly alleviated by employing $\hat{v}$ in (17). Performing carrier frequency offset alleviation; the carrier phase offset estimation can be performed by

$$\hat{\theta} = tan^{-1} \frac{\sum_{i=0}^{L_\theta - 1} I[y_c(iT_s)]}{\sum_{i=0}^{L_\theta - 1} R[y_c(iT_s)]} \tag{19}$$

where $R[.]$ and $I[.]$ are the real and imaginary part of a complex signal, respectively. Here, $L_\theta \theta$ represents the duration for the phase synchronization. Finally, $y_c(iT_s)$ represents the compensated (carrier frequency offset) and demodulated signal. Mathematically, it can be expressed as

$$y_c(iT_s) = e^{j[2\pi(kT+nT_s)\hat{v}]} y(iT_s) \tag{20}$$

where $k = \left\lfloor \frac{i}{N} \right\rfloor$ and $(n = i - Nk)$.

Here, it must be noted that $L_\theta$varies as per variation in the phase property and the higherL_θ assures better phase estimation, under the condition that θ is constant duringL_θ. Still, it can be found that because of the residue carrier frequency offset introduced by certain imperfect frequency estimation, the phase gradually but steadily changes over time and therefore L_θ cannot be more than the logical phase processing time. In this paper, introducing preamble, the initial value of θ has been estimated which has been updated during the data transmission. To decode the data, in our proposed model, we have employed symbol by symbol (SBS) MAP decoding scheme. A brief of the implemented SBS MAP algorithm is given in the following section.

V. Symbol by Symbol Demodulation

This is the matter of fact that the symbol-by-symbol (SBS) maximum *a posteriori* probability (MAP) algorithm, also known as SBS MAP algorithm is an optimum decoding algorithm for codes , which can be presented by a trellis of finite duration [15][16][17]. In this paper, SBS MAP demodulation has been employed, which has been derived for the case of continuous phase modulation (CPM) signals transmitted over Gaussian and Rayleigh flat-fading channels, and a corresponding receiver structure, as already discussed in above sections. The proposed SBS MAP algorithm needs estimating the sum of the products (SOP) of the weights of all traces or paths across the trellis which pass through that specific branch. Such computation can be significantly enhanced by means of certain forward and backward recursion scheme across the trellis. In this paper, we have explored the strengths of an existing literature [18] and we have used MAP algorithm for demodulation in our proposed GSM systems. SBS MAP algorithm employs *a priori* symbol probabilities function at its input and generates optimal decisions as its output. Since, this approach is well suited for iterative process based applications, where processed and refined input symbol probabilities are iteratively fed back to the demodulator as *a priori* information. Thus, the ultimate refined results and respective decisions generate enhancements in the successive phases. SBS MAP algorithm has illustrated significant performance for decoding utilities for communication systems [19][20][21]. A brief of its functional approach is given as follows:

Consider certain received sample sequence, the predominant objective of SBS MAP demodulation algorithm is o estimate all feasible symbols, respective times, and the likelihood that certain symbol was transmitted at that specific time instant. Determining the probabilities of these parameters, the demodulator may than employ them to perform decisions and further they can be employed for extracting bit soft decisions. In this section, the process for demodulating certain CPM signals with the conditional probability density values on the Gaussian and Rayleigh flat-fading channels has been discussed. Some of the variables used for SBS demodulator are given as follows:

B → Transition Probabilities of the states
Q → Number of data symbols
N →The length of data block, in symbol periods;
M → number of states in trellis at a given time;
K →hypothesis;
R →number of samples/symbol
T →discrete-time index, in symbol periods;
U → transmitted symbols;
X → transmitted symbol samples;
Y → received symbol samples;
U(k) → Q-ary input symbols;
X(k) → Transmitted samples.

In our developed SBS modulator, it has been assumed that the collective memory of the channel and the modulator is lower than the K symbol periods so that any received sample is impacted by not more than $K+1$ successive input symbols. Hence, as a result the trellis is formed less than $M = Q^k$ states can be used. Here, the individual trellis node posses Q input branches and same output branches, where the individual branch corresponds to one of the Q data symbols. Here, it can also be considered that in our proposed GSM system, our proposed system functions on a block of data which starts and ends in certain acknowledged state. An approach to obtain such condition may be to start and end the individual data block with certain known symbols. B, the state transition probabilities is of great significance because these can be employed for estimating the probability that a symbol was transmitted at certain time t. Now, consider the subset of the set of hypotheses $\{k\}$ be $C_t(m', m)$ which traverse certain trellis branch in between the states $s_{t-1} = m'$ and$s_t = m$. In our proposed model, the state transition probability has been estimated by

$$P_r\{\, s_{t-1} = m'; s_t = mY\} = \frac{\sum_{k \in C_t(m',m)} \Pr\{\dot{U} = U(k)Y\}}{\sum_k \Pr\{\dot{U} = U(k)Y\}} \tag{21}$$

In order to estimate the state transition probability (21), the parameter$\left|\Pr\{\dot{U} = U(k)Y\}\right|$ has been obtained using Bayes' theorem [22], which is expressed as

$$\Pr\{\dot{U} = U(k)Y\} = \frac{\mathrm{p}(Y\dot{U} = U(k)).\Pr\{\dot{U} = U(k)\}}{p(Y)} \tag{22}$$

Substituting (22) in (21), it can be noticed that all the terms would have similar denominator that would be cancelled and hence can be ignored in calculation. To evaluate the numerator in (22), in our model, we have assumed that the $Q-ary$ input symbols, which are transmitted at certain distinctive time instants, are usually independent. Hence, the second factor of the numerator in (22) is turns out to be

$$\Pr\{\dot{U} = U(k)Y\} = \prod_{t=0}^{N-1} \Pr\{\tilde{u}_t = u_t(k)\} \tag{23}$$

Now, considering first factor in the numerator of (22), $p\big(Y\dot{U} = U(k)\big)$, it can be found that there exists a 1-to-1 connection between the input vectors$U(k)$ and the transmitted sample vector$X(k)$. Hence, as a result, it is obtained as

$$p(Y\dot{U} = U(k)) = p(Y\dot{X} = X(k)) \tag{24}$$

Thus, the right-hand side of (24) is obtained by

$$p_{y|x}[Y|X(k)] = p_{y|x}\big[(y_{rN-1}, \dots, y_1, y_0)\big|X(k)\big] = \prod_{j=0}^{rN-1} p_{yj}\; y_{j-1}[y_j|y_{j-1}(k)] \tag{25}$$

Where

$$y_j(k) = \{(y_j, \dots, y_1, y_0), X(k)\} \tag{26}$$

Here, the estimation of the factor $p_{yj} \mid y_{j-1}[y_j|y_{j-1}(k)]$ depends on the channel model and modulation scheme, which in our proposed system are Gaussian and Rayleigh fading channel and GMSK modulator respectively. Now, here we consider that the computation does rely primarily on $K+1$ symbols associated with a trellis possessing Q^k states. During the formation of trellis and for any trellis branch, the individual feasible symbol at certain specified time is exclusively characterized by the starting and ending states of the subsequent branch at that time. Hence, in our proposed SBS algorithm there is a 1-to-1 connection between the input symbols sequence $U(k) = \{u_1(k) \cdots u_{N-1}(k)\}$ and the state transition sequence $M(k) = \{(m', m)_0 (m', m)_1 \cdots (m', m)_{N-1}\}$, where $\{(m', m)_t\}$ states the initial and end (i.e., starting and ending) states for kth hypothesis at certain time t. In our developed algorithm m'at time t is equivalent to that of m at time$(\,t-1)$.

Consider,

$$W_t(m', m) = \prod_{j=rt}^{r(t+1)-1} p_{yj}\; y_{j-1}[y_j|y_{j-1}(k)] \tag{27}$$

Now, substituting equation (27) into (25) gives

$$p_y[Y\,X(k)] = \prod_{t=0}^{N-1} W_t(m',m) \tag{28}$$

Where $\{W_t((m',m)\}$ is independent of the hypothesis k as the estimation of $p_{yj}\,y_{j-1}[y_j\,y_{j-1}(k)]$ depends only on $K+1$ successive symbols. Now taking into consideration of the equations, (23, 24, 28), the numerator of (22) becomes

$$p\left(Y\widetilde{U} = U(k)\right).Pr(\widetilde{U} = U(k)\} \tag{29}$$

$$= \prod_{t-1}^{N-1} Pr\{\tilde{u}_t = u_t(k)\}\,.\,W_t(m',m)$$

$$== \prod_{t-1}^{N-1} \daleth_t(m',m)$$

Where $\daleth_t(m',m) = Pr\{\tilde{u}_t = u_t(k)\}\,.\,W_t(m',m)$. As the sequence of multiplicative branch weights is a function of the hypothesis k, individual multiplicative branch weight $\daleth_t(m',m)$ are not functions of the hypothesis k due to the reason that the individual branch is connected to certain specific symbol and hence all those hypotheses which pass through certain specific branch encompasses the specific symbol in that duration. Thus, finally, the state transition probability, as defined in equation (21) becomes

$$\Pr\{S_{t-1} = m'; S_t = mY\} = \frac{\sum_{k\in C_i(m'_t,m_t)} \prod_{i=0}^{N-1},\daleth_i(M_i(k))}{\sum_k \prod_{i=0}^{N-1} \daleth_i(M_i(k))} \tag{30}$$

Where $M_i(k)$ represents the ith element of the hypothesized path through the trellis$M(k)$. For the purpose of signal demodulation in GSM (GSM Standard GSM 05.03), we are interested in estimating $Pr\{u_t = qY\}$ where q refers one of the Q-ary input symbols, which is input to the SBS MAP demodulator. In our proposed decoder, it has been estimated by adding the overall transition probabilities corresponding to those all branches allied with the symbol $q$at certain time$t$. In this paper, computations based on soft as well as hard decisions based demodulation has been done, where decoding using hard decision has demonstrated better performance as compared to soft decision process. The final decoded signals have been used for bit error ratio analysis. The results obtained for BER analysis with different SNR and Eb/N0 are discussed in the following section.

VI. Results and Discussion

In this paper, a novel synchronization scheme for Gaussian Minimum Shift Keying (GMSK) algorithm has been developed for low SNR, GSM system. To simulate GSM system, a burst mode transmission scheme has been developed for GSM simulation, where a single GSM data block with 260 random bits has been employed as input data sample. The overall simulation model has been developed using MATLAB software and GSM 05.05 (3GPP TS 05.05 standard) standard. The overall developed transmitter and receiver components comprises data generator, differential coding, interleaver, multiplexer, GMSK modulator and GMSK demodulator, demultiplexer, de-interleaver, SBS based decoder, respectively. Here for simulation, BT=0.3 (GSM standard), oversampling rate (OSR) of 4 and sample time $T = 3.692 \times 10^{-6}$ has been considered. In this paper we have proposed a joint synchronization scheme that intends to synchronize symbol time offset, carrier frequency offset and carrier phase offset altogether. Unlike other GSM synchronization schemes, in this paper we have used three variables (time, frequency and phase) based synchronization altogether. In this paper, we have developed a symbol by symbol (SBS) maximum *a posteriori* probability (MAP) algorithm, named SBS-MAP algorithm for signal decoding, which has been followed by Bit Error Ratio (BER) analysis. Figure 2 represents the BER performance of our proposed GMSK modulation based synchronization scheme for GSM system. Figure 3 depicts signal to noise per bit (Eb/No) for the developed system. GSM 05.05 and other standards for GSM communication system suggests low SNR up to 7dB for mobile communication. These hard decision based SBS decoding affirms better performance. Following figure affirms the standard requirements (Figure 2 and Figure 3) for GSM systems. Figure 4 represents the BER performance with varying block size or data frame, where the results obtained assures better performance with decreasing SNR slope as per increase in number of data blocks.

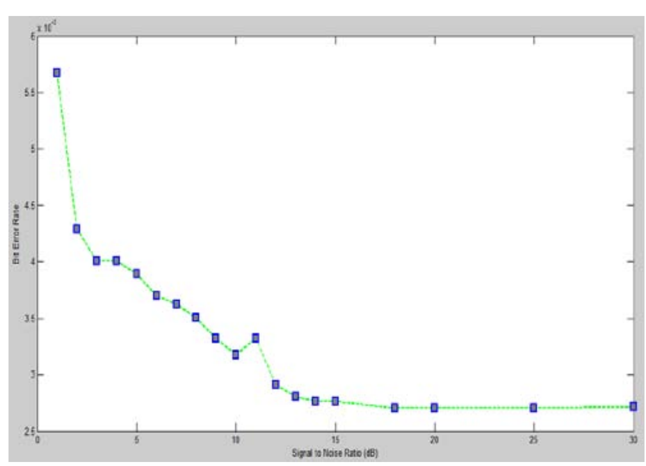

Figure 2 : BER Vs SNR

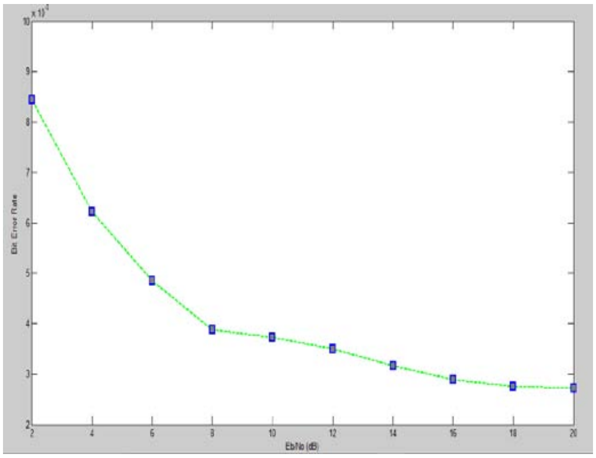

Figure 3 : BER Vs Eb/No

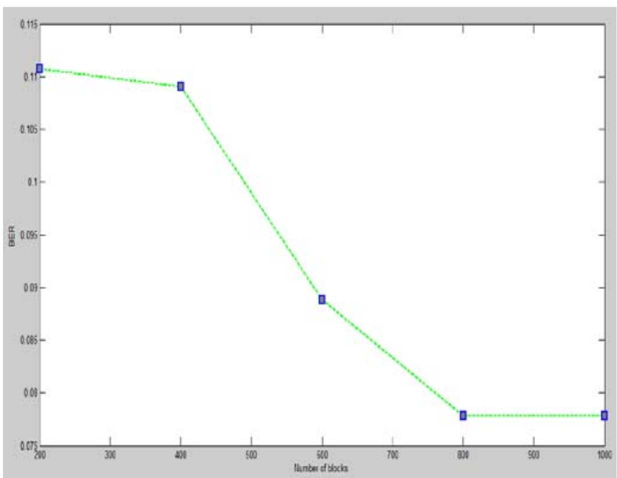

Figure 4 : BER Vs Number of Blocks (Frames)

VII. Conclusion

Being a very potential candidate for mobile communication system, GSM has emerged with varied communication facilities and supporting services. The ultimate service qualities of GSM systems are undoubtedly influenced by the efficiency of modulation techniques and signal decoding. In addition, synchronization of signals can be a significant approach to enhance efficiency of the communication system. Considering these as motivation, in this paper, a Gaussian Multiple Shift Keying (GMSK) synchronization scheme has been developed for GSM systems. The novelty of this paper is the implementation of symbol time offset estimation, carrier frequency offset estimation and carrier phase offset estimation altogether for an efficient synchronization. Furthermore, the implementation of symbol by symbol (SBS) demodulator for signal decode has also resulted better performance. The developed burst mode transmission paradigm based GSM system and its efficient synchronization has enabled it to be efficient for low SNR environment. In future, the comparative performance analysis of the proposed scheme can be done with other modulation techniques and synchronization approaches for GSM systems.

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Reducing Generation Cost in Transmission System using Facts Devices

By K. Niteesh Kumar & Dr. Ch. Chengaiah
SV University, India

Abstract- In recent years, a number of Flexible AC Transmission system (FACTS) devices have been proposed for better utilization and enhancing the power transfer capability of existing power transmission network. There are several conventional methods to improve the voltage profile and annual savings, but FACTS devices are shown better results to improve transmission line performance such as power profile and annual savings. The ability to enhance power transfers lead to their applications in a multi machine power system for the purpose of an overall reduction in power generation cost, compared to others. This paper focus on the evolution of economic viability for reducing generation cost using FACTS devices. The most and versatile FACTS devices, such as Static Var Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC) and Unified Power Flow Controller (UPFC) are used to improve transmission capacity of the system. The devices are incorporated in the system by the Optimal Power Flow method and Genetic Algorithm based optimization technique. The proposed methods are tested on IEEE-57 bus system and the corresponding test results are compared with conventional method.

Keywords: optimal power flow, genetic algorithm, SVC, TCSC, UPFC and LDC.

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REDUCINGGENERATIONCOSTINTRANSMISSIONSYSTEMUSINGFACTSDEVICES

Strictly as per the compliance and regulations of :

Reducing Generation Cost in Transmission System using Facts Devices

K. Niteesh Kumar [α] & Dr. Ch. Chengaiah [σ]

Abstract- In recent years, a number of Flexible AC Transmission system (FACTS) devices have been proposed for better utilization and enhancing the power transfer capability of existing power transmission network. There are several conventional methods to improve the voltage profile and annual savings, but FACTS devices are shown better results to improve transmission line performance such as power profile and annual savings. The ability to enhance power transfers lead to their applications in a multi machine power system for the purpose of an overall reduction in power generation cost, compared to others. This paper focus on the evolution of economic viability for reducing generation cost using FACTS devices. The most and versatile FACTS devices, such as Static Var Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC) and Unified Power Flow Controller (UPFC) are used to improve transmission capacity of the system. The devices are incorporated in the system by the Optimal Power Flow method and Genetic Algorithm based optimization technique. The proposed methods are tested on IEEE-57 bus system and the corresponding test results are compared with conventional method.

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I. Introduction

Stringent requirements imposed on electric utilities in addition the environmental impact of constructing new transmission lines exert increasing restrictions on the expansion of existing transmission networks.

FACTS technology has introduced new, yet effective, ways of controlling a power network, which makes the system operation more flexible and secure. This is accomplished by targeting/ modifying key elements in power flow, namely transmission line impedance, phase angle, and voltage magnitude. The flexibility gained in this regard is an achievement not to be taken lightly as it benefits the power system economically and technically.

The flexibility to the power system offered by installing FACTS devices comes at substantial cost though and such necessitates careful planning of new installations of FACTS devices. One of the main elements of planning is the selection and placement of candidate FACTS devices in the power system which will provide the highest added value to the system in terms of cost saving and system operation improvements.

Various assessment tools exist, and have been used in the past for this purpose but the Optimal Power Flow (OPF) seems to be one of the best suited for this task due to its scalar measurability of the economic and technical benefits that play a crucial role in the investment decision. Some studies such as [1-2] used OPF for the allocation of FACTS devices in order to maximize the benefits arising from their usage while others [3-4], incorporated the FACTS devices cost in order to show them as a cost effective solution.

This paper focuses on economical benefits due to the installation of FACTS devices where the emphasis is on attaining maximum profitability over the lifetime of the devices. The allocation process relies heavily on OPF calculations and Genetic Algorithm (GA) optimizations for the placement of three types of FACTS devices (SVC, TCSC and UPFC) where the objective is founded on the cost of generated active power, net annual savings, and load growth. The annual Load Duration Curve (LDC) is employed in this study for the purpose of selecting a range of operating conditions and in turn having an unbiased solution.

II. Modelling of Facts Devices

From an operational point of view, the power flow in an electrical network between any two buses is governed by the voltage magnitudes and angles of the respective buses and impedance of the line is expressed as

$$P_{12} = \frac{v_1 v_2}{x} \sin(\delta_1 - \delta_2) \ldots\ldots\ldots \quad (1)$$

From this expression the FACTS devices of SVC, TCSC and UPFC are discussed in the following way.

a) *Static Var Compensator (SVC)*

Increasing power transfer during steady state conditions and controlling the voltage profile has long been recognized as key contribution of reactive shunt compensators. The reactive compensation changes the transmission line characteristics to cope with the load demand. A detailed review of Static Var Compensators can be found in [3, 7]. The steady state SVC model comprises two ideally switched parallel elements a

Author α σ: Department of Electrical and Electronics Engineering, SVU College of Engineering, SV University, Tirupati, A.P., India.
e-mails: niteesheee@gmail.com, chinthapudi_ch@rediffmail.com

variable capacitor and a variable inductor shown in Fig.1 the range of injected or absorbed values are lies between -80 MVAr to +80 MVAr. The mathematical model of SVC is described as [11]

$$I_{SVC} = jB_{SVC}V \qquad \text{.................. (2)}$$

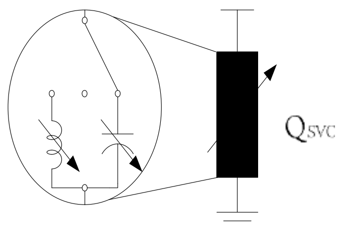

Fig.1 : SVC Steady State Model

From the fig.1 the reactive power is exchange with an 'ith' bus can be expressed as

$$Q^i_{SVC} = B^i_{SVC}.V_i^2 \quad \text{........................(3)}$$

Where

i=1, 2, 3..........are the buses.

b) Thyristor Controlled Series Capacitor (TCSC)

A TCSC model in steady state which accounts for the compensation or gain in transmission line reactance consist of three ideally switched parallel elements such as a capacitor, an inductor, and a wire which is shown in fig.2. With this arrangement there is no effect of system performance. However the inductance and capacitance are variable and their values are expressed as a function of the line reactance.

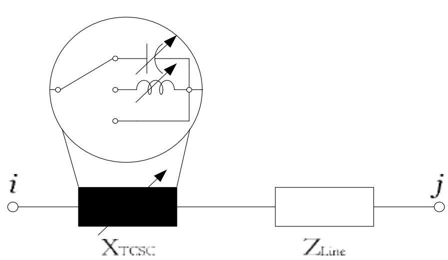

Fig. 2 : TCSC Steady State Model

The effective impedance of the transmission line with TCSC is governed by the following expression

$$\left.\begin{aligned} X_{eff} &= X_{line} + X_{TCSC} \\ &= (1+K)X_{line} \end{aligned}\right\} \qquad \text{.............. (4)}$$

where

X_{line} and X_{TCSC} are the line and TCSC impedances, k is the degree of compensation[3, 7] which is obtained by

$$K = \frac{X_{TCSC}}{X_{line}} \qquad 0 \le K < 1$$

By considering the reference values in this study, the maximum value of gain was set at 20% of the line impedance while the maximum compensation was fixed at 80% of the line impedance.

c) Unified Power Flow Controller (UPFC)

Among the available FACTS devices, the UPFC is capable of supplying and absorbing both real and reactive power. The basic configuration of a UPFC is shown in Fig.3. And it consists of two ac/dc converters.

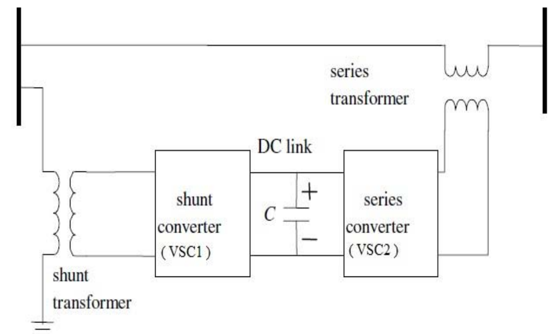

Fig. 3 : UPFC Steady State Model

One of the two converters is connected in series with the transmission line through a series transformer and the other in parallel with the line through a shunt transformer. The dc side of the two converters is connected through a common capacitor, which provides dc voltage for the converter operation. The power balance between the series and shunt converters is a prerequisite to maintain a constant voltage across the dc capacitor. As the series branch of the UPFC injects a voltage of variable magnitude and phase angle, it can exchange real power with the transmission line and thus improves the power flow capability of the line as well as its transient stability limit. The shunt converter exchanges a current of controllable magnitude and power factor angle with the power system. It is normally controlled to balance the real power absorbed from or injected into the power system by the series converter plus the losses by regulating the dc bus voltage at a desired value.

From the modelling analysis of FACTS devices the cost function of generation is evaluated with proposed FACTS devices which are described in the following subsequent sections in this paper.

III. Generation Cost Functions

The cost function of generated active power can be represented by a second order polynomial equation is

$$C_p = C_0 + C_1P + C_2P^2 \quad (\$/hr) \qquad \text{.........(5)}$$

The adopted values for the coefficients are taken from MATPOWER toolbox is shown in Table. 1. Where the first column represents the generator number, the second column shows the bus at which the generator is connected, and the rest of the columns represent the coefficient values accordingly.

Table 1 : Cost function coefficients

G_{num}	Bus	C_0	C_1	C_2
1	1	0	20	0.0775795
2	2	0	40	0.01
3	3	0	20	0.25
4	6	0	40	0.01
5	8	0	20	0.0222222
6	9	0	40	0.01
7	12	0	20	0.0322581

From the table.1cost function coefficient values are considered for evaluation of generation cost in transmission system.

IV. The Proposed Methodology

The aim of placement of the chosen FACTS devices in the network is to maximize the profits gained by such placement. The profit is created by reducing the generation cost (while at the same time obeying the limits imposed by the physical network, i.e., the thermal limits of the lines and the voltage limits of the buses) which introduces savings that will be compounded over the lifetime of the devices. On its own, the optimization problem is formulated based on the OPF variables which consist of real and reactive generator injections (Pg and Qg), and voltage magnitudes (V) and angles (θ) at each bus. Thus, the optimization problem is expressed as

$$min \sum_{n}^{N_p} (C_{pn}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

Subject to

-Power balance equations for equality constraints are

$$\sum_{m}^{N_b} |V_j||V_m|(G_{jm}\cos\theta_{jm} + B_{jm}\sin\theta_{jm}) - P_{gj} + P_{gj} = 0 \quad \ldots (7)$$

$$\sum_{m}^{N_b} |V_j||V_m|(G_{jm}\sin\theta_{jm} - B_{jm}\cos\theta_{jm}) - Q_{gj} + Q_{gj} = 0 \quad \ldots (8)$$

-Operational Constraint

$$P_{gj}^{min} \le P_{gj} \le P_{gj}^{max}$$

$$Q_{gj}^{min} \le Q_{gj} \le Q_{gj}^{max}$$

$$|V_j^{min}| \le |V_j| \le |V_j^{max}|$$

$$|S_j(\theta, V)| \le S_j^{max}$$

Where

N_b= Number of buses

N_g= Number of generator buses

N_T= Number of transmission lines

P_d= Power demand

S_j^{max}= Thermal limit

$G_{jm}+iB_{jm}$= jm[th] element of the Y-bus matrix

From the above analysis the FACTS devices are located in electrical transmission system with GA technique [12]. This is most versatile technology to identify the location of FACTS devices in the system with respect to OPF analysis. From the literature the annual load duration curve and corresponding operating conditions and their cumulative percentages are considered for the operation of FACTS devices in the system.

With this technique the following steps are summarised for the placement of FACTS devices in IEEE-57 bus system.

1. The Optimal Power Flow will run after each gradual increase in the network loading factor until the solution diverges. This divergence was a result of one or multiple network constraints violations. The load factor at the point of divergence is recorded as the limiting network loading factor.
2. Identify the areas at which load growth might occur and repeat step 1 but only for those buses that foresee load growth. The maximum loading factor is recorded in the same manner as of step1. This loading factor will be greater than that of the pervious step.
3. Based on a typical load duration curve eleven operating conditions are elected for use in the allocation of FACTS devices. The operating conditions will start at 100% of the system maximum demand coming down to the minimum one. The limiting network load is set as the maximum demand.
4. A total of three FACTS devices, i.e., one devices of each kind, are made available for the placement.
5. Genetic Algorithm originally discussed in [13] is modified i.e., made more computationally efficient and applied for the optimal placement of the FACTS devices.

Each device has two extra variables that need determination, rating and location. The SVCs have 50 buses available as possible locations, excluding the seven generator buses, and their allowed rating is from -80 MVAr to +80 MVAr.

On the other hand, the remaining FACTS devices have no restrictions at all as to where their allocation takes place. Finally, TCSC has a range of -0.8 to 0.2 of the line reactance and for UPFC has a range of 0.1 of max voltage and range of the angle between-180 degree to +180 degree

6. Only one device can be installed on a bus or a branch. Most practices call for a use of a penalty factor that increases the cost of allocation in case a second device is occupying the same location. This has the effect of eliminating the solution from further consideration. In this study the penalty factors were not applied, instead suggested locations of all devices are checked to insure that each device

occupies a distinct bus or branch otherwise the hypothesized locations are discarded.

From the proposed technique the IEEE-57 bus system is tested and the test results are described in the following section.

VII. Test of IEEE-57 Bus System

The layout of IEEE-57 bus system consists of 7 generator buses, 17 transformers and 80 transmission lines and the total load of P=1250.80MW and Q=336.40MVAR. For obtaining generation cost the system has tested with OPF-GA on MATPOWER tool box and the corresponding test results of generation cost, loading factors, annual savings and voltage profile are shown from table.2 to table.5.

Table 2 : Generating Cost

Parameter	Generating Cost			
	Without FACTS	With SVC	With TCSC	With UPFC
P_{G1}(MW)	142.63	141.29	141.07	140.28
P_{G2}(MW)	87.82	79.57	77.78	73.60
P_{G3}(MW)	45.07	44.64	44.45	44.37
P_{G6}(MW)	72.90	65.11	58.64	60.04
P_{G8}(MW)	459.83	454.49	450.44	451.00
P_{G9}(MW)	97.51	84.88	83.15	77.64
P_{G12}(MW)	361.54	356.71	357.73	352.84
Cost($/hr)	41737.7 0	38362.94	37836.71	37291.41
loss(MW)	16.513	15.103	15.717	14.886

From Table.2 it is observed that the generating cost is reduced with FACTS compared to base case and it is evident that the generating cost is reduced from 41737.70($/hr) to 38362.94($/hr), 37836.31($/hr), 37291.41($/hr) with SVC, TCSC, UPFC respectively. The corresponding power loss is also reduced from 16.513(MW) to 15.103(MW), 15.717(MW), 14.886(MW) respectively. From Table.2 it is also evident that the power produced by individual generating units also reduced with FACTS devices which intern reduces the total operating cost of the system.

The loading factors and load growth loading factors with respect to operating conditions are given in Table 3.

Table 3 : Loading Factors

Operating Condition number	Base case Loading Factor	Load growth Loading Factor	Yearly Operating Hours
1	1.0819	1.5060	87.9
2	0.8771	1.2209	788.4
3	0.8279	1.1524	876.0
4	0.7831	1.0900	876.0
5	0.7438	1.0353	876.0
6	0.7128	0.9923	876.0
7	0.6798	0.9463	876.0
8	0.6399	0.8908	876.0
9	0.5915	0.8233	876.0
10	0.5254	0.7313	876.0
11	0.3895	0.5422	876.0

From Table.3 the annual savings at different operating conditions and net annual saving are obtained which are given in Table.4

Table 4 : Annual Savings

Operating Condition number	with SVC ($)	with TCSC ($)	with UPFC ($)
1	229585.77	241669.23	290003.07
2	714.52	752.13	902.56
3	632.47	665.76	798.91
4	505.97	532.60	639.12
5	412.77	434.49	521.39
6	339.53	357.40	428.88
7	270.46	284.70	341.64
8	204.72	215.49	258.59
9	138.97	146.29	175.55
10	73.233	77.08	92.505
11	0	0	0
Net savings	232878.41	245135.17	294153.21

Table.4 shows the savings at different operating conditions and it is observed that the annual savings are 232878.41($), 245135.17($), 294153.21($) with SVC, TCSC, UPFC respectively.

In addition to the generating cost the voltage profile of the system also controlled/improved with FACTS devices which are shown in Table.5

Table 6 : Voltage profile

BUS No:	Voltage magnitude(p.u)			
	Base	SVC	TCSC	UPFC
1	1.009	1.007	1.008	1.006
2	1.008	1.005	1.006	1.004
3	1.003	1.001	1.003	1.001
4	1.006	1.004	1.008	1.004
5	1.016	1.013	1.017	1.013
6	1.026	1.023	1.027	1.022
7	1.024	1.022	1.027	1.022
8	1.044	1.042	1.048	1.042
9	1.004	1.003	1.005	1.002
10	0.984	0.983	0.984	0.983
11	0.984	0.983	0.984	0.983
12	0.992	0.991	0.991	0.992
13	0.978	0.977	0.978	0.977
14	0.970	0.970	0.970	0.970
15	0.988	0.987	0.988	0.987
16	0.991	0.989	0.990	0.991
17	0.993	0.991	0.992	0.991
18	1.026	1.024	1.030	1.023
19	0.988	0.987	0.989	0.987
20	0.977	0.977	0.976	0.977
21	1.015	1.015	1.016	1.014
22	1.015	1.015	1.016	1.015
23	1.014	1.014	1.015	1.014
24	1.017	1.016	1.018	1.016
25	1.001	1.000	1.002	1.00
26	0.976	0.975	0.977	0.975
27	1.013	1.011	1.015	1.011
28	1.033	1.031	1.035	1.031
29	1.050	1.048	1.023	1.048
30	0.980	0.979	0.981	0.979
31	0.951	0.950	0.952	0.950
32	0.960	0.959	0.961	0.959
33	0.958	0.957	0.958	0.957
34	0.967	0.966	0.967	0.966
35	0.973	0.973	0.974	0.973
36	0.982	0.982	0.983	0.982
37	0.991	0.990	0.991	0.990
38	1.016	1.016	1.017	1.016
39	0.989	0.988	0.989	0.988
40	0.980	0.979	0.980	0.979
41	1.007	1.006	1.007	1.006
42	0.975	0.974	0.975	0.974
43	1.020	1.019	1.020	1.019
44	1.019	1.018	1.019	1.018
45	1.035	1.033	1.035	1.033
46	1.060	1.060	1.060	1.060
47	1.034	1.036	1.035	1.036
48	1.029	1.030	1.030	1.030
49	1.038	1.037	1.038	1.037
50	1.024	1.023	1.024	1.023
51	1.052	1.051	1.052	1.051
52	1.019	1.017	1.021	1.017
53	1.009	1.007	1.011	1.007
54	1.029	1.027	1.031	1.027
55	1.059	1.057	1.059	1.057
56	0.975	0.974	0.975	0.974
57	0.970	0.970	0.970	0.970

From Table.5 it is observed that the voltage at bus 2 is controlled from 1.008 to 1.005, 1.006 and 1.004 with SVC, TCSC and UPFC respectively. Similarly all the bus voltages are controlled within the stationery limits.

VIII. Conclusion

In this paper, GA based reducing generating cost in transmission system using FACTS devices is done to increase power system load ability, annual saving and voltage profile. The annual savings was calculated by considering the operating conditions which effectively works in analyzing the annual saving of the system. From the results it is clearly evident that the proposed technique is increased overall annual savings and overall voltage profile of the system also controlled.

The proposed problem can also test with fuzzy approach, neuro fuzzy etc., for future work.

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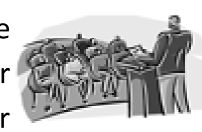
FARSE designated members are entitled to avail a 40% discount while publishing their research papers (of a single author) with Global Journals Incorporation (USA), if the same is accepted by Editorial Board/Peer Reviewers. If you are a main author or co-author in case of multiple authors, you will be entitled to avail discount of 10%.

Once FARSE title is accorded, the Fellow is authorized to organize a symposium/seminar/conference on behalf of Global Journal Incorporation (USA).The Fellow can also participate in conference/seminar/symposium organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent.

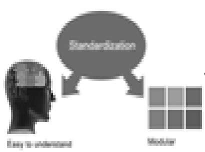


You may join as member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. In addition, it is also desirable that you should organize seminar/symposium/conference at least once.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The FARSE can go through standards of OARS. You can also play vital role if you have any suggestions so that proper amendment can take place to improve the same for the benefit of entire research community.

As FARSE, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.



The FARSE will be eligible for a free application of standardization of their researches. Standardization of research will be subject to acceptability within stipulated norms as the next step after publishing in a journal. We shall depute a team of specialized research professionals who will render their services for elevating your researches to next higher level, which is worldwide open standardization.

The FARSE member can apply for grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A. Once you are designated as FARSE, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria. After certification of all your credentials by OARS, they will be published on your Fellow Profile link on website https://associationofresearch.org which will be helpful to upgrade the dignity.

The FARSE members can avail the benefits of free research podcasting in Global Research Radio with their research documents. After publishing the work, (including published elsewhere worldwide with proper authorization) you can upload your research paper with your recorded voice or you can utilize chargeable services of our professional RJs to record your paper in their voice on request.

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The FARSE is eligible to earn from sales proceeds of his/her researches/reference/review Books or literature, while publishing with Global Journals. The FARSE can decide whether he/she would like to publish his/her research in a closed manner. In this case, whenever readers purchase that individual research paper for reading, maximum 60% of its profit earned as royalty by Global Journals, will be credited to his/her bank account. The entire entitled amount will be credited to his/her bank account exceeding limit of minimum fixed balance. There is no minimum time limit for collection. The FARSE member can decide its price and we can help in making the right decision.

The FARSE member is eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get remuneration of 15% of author fees, taken from the author of a respective paper. After reviewing 5 or more papers you can request to transfer the amount to your bank account.

MEMBER OF ASSOCIATION OF RESEARCH SOCIETY IN ENGINEERING (MARSE)

The ' MARSE ' title is accorded to a selected professional after the approval of the Editor-in-Chief / Editorial Board Members/Dean.

The “MARSE” is a dignified ornament which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., MARSE or William Walldroff, M.S., MARSE.

MARSE accrediting is an honor. It authenticates your research activities. After becoming MARSE, you can add 'MARSE' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, Visiting Card and Name Plate etc.

The following benefitscan be availed by you only for next three years from the date of certification.

MARSE designated members are entitled to avail a 25% discount while publishing their research papers (of a single author) in Global Journals Inc., if the same is accepted by our Editorial Board and Peer Reviewers. If you are a main author or co-author of a group of authors, you will get discount of 10%.

As MARSE, you will be given a renowned, secure and free professional email address with 30 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The MARSE member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.

Once you are designated as MARSE, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

Institutional Fellow of Open Association of Research Society (USA)-OARS (USA)

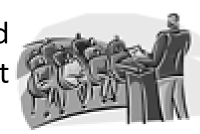
Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.
The author fees of such paper may be waived off up to 40%.



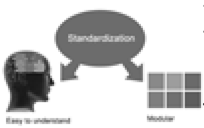
The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.



After nomination of your institution as “Institutional Fellow” and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.

The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.

Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer, then Direct Submission through Homepage is also available.

(C) If these two are not conveninet , and then email the paper directly to dean@globaljournals.org.

Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

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MANUSCRIPT STYLE INSTRUCTION **(Must be strictly followed)**

Page Size: 8.27" X 11'"

- Left Margin: 0.65
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- Top Margin: 0.75
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- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, “Abstract” word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript’s Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

Journals Inc. (US) are being abstracted and indexed (in process) by most of the reputed organizations. Topics of only narrow interest will not be accepted unless they have wider potential or consequences.

2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

Papers are accepted on strict understanding that the material in whole or in part has not been, nor is being, considered for publication elsewhere. If the paper once accepted by Global Journals Inc. (US) and Editorial Board, will become the copyright of the Global Journals Inc. (US).

Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals Inc. (US) follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

Appeal of Decision: The Editorial Board's decision on publication of the paper is final and cannot be appealed elsewhere.

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Please mention proper reference and appropriate acknowledgements wherever expected.

If all or parts of previously published illustrations are used, permission must be taken from the copyright holder concerned. It is the author's responsibility to take these in writing.

Approval for reproduction/modification of any information (including figures and tables) published elsewhere must be obtained by the authors/copyright holders before submission of the manuscript. Contributors (Authors) are responsible for any copyright fee involved.

3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

6.1 Proof Corrections

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

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Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

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You must strictly follow above Author Guidelines before submitting your paper or else we will not at all be responsible for any corrections in future in any of the way.

Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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