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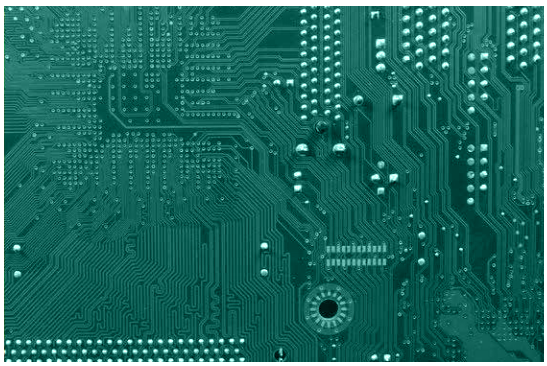
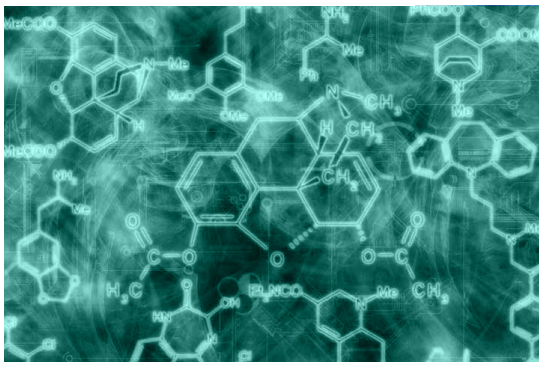

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AN EFFECTIVE CODE BREAKING SCHEME

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ABSTRACT

Cryptography is one of a way to protect data transmission over the network and the data security is the main aspect of data transmission. Due to the rapid development of Information Technology now a day's data security is a big challenging issue for researchers / application developers in data communication / data transmission over a network. Researchers have proposed many data encryption techniques/ standards to protect data from various types of attacks like brute force attack, frequency attack and differential frequency attack. But breaking a code is also a big research challenge for the researchers / designers, which can be very much effective in various operations in defence. In this paper we propose one effective code breaking scheme by applying guess factor.

Keywords - Perfect Security, Guess factor, Code Breaking, Weighted Average.

I. NTRODUCTION

Several techniques are available for breaking key and / or crypto analysis [1-4]. The subject of perfect security is a common research challenge [5-10]. Equally a great research challenge is to break the key and / or perform crypto analysis to get back the original message enveloped in code, which is of paramount importance and necessity in different operations including these of defence. The conventional key breaking / crypto analysis techniques are: i) Brute force attack, ii) Key Extortion algorithm, iii) Frequency attack, iv) Differential Frequency attack etc.

The logical operation of frequency attack may lead to development of a technique of an attack by guessing by expertized professionals. In this paper we like to propose a technique of applying guess factor for crypto analysis.

II. BASIC IDEA

It is assumed that five experts are applying guess to break a code. Each of the experts are given opportunity to identify five guesses on priority basis. The priority scale / weightage of guess are listed in table-I. Five experts may have listed their guesses as in table-I in a case, say.

Expert	1st guess (priority weight = 5)	2nd guess (priority weight = 4)	3rd guess (priority weight = 3)	4thguess (priority weight = 2)	5th guess (priority weight = 1)
A	a1	a4	a2	a3	a5
B	a4	a5	a2	a3	a1
C	a2	a1	a3	a5	a6
D	a6	a4	a3	a2	a3
E	a4	a2	a3	a5	a6

Table-I: Guess factor of different experts.

From table-I,we calculate weighted average of different guesses as under.

a1= (5+1+4)/5=10/5 =2
a2= (3+3+5+2+4)/5=17/5=3.4 = 3 (approx.)
a3= (2+2+3+3+3)/5=13/5=2.6 = 3(approx.)
a4= (4+5+4+5)/5=18/5=3.6 = 4(approx.)
a5= (1+4+2+2)/5=9/5=1.8 =2(approx.)
a6= (1+5+1)/5=7/5=1.4 =1(approx.)

The order of weighted average of guess factor is a4, a3, a2, a1, a5, a6 that may now be applied to break the code.

Say in another case seven experts may have listed their guesses as in table-II.

Expert	1st guess (priority weight = 7)	2nd guess (priority weight = 6)	3rd guess (priority weight = 5)	4th guess (priority weight = 4)	5th guess (priority weight = 3)	6th guess (priority weight = 2)	7th guess (priority weight = 1)
A	a1	a2	a3	a4	a5	a6	a7
B	a1	a 6	a 2	a 7	a 3	a 8	a 4
C	a 8	a 4	a 7	a 3	a 6	a 1	a 5
D	a 5	a 2	a 6	a 3	a 7	a8	a9
E	a1	a 7	a2	a6	a9	a3	a5
F	a2	a6	a9	a3	a7	a4	a1
G	a2	a5	a7	a3	a9	a4	a6

Table-II: Guess factor of different experts.

From table-II, the weighted averages of different guesses are.

a1= (7+7+2+7+1)/7=24/7=3.4 = 3(approx.)
a2= (6+5+6+5+7+7)/7=36/7=5.1 = 5 (approx.)
a3= (5+3+4+4+2+4+4)/7=26/7=3.7 = 4(approx.)
a4= (4+1+6+2+2)/7=15/7=2.1 = 2(approx.)
a5= (3+1+7+1+6)/7=18/7=2.6 = 3(approx.)
a6= (2+6+3+5+4+6+1)/7=27/7=3.9 = 4(approx.)
a7= (1+4+5+3+6+3+5)/7=27/7=3.9 = 4(approx.)
a8= (2+7+2)/7=11/7=1.6 =2(approx.)
a9= (1+3+5+3)/7=12/7=1.7 =2(approx.)

The order of weighted average of guess factor is a2, a3, a6, a7, a1, a5, a4, a8, a9;that may now be applied to break the code.

A unique case may happen when the weighted average will be same of all guess factors. This is illustrated in table-III

Expert	1st guess (priority weight = 5)	2nd guess (priority weight = 4)	3rd guess (priority weight = 3)	4thguess (priority weight = 2)	5thguess (priority weight = 1)
A	**a1**	**a2**	**a3**	**a4**	**a5**
B	**a2**	**a1**	**a3**	**a4**	**a5**
C	**a3**	**a4**	**a1**	**a5**	**a2**
D	**a4**	**a6**	**a2**	**a5**	**a3**
E	**a5**	**a6**	**a4**	**a3**	**a1**

Table-III: Guess factor of different experts.

From table-III, the weighted averages of different guesses are.

a1= (5+4+3+1)/5=13/5=2.6 = 3(approx.)
a2= (4+5+1+3)/5=13/5=2.6 = 3 (approx.)
a3= (3+3+5+1+2)/5=14/5=2.8 = 3(approx.)
a4= (2+2+4+5+3)/5=16/5=3.2 = 2(approx.)
a5= (1+1+2+2+5)/5=11/5=2.2 =2(approx.)
a6= (4+4)/5=8/5=1.6 =2(approx.)

In such a scenario it is proposed to provide level of experience of experts to assign priority to guesses. If level of expertise of experts in example is A> B > C > D > E; the priority of applying guesses will be: a1, a2, a3, a4, a5, a6.

III. SIMPLE ANALYSIS

It will be most appropriate of the proposed scheme is applied with brute force attack/ key exhaustion algorithm. If key is of n bits, the probability of breaking key is an attempt (P1) is: P1 = 1/2n.
If the proposed scheme is made with brute force attack, the probability of breaking key will be: P2 = Weighted average of applied guess X 1/2n. Where P2> P1.

IV. CONCLUSION

In the paper we have suggested a basic scheme of breaking code which is found to be superior to existing techniques. And it is found that if the number of experts and the number of guesses are increased the probability of finding the accurate code will be higher. The proposed scheme will be further studied with simulation in our future research work.

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BANDWIDTH OPTIMIZATION OF RECTANGULAR PATCH ANTENNA FOR WIRELESS LAN

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ABSTRACT

Advancements in high speed WLAN technology demand antennas with high bandwidth, high gain and compact size. This paper presents design and analysis of an efficient Rectangular microstrip patch antenna for the application of Wireless LAN for operating frequency 2.45GHz. CLTE with relative permittivity 2.96 and loss tangent 2.3e-3 was used as Dielectric substrate material with a height of 1.194mm. The antenna was designed and simulated using FEKO, Electromagnetic solver software. An improved bandwidth of 83.242MHz was achieved with a gain of 3.44235 dBi. Other Performance parameters like VSWR, Reflection coefficient and Impedance are very good in arguments. Both performance and design parameters have been tabulated.

Index Terms: - WLAN, CLTE, Fringing Field, Reflection coefficient, VSWR, FEKO.

I. NTRODUCTION

Microstrip patch antennas, being low cost, low profile, light weight, mechanically robust, easy to fabricate, have attracted a huge area of interest and have been widely used in satellite communications, aerospace, mobile and many more applications. In this paper basic structure of Microstrip patch antenna was taken under design consideration. Microstrip patch antenna uses a radiating patch of perfectly conducting material separated from the copper ground plane using dielectric substrate material. It is a printed resonant antenna that is very popularly required for wireless links of narrow-band microwave because of its semi-hemispherical coverage. There are various feeding techniques in which coaxial probe feed method is a popular one. Coaxial probe feed method, being easy and flexible was considered because it can be placed at any desired location to match impedance.[1][2] The microstrip antenna radiates a relatively broad beam broadside to the plane of the substrate. Thus the microstrip antenna has a very low profile, and can be fabricated using printed circuit (photolithographic) techniques. This implies that the antenna can be made conformable, and potentially at low cost [3]. However these antennas suffer from a major disadvantage i.e. narrow bandwidth. The radiation efficiency of the patch antenna also tends to be lower [4]. The bandwidth that can be achieved with coaxial probe feed normally ranges in 2%-5%. Bandwidth can be increased by using various bandwidth enhancement techniques [5]. One important consideration in designing microstrip patch antenna is the fringing fields. Fringing field is a function of effective dielectric constant. The fringing fields along the width can be modeled as radiating slots increasing electrical length of patch than physical length [6]. Fringing field is responsible for pseudo expansion of dimensions.

II. DESIGN PARAMETERS OF PATCH ANTENNA

The radiating patch of antenna may be square, rectangular, circular, elliptical, triangular, and any other configuration. In this work, rectangular microstrip patch antenna has been taken under consideration. The rectangular microstrip antenna consist of a rectangular patch with dimensions width, W, and length, L, over a ground plane with its width Wg, length Lg and substrate thickness h and dielectric constants εr of the dielectric material.[7]

Effect of fringing field in extension of dimensions cannot be accounted exactly hence it is customary to trim the length by 2% - 4% while designing patch, to achieve resonance at the desired frequency [8]. Dimensions tabulated here are based on 3% reduction in the actual dimensions calculated.

A. Frequency of Operation (f_o)

Based on the IEEE802.11 standards, Wireless Local

Area Network (WLAN) communication technologies use frequency bands 2.4, 3.6, 5 and 60 GHz. The antenna was designed for the application of wireless LAN that uses operating frequency 2.45GHz as per IEEE 802.11b/g standards.

B. Selection of Dielectric material

Relative permittivity of Dielectric material controls the fringing field which is the main cause of radiation in microstrip patch antenna. The lower will be εr, the wider will be the fringes which in turns results into the better radiation and also increased bandwidth and efficiency. Hence a dielectric material CLTE with dielectric constant 2.96 and loss tangent 2.3e-3 was used. Substrate height was taken 1.194mm to minimize inductive impedance and surface waves [9].

C. Calculation of Width (W)

Width for better radiation can be calculated as follow [7]:

$$W = \frac{c_o}{2f_o}\sqrt{\frac{2}{(1+\varepsilon_r)}}$$

Where c0 is the free-space velocity of light i.e. 3×10¬8 m/s and εr is the dielectric constant of material.

D. Calculation of Effective Dielectric Constant ε_{reff}

The value of effective dielectric constant is less than dielectric constant of the substrate, because the fringing fields around the periphery of the patch are not confined in the dielectric substrate, but are also spread in the air. The value of this effective dielectric constant is given by [10]:

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-1/2}$$

Where h and W are the height and width of substrate material for an antenna respectively

E. Calculation of Length (L)

The length of the patch determines the resonance frequency thus it is a critical factor for narrowband patch. Length can be calculated as [11]:

$$L_{eff} = \frac{c_o}{2f_o\sqrt{\varepsilon_{reff}}} - 2dL$$

The dL is the length extension due to the fringing field and can be calculated using the equation

$$dL = 0.412h\frac{(\varepsilon_{reff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{reff}-0.258)\left(\frac{W}{h}+0.8\right)}$$

F. Calculation of Ground Dimensions

The ground dimension for the antenna can be calculated as below:

Width of the ground is given as: $W_g = W + 6h$

Length of ground is given as: $L_g = L + 6h$

G. Feeding Technique & Location

The most common technique Coaxial-probe feeding was used for Microstrip patch antennas. The impedance match depends on location of feed point on the patch. An improved impedance match will ideally increase the bandwidth, the return loss and improve performance by reducing the excitation of unwanted modes of radiation. Hence the feed point locations in order to match 50 ohm impedance were calculated using the following equation [12]:

Along the width of patch:

$$X_f = \frac{W}{2}$$

Along the length of patch: $Y_f = Y_0 - dL$

Where $Y_0 = \frac{L}{\pi}\cos^{-1}\sqrt{\frac{50}{Z_0}}$

$Z_0 = \sqrt{50 * Z_{IN}}$

$$Z_{IN} = 90 * \frac{\varepsilon_r^2}{\varepsilon_r - 1}\left(\frac{L}{W}\right)^2$$

The calculated feed point coordinates are Xf=21.10 and Yf=8.653. However this equation only provides an approximation. Impedance matching was achieved after a lot of iteration, the exact co-ordinates are given in Table I.

Upper view of patch antenna in Figure 1 shows the various design parameters.

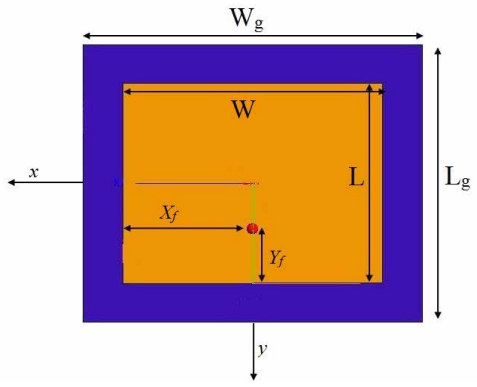

Fig. 1. Upper view of model of Microstrip patch antenna

DESIGN PARAMETERS	
RELATIVE PERMITIVITY	2.96
LOSS TANGENT	2.3e-3
PATCH WIDTH (mm)	42.20
PATCH LENGTH (mm)	34.16
GROUND WIDTH (mm)	49.364
GROUND LENGTH (mm)	41.324
FEED LOCATION (mm)	(21.10,11.46)

Table I. Design Parameters

III. SIMULATION & RESULTS

This antenna was designed and simulated using Electromagnetic solver software FEKO which uses Method of Moment (MoM) technique. The feed point location using the earlier mentioned formula was calculated at (21.10, 8.653). But the best impedance matching was obtained at feed point location (21.10, 11.46), where the impedance was found to be 49.0714 Ω. At this feed point the VSWR and Reflection coefficient were also found minimum. The Table II presents the performance parameters of antenna.

PERFORMANCE PARAMETERS	
RESONANCE FREQUENCY (GHz)	2.45139
GAIN (dBi)	3.44235
IMPEDENCE (Ω)	49.0714
VSWR (ABSOLUTE VALUE)	1.02179
REFLECTION COEFFICIENT (dB)	-39.35
-3 dB BANDWIDTH (MHz)	83.2425
-10 dB BANDWIDTH (MHz)	27.6864
-3 dB HALF POWER BEAM WIDTH (Deg)	90.2203

Table Ii.comparison Of Performance Parameters

The antenna was found to be resonating at 2.45139GHz with a gain of 3.44235 dBi. The values of VSWR and Reflection coefficient are very low and close enough to ideal values. The bandwidth 83.2425 MHz is a good figure in the context of patch antennas. Bandwidth (BW) % can be calculated as follow:

BW (%) = (BW/ f0) * 100
BW (%) = (83.2425/2450) * 100
BW (%) = 3.398%

Hence a bandwidth with 3.398% was achieved. The following graphs show the plots of various performance parameters. Figure 7 shows the 3-D radiation pattern of antenna.

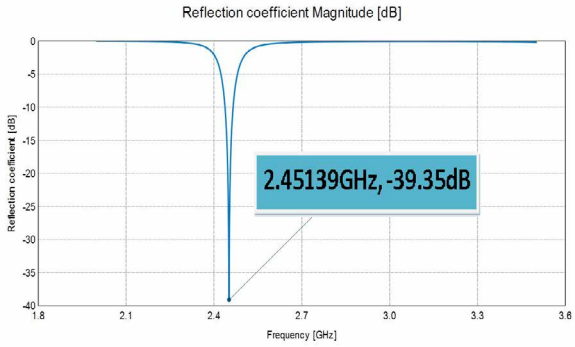

Fig. 2. Magnitude of Reflection Coefficient (in dB)

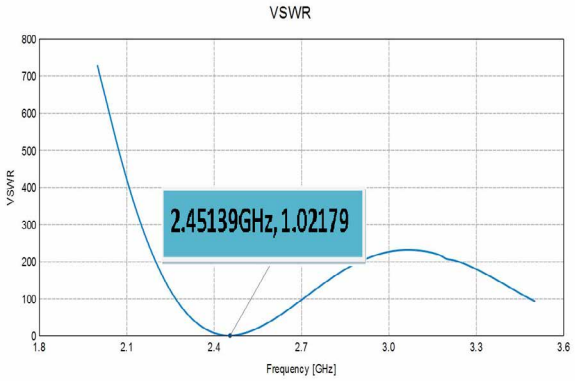

Fig. 3. Absolute value of VSWR

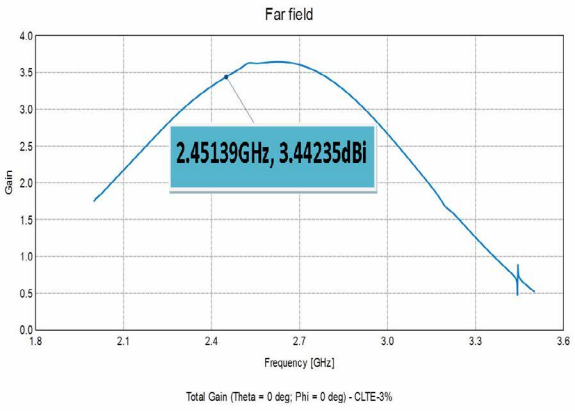

Fig. 4. Gain of the antenna

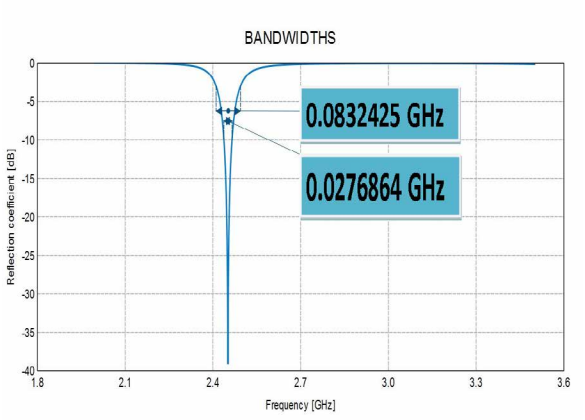

Fig. 5. -3dB and -10dB bandwidth of antenna

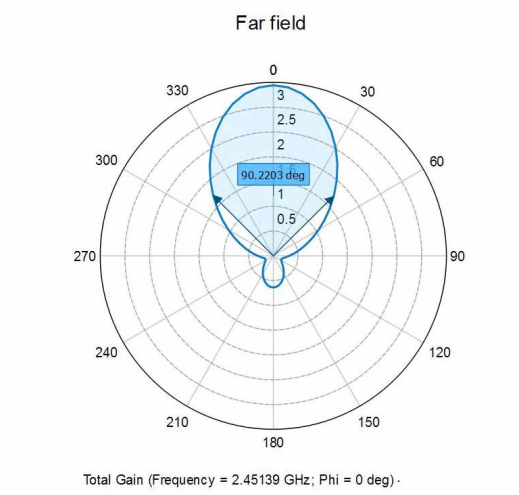

Fig. 6. Polar plot of antenna and Half power beam width

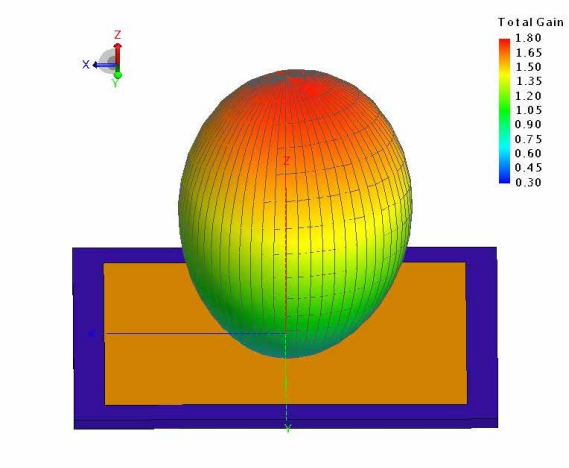

Fig. 7. 3-D Radiation Pattern

IV. CONCLUSION

The antenna designed for the purpose of Wireless LAN communication purpose at the frequency of 2.45GHz has an improved bandwidth of 83.2425GHz and it also holds good performance parameters. The VSWR and return loss have been minimized and a good enough bandwidth and gain are obtained. Resonance frequency obtained is very close to desired frequency. Also the antenna is compact in size and can be used for various other applications.

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A SURVEY ON GREEN COMPUTING: NEED FOR FUTURE GENERATION OF ENERGY SAVING

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ABSTRACT

The reduction of Energy consumption has become a key issue for industries, because of economical, environmental and marketing reasons. This worry has a strong influence on electronic circuits design, Information and Communication technology sector and more precisely on networking. Certainly, the volume of CO2 emission produced by the ICT (Information Communication and Technology) sector alone has been estimated to be approximately 2% of total man-made emission. Communication demands are growing in both wired and wireless. As a Result, huge amount of green house gases (especially CO2) emission occurs due to the rapid increases of Information and Communication Technology (ICT). If new technologies and research are not introduces, then it will become a big threat in both environmental impact as well as potential economical benefits. This paper presents a brief survey of green computing, its research areas.

Keywords : Wireless communication, Wired communication, Green Computing, Green networking, Reversible Computing

I. NTRODUCTION

The idea of green computing originated in 1992 following the energy star program. Energy star is an international standard, redesigned and developed by a joint program of US Department of Energy. In the early of 1990s, it helps to the customers to save money and to make clean environment through energy efficient products and practices. Earlier computers and monitors were the first energy star leveled product, now it is applied in major equipments, appliances and products. However, most of the networking devices generally do not have energy star level. Networking devices such as Router, Switch, Base station etc are consuming huge amount of power to maintain reliable and available services. The infrastructures of these devices are generally design for work in high performance and high availability. But most of the times these devices are underutilized and at the same time air conditioning is needed due to heat dissipation produce by the networking devices. The network devices can also dissipate significant amount of heat. It has found that, 40% of the total power consumed for actual task and remaining 60% of energy wasted due to heat dissipation & its cooling purpose. This heating can lead to more power consumed by fan/compressor for cooling the devices. Again going to Data centers, which are also consume huge energy. According to European Pean Union report, GHG gases are required to reduce its emission to 15%-30% to keep temperature below 2oC[1]. In 2007 EPA report, U.S data centers alone consume 61billion kWh in the year of 2006 [2]. All these threats are generating huge amount of CO2 emission, since the grid powers are delivering energy from burning the fossil. Then Green Computing comes from these issues to give approach and design architecture for energy efficient, minimize power usages in IT industry. From environmental point of view, the motto of green networking is to aim at the reduction of the GHG emission.

There are different approaches of Green Computing and these are Virtualization, Green Wired networking, Green Cellular networking, Algorithm Efficiency, Green Data Center design, Cloud Computing, reversible computation & computing etc. The approaches are discussed briefly in this review paper.

II. DIFFERENT TYPES OF GREEN APPROACHES

A. Virtualization

Virtualization refers to the sharing of resources and make resource available to the users. Most of the time it is finds that the servers are underutilized. Servers are higher energy efficient when run at higher utilization. By increasing utilization will not increase power usages at the same rate. The one of the motto of virtualization is to increase utilization level of resources. According to Green Maturity model [5], virtualization is classified into four groups namely Level 0, Level 1, Level 2, and Level 3.

Level 0 or "Local" means no virtualization and individual PC without any sharing of data. All applications are reside in the same PCs. Therefore, in this level, there is no means of virtualization.

Level 1 or "Logical Virtualization" means Client/ Server Technology. In this virtualization technique, different clients share application programs. Many organizations provide dedicated server for application programs and clients shares the application programs. The computations of the client's requests are done in the Server and the results are delivered to the clients. This approach reduces the individual hardware requirements for the applications execution in clients PCs.

Level 2 or "Data Server Virtualization" means Server Virtualization in which all hardware resources of the individual server deployed do needed to be consumed and this resources can be therefore be shared across multiple logical server. Different types of platforms, for examples VMware, Microsoft Virtual Server etc, are available to implement "Data Server Virtualization". Some other examples are Storage Area Network (SAN) for implementation of virtual storage allocation. Virtual Private Network is also the examples of Data Server Virtualization or Level 2.

Level 3 or "Cloud Virtualization" means virtualization of not only hardware or software resources, but also of the location virtualization as well as the ownership of the infrastructure. Software as a service (SaaS), PaaS Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Desktop as a Service (DaaS) etc are the direction to implement the concept of Cloud Virtualization. Examples are Google App Engine, Google Wave, Amazon Elastic Compute Cloud, Microsoft Windows Azure, Ajax13, ThinkFree, Office Live, NASA's Nebula Platform, AbiCloud, Elastichosts, Spicebird, Mikogo, Stixy, online storage devices Humyo, ZumoDrive, Microsoft SkyDrive etc.

B. Green Wired Networking

According to research paper [1], researches of Green Networking categorized as followings.

Adaptive Link Rate: During idle time, the links continuously send meaningless packets in order to maintain synchronization. As a result, this is making consumption and can be solve by Rate Switching and Sleeping mode methodologies.

In case of Rate Switching, the link rate is reducing to low during low utilization level. The data rate changes from higher rate to low data rate or vice versa. For example, Network Interface Card power consumption depends on data rate and changing data rate from 10Mbps to 1Gbps is approximately increases 5% of extra consumption.

Another approach is Sleeping mode in which the links are turn off during idle time. Sometimes shadow ports are used for receiving the packets instead of the sleeping ports.

However sometimes, semi sleep state is also exists in which some electronic parts of the circuits are always active to detect the arrival of packets.

Interface Proxying: During the idle or sleeping time, packets may be drop by the sleeping nodes. Some simple exchange such as ARP Processing, ICMP echo, DHCP rebinding are the task that could be done by some proxy. NIC is a good example for proxying on behalf of full system. The system will be woken up during further processing. Therefore, this approach focuses on the solutions in which the PCs enter into the stand by or sleeping state without losing network connection.

In some situation, Switches may be acting as proxy on behalf of the LAN and thereby going the PCs in longer sleeping time. More sleeping time means more energy savings.

Energyware Infrastructure and Applications: According to research paper [1], Energyware infrastructure is to advocate a redesign of the network architecture in a clean-slate. For example, Energyware Routing. It involves the link adaption, proxying techniques, Coordinate sleeping, optical switching etc.

Energyware application means energy-awareness in the software design. This approach is to make software less keen in terms of the energy it consumes. Energy aware application covers modification of network protocols stack with inclusion of sleep-states.

Modifying the network operations according to the traffic load by the applications is another research area to avoid unwanted energy consumption. Examples are Redesign Telnet, Voice over IP, P2P protocols. Authors also suggest TCP Protocol modification may be change with greener perspective. TCP processing cost about 25% for only for Checksum processing. TCP may be supposed to be change by exploiting the some features and thus reducing computation cost.

C. Green Wireless Cellular Networks

The cellular networks are sharply growing in recent years and in future, the rate of growth of cellular networks will be increase rapidly. Paper [5] provides an overall survey of Green Cellular Networks and its perspective. An average of 25MWh is consumed by each base station. Mobile networks do overall 0.2%

of total carbon emission and it is expected to increase every years. Paper [5] also mentioned that Diesel based Base Stations approximately cost to running is 10 times than grid based Base Stations. Some recent projects on Green Cellular Networks are EARTH (Energy Aware Radion and Network Technologies), TREND (Towards Real Energy Efficient Network Design), C2POWER (Cognitive Radio and Cooperative Strategies for Power Savings in Multi Standard Wireless Devices etc.

In base station, one of the components is Power Amplifier. It is found that Power amplifier of base station consumes almost 65% of total power consumption. A good amount of power is wasted due to heat dissipation in Power Amplifier, therefore need extra cooling system. Energy can be save by improving transmitter efficiency, efficient modulation scheme, system features, fresh air cooling, renewable energy sources, power saving during low traffic period etc.

Another power saving technique is Cell zooming, in which low load Base Stations are shutdown and others Base Stations enlarge their coverage areas to provide network to all areas. Different power saving protocol is proposed to work under low load condition because at night the traffic is less or traffic vary with respect to time. Heterogeneous network deployment base on micro, pico and femto cells are another solutions to make less power consumption in cellular network. These small cellular networks are good in power saving but, it requires good management and coordination of entire systems.

Another power saving research areas under wireless communication is via intermediate node. These intermediate nodes relay either on agent or intermediate user. We know that the power consumption for transmission is proportional to square of the distance. The power is saved because long distances are fragmented into small distance. The intermediate node retransmits the data to the next hop. Manet mainly works with this principle.

D. Green Data Center Design

Author [7] illustrates the way to design Energy Efficient Datacenters. About 1.7% to 2.2% of total electricity is consumed in data center in U.S in 2010. Google was running about 1 million volume servers in 2010, increases from 25000 in 2000 and 350000 in 2005. Other than Google, the giant companies are Facebook, Twitter, Yahoo etc and these companies have large number of data centers. There are different reasons for inefficiencies of energy in datacenters. Common reasons are Energy Non Proportional Servers. Power consumption of these servers are constant irrespective of its usages, Over-provisioned Server in which the servers are underutilized most of the times, Energy Inefficient Legacy Server Hardware in which most of the datacenters are old technology of 10 or more years ago and less energy efficient, multiple power conversions occurs from AC to DC & vice versa & also in different power level to support various subsystem, Energy cost of cooling and Air Conditioning unit etc.

Authors [8] have given an overview of Microsoft Data Center Cooling Process, entitled as Project Genome by introducing Wireless Sensor Network. It is observed that 50C of temperature variation occurs across a couple of meters in large data centers. In data centers, IT equipments need excessive cooling and high-speed fan to operate safely and avoid the creation of potential hot spot. In Microsoft Datacenter, Cold air blow from floor vents, while hot air rises from hot aisles. Mixed air is passed to the air conditioning and the cycle repeats. IEEE 802.15.4 Wireless technology and WiFi is used to make wireless network and sense temperature and humidity. This is the first step to collect cooling data and understand energy patterns of data centers. This technique illustrates optimal utilization of energy for cooling management.

E. Algorithm Efficiency

Algorithm efficiency relating to green computing can measured in different ways. The methods may be considered space reduction, computation time reduction, resource utilization reduction, loop optimization, object code optimization etc. For instance, a good compression algorithm helps in reducing the size of packets and reduces bandwidth utilization thus provides less traffic. Therefore, algorithm efficiency makes the system more energy efficient. It is said in different articles that the average google search released 7 grams of carbon dioxide (CO2). However, Google refuges this statement and saying a release of 0.2 grams of carbon dioxide in average for each search. Our requirements are increasing day by day and at the same time, resources are needed to be increase for high computation to satisfy the requirements. Power consumption is also increasing highly. More recently, an independent study demonstrated that Windows 7+ Office 2010 requires 70 times more memory (RAM) than Windows 98 + Office 2000.

Chia-Tien Dan Lo et al [6] propose green programming in which the programmer controlling memory block, input/output devices and other resources activation and deactivation. Authors have given an example of such programming code entitled as “Fine Grained Green Computing” methodology.

F. Optical fiber networks

In optical communication system, web-length division multiplexing (WDM) modulation technique is used for fiber optical based communication, where two types of technique are used one optical bypass and another optical non bypass. In non by-pass mode incident light path terminated at node and forwarded by IP routers, where the light directly by pass intermediate router by considering threshold cut through light path [9]. The power consumption is one of the main issues for communication. It is used to define optical node to optimize the power by controlling traffic.

G. Reversible Computation and Computing

According to Landauer in his principle heat dissipation happened due to the loss of information and each loss of one bit information generates minimum KT ln2 joules of heat energy, where K, T are boltzman constant and absolute temperature respectively [10]. In any circuit generally contains lots of loss of information and produces a good amount of heat. This is due to the irreversibility of circuits. Irreversibility means the input values cannot be indentified from output values. However, Bennett in his principle said that the heat dissipation problems could be solved if circuits are designed with reversibility [11]. It's informed that all quantum circuits are reversible and these are less heat dissipation problems. Reversible computation are relating with Quantum Computing. Reversible computation and reversible computing are mainly concern with these problems to minimize heat dissipation and create reversible circuits. Reversible programming languages, for example Jenus, are now recent research areas to make programming language in deterministic forward and backward computation.

H. Software Defined Networking (SDN)

Traditional networking devices such as Hub, Switch, Router etc are self-taking decision devices. That means dataplane and control plane is coupled together in the node. But this traditional networking needs to change. Recently Software Defined networking introduced. In this concept, a central controller is there, which is responsible for controlling all the switches and provides instructions to the switches how to handle arrived packed. In this approach, Data plane and control plane are decoupled in OpenVswitches and the Controller. Openflow protocol is designed in Software Defined Networking for communication purposes. Examples of SDN controllers are NOX, POX, FloodLight, OpenDaylight etc. Powersaving technique can be achieved hugely by enabling /disabling of nodes by taking decision from controller. ElasticTree is an example of power saving techniques introduces in Datacenters [13]. It saves a good amount of power in datacenters without affecting the QoS.

III. CONCLUSIONS

The goal of the survey paper is briefly illustrate the vast research areas of Green Computing and its perspective. It is briefly covering virtualization, Networking, Wireless/ cellular communication, Data Center Design, algorithm efficiency, reversible computing and SDN in greenness perspective. Most of the approach is based on changing protocol in respect to sleeping mode, Rate change, reduce algorithm complexity, energy proportional hardware, increase utilizations level by load balancing in networking devices, implementing virtualization & sharing resources among the users, ElasticTree algorithm etc. In this process, we explain briefly the different technology towards greenness, measuring greenness, placing greenness in different areas. Our future plans are to propose a framework of Green Computer Network Architecture using SDN and designing various reversible quantum circuits.

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PHOSPHONIC ACID BASED HYDROXYAPATITE AND ITS BIOCOMPATIBILITY

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ABSTRACT

The present research attempt consists in the synthesis of phosphonic acid modified nanosized hydroxyapatite (n-HAp) through a simple chemical method. The X-ray diffraction (XRD) and Electron diffraction X-ray (EDX) studies show the crystalline and stoichiometric creation of HAp particles respectively. Transmission electron microscopy (TEM) analysis reveals needle like acicular crystals of HAp particles with inexact size of 25-35 nm in diameter by 70-88 nm in length. The hemocompatibility study divulges that the material is highly hemocompatible with percent of hemolysis 3.3. The cell viability study confirms that the material is cytocompatible. The phosphonic acid modified hydroxyapatite material may be used in building a biocomposite with elevated interfacial bonding for biomedical applications.

Keywords - Biocomposite; Nanosized hydroxyapatite; Transmission electron microscopy; Hemocompatibility.

I. INTRODUCTION (HEADING 1)

Hydroxyapatite [Ca10(PO4)6(OH)2] (HAp) is an interesting biomaterial because of its excellent biocompatibility [1]. HAp, being structurally similar to the inorganic component of bone, enamel and dentin has received considerable attention from the biologist, chemists and biomaterial scientists. HAp has been successfully used as bone fillers, aesthetic restorative, coating of orthopedic implants, filler of inorganic/polymer composites, cell-culture carriers and so on. However, it is well-known that the application of pure HAp is restricted due to its brittleness. In modern years, the progress of bioactive ceramic-polymer biocomposites has gained a phenomenal impetus in the orthopedic field for their bone analog design in addition to good biological and mechanical performances to meet specific clinical requirements [2,3].

The mechanical properties of a biocomposite can be considerably enhanced by controlling the interfacial bonding between matrix and the reinforcement. Various methods have been developed to improve the interfacial bonding between the same, such as, zirconyl salt ZrO(CH3)2 absorption [4], polyacid RCOOH adsorption [5], and isocyanate NCO grafting [6]. On the other hand, the use of considerately chosen coupling agents has been proved as a dependable method to strengthen the interfacial bonding between the filler and polymer matrix with a substantial improvement of the compatibility by making the chemical bridges. Organosilane and organotitanate based coupling agents have previously been reported to tailor the particle surface properties by lowering their specific surface energy [7]. Nevertheless, these coupling agents are not suitable for the preparation of composites because of their pitiable stability in an aqueous environment. Grafting of organophosphorus coupling agents (OPCA) on preformed inorganic supports or in-situ formation of the inorganic part in attendance of organophosphorus reagents offers a potential alternative to the silicon or titanate based coupling agents [8].

The present research work consists in the development of novel phosphonic acid modified nanosized hydroxyapatite (n-HAp) powders. 2-Carboxyethylphosphonic acid (CEPA), a nontoxic, highly bioactive and biocompatible OPCA has been used as the coupling agent [9]. The phosphonic acid group (-PO(OH)2) of CEPA can powerfully anchor on apatite surface. We account here the synthesis of n-HAp in presence of CEPA through a simple chemical methodology. We have characterized the material through XRD, EDS and TEM studies. We study the hemocompatibility of prepared CEPA modified n-HAp material. Biocompatibility study has also been performed through cell viability study that is measured by the methyl- thiotetrazole (MTT) test.

II. MATERIALS AND METHODS

A. Chemicals

Diammonium hydrogen phosphate (DAHP) (99%) and calcium nitrate (99%) were procured from Merck, Mumbai, India. 2-Carboxyethylphosphonic acid was procured from Sigma-Aldrich, Spruce Street, St. Louis,

USA. Ammonia solution (25%) was obtained from Merck, Mumbai, India."

B. Preparation of phosphonic acid coated nano hydroxyapatite (n-HAp)

Stock solution each of Ca(NO3)2.4H2O (0.5 M) and (NH4)2HPO4 (0.5 M) was prepared in distilled water. Both the solutions were taken in such extent that Ca: P molar ratio was maintained at 1.67. 2-Carboxyethylphosphonic acid was mixed with (NH4)2HPO4 solution in 1:1 molar ratio. The pH of both calcium nitrate and DAHP solutions was maintained at ~11 - 12. Then the mixture of phosphonic acid and (NH4)2HPO4 was added drop-wise to the Ca(NO3)2.4H2O solution and energetically stirred at room temperature using a mechanical stirrer (2000 rpm). The pH of the reacting mixture was also maintained in the range of 11 to 12 by adding NH4OH solution gradually. The process was continued up to 6 h. The gelatinous precipitate thus obtained was filtered by a centrifugal filtration method. The precipitate was washed with water thoroughly and dried at 90oC for 15 h.

C. Characterization

The phase investigation of the HAp powders was done by XRD (Model PW 1729, Philips, Holland) using 35 milliamps, and 40 kV current, with a monochromatic CuKα (target) radiation (λ=1.5405 Å) with a step size of 0.04o 2θ, a scan rate of 0.02o 2θ/ s and a scan range from 2θ = 20 to 50o. The morphology, particle size of HAp powders were observed through a Phillips CM 200 transmission electron microscope (TEM) with an speeding up voltage 200 kV. Calcium-phosphorous molar ratio of hydroxyapatite powder was calculated by EDX analysis (Model ISIS300, Oxford, USA).

Hemolysis test of HAp material was performed spectrophotometrically using UV-1601, UV-VIS spectrophotometer, Shimadzu, Japan. For this test, 8 ml of human blood was collected in a beaker containing sodium citrate (3.8 gm%, 10:1) to keep away from coagulation. The anti-coagulated blood was then watered down with normal saline solution in the proportion of 8:10 (8 ml blood + 10 ml normal saline). For positive control, 0.2 ml of diluted blood was added to 0.5 ml of 0.01 (N) hydrochloric acid (HCl) and was diluted up to 10 ml afterward incubation for 1 h at 37°C. Correspondingly, for negative control, 0.2 ml of blood was watered down up to 10 ml with the addition of normal saline and was incubated for 1 h at 37°C. A mixture of 0.2 ml of diluted blood and 9.8 ml of normal saline solution in centrifuge tubes was incubated at 37°C for 30 minutes to attain temperature equilibrium. Samples of HAp were taken in centrifuge tubes containing blood-saline mixture and incubated for 1 h at 37oC. After incubation, all the sample solutions were centrifuged for 10 minutes at 6000 rpm and the supernatant fluid was cautiously removed and transferred to the cuvette for spectrophotometric analysis. The optical density (OD) of the incubated sample solutions was calculated by the aforesaid UV-VIS spectrophotometer at 545 nm.

Cell viability was quantified by the methyl- thiotetrazole (MTT) test (Sigma Chemical, St Louis [MO], USA). Murine fibroblast L929 cells were cultured in DMEM and plated (105 ml-1) in a 96-well tissue culture plate at their exponential phase of growth. The cells were allowed to attach to the plate surface for 4 h in 5% CO2 incubator at 37oC. Samples of different concentration in liquid phase were added directly to each well keeping the final concentration of the adytum 0.5% (v/v) of the medium. The plates were incubated for 24 hours at 37oC in a humidified atmosphere of 5% CO2 in air. After 24 h incubation, 0.02 ml of MTT (4mg/ml) was added to each well and incubated for further 4 h at 37°C. Subsequently, the media containing MTT was removed and 200 µl of DMSO was added to dissolve the formazan crystals. The absorbance was measured using a ELISA plate reader (Biorad, USA) at 595 nm.

D. Results and Discussion

The X-ray diffraction pattern of the synthesized apatite powder has been presented in Figure 1. The broadening of XRD peaks indicates nanocrystalline nature of the synthesized apatite powder. It is evident from the observed outcome that no characteristic diffraction angles from other calcium phosphate phases are detected. The main crystalline peaks observed for the HAp at diffraction angles 25.89º, 31.91º, 39.85º, and 46.71º respectively represent the hydroxyapatite phase with d-spacing 3.44, 2.80, 2.26, and 1.94 Å likewise. The mean crystallite size has been calculated using Scherrer's equation i.e., $D = 9\lambda/\beta_{sample}\cos\theta$ where D is the average crystallite size in Å, β_{sample} represents the crystallite size contribution to the peak broadening of the diffraction line for the sample measured at half of its highest intensity in "radian", λ is the wavelength of X-rays, and θ is the Bragg's diffraction angle. The peak width β_{sam} is calculated using the equation

$$\beta^2_{sample} = \beta^2_{exp} - \beta^2_{inst}$$

where β_{exp} is the experimentally measured full width of the peak at half of the maximum intensity and βinst is the instrumental broadening contribution determined from a silicon standard. The average crystallite size for the synthesized HAp powder is found to be 30 nm. The relationship between lattice constant (a & c), Miller's indices (h,k,l) and lattice spacing (d) is used to compute lattice parameter values i.e.

$$\frac{1}{d^2} = \frac{4}{3}\left(\frac{h^2 + hk + k^2}{d^2}\right) + \frac{l^2}{c^2}$$

The lattice parameters are found to be a=b=9.42 Å and c=6.88 Å. Therefore, the wide angle XRD represents that the synthesized material is pure hydroxyapatite phase. The result is also supported by the energy dispersive X-ray analysis (EDX), which designates the material is stoichiometric with Ca: P mole ratio 1.66. The crystallinity (Xc) of the pure phosphonic acid grafted HAp composite is determined by an empirical relation between Xc and β_{002} i,e,

$$\beta_{002} \times \sqrt[3]{Xc} = K_A$$

where Xc is the crystallinity degree, β002 is full width of the peak at half intensity of (002) plane in degree-2θ, KA is a constant (0.24) [10].

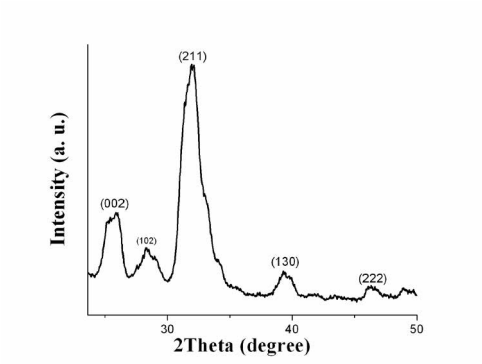

Fig 1: X-ray diffraction pattern of phosphonic acid modified hydroxyapatite powders.

The crystallinity (Xc) for HAp powder is calculated to be 0.21. For biomedical purposes, samples containing nanoapatites with low crystallinity are wanted for their high 'in vivo' restorability rate [11].

The morphology and the particle size of synthesized hydroxyapatite powder are exposed by TEM micrograph. Figure 2 shows the TEM micrograph of as synthesized phosphonic acid modified n-HAp powder. The micrograph depicts the acicular needle like crystals of HAp powder in nanometer range, having 25-35 nm in diameter by 70-88 nm in length.

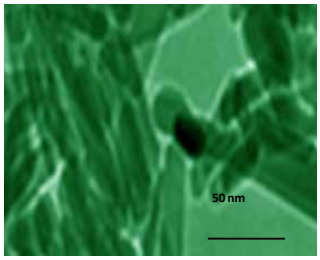

Fig 2: TEM image of synthesized phosphonic acid modified hydroxyapatite powders.

The hemocompatibility test is mainly aimed to find out the extent of hemolysis caused in the presence of the samples. Hemolysis indicates premature destruction of red blood cells when they get in touch with with the samples. The proportion of hemolysis has been measured in the following equation, i.e.

$$\%\text{Hemolysis} = \frac{[OD_{test} - OD_{negative}]}{[OD_{positive} - OD_{negative}]} \times 100$$

Where ODtest is the optical density of the sample solution, ODpositive is the optical density of the positive control and ODnegative is the optical density of the negative control. When the hemolysis percentage is less than 10, the test material is considered as hemocompatible and if it is less than 5, the material is taken as highly hemocompatible [12]. The percentage of hemolysis for the phosphonic acid modified HAp material is found to be 3.3. Therefore, the result shows that the material is highly hemocompatible.

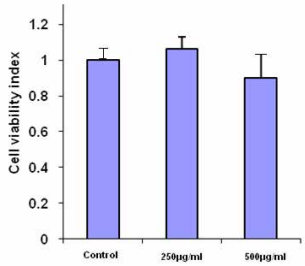

Fig. 3: The MTT assay of cells (L929) cultured on modified hydroxyapatite samples with different concentrations.

The biocompatibility of the synthesized sample has been investigated through MTT assay test. The differences in cell viability index are shown in Fig. 3 of the samples of dissimilar concentrations, as compared to the control tissue culture plate, which are inconsequential (verified by student's t-test). Hence we can conclude that the synthesized material is cytocompatible.

E. Conclusions

Phosphonic acid modified n-HAp particles have been synthesized effectively following a solution-based chemical method. XRD study confirms that the synthesized material restrains single phase pure hydroxyapatite. EDX study shows that the material is stoichiometric with Ca:P mole ratio of 1.66. TEM analysis exposed the morphology of HAp powders with dimensions of 25-35 nm in diameter by 70-88 nm in length. The developed material is highly hemocompatible with hemolysis of 3.3%. Biocompatibility has also been investigated from MTT assay test. The study revealed that the synthesized material is highly cytocompatible. The developed phosphonic acid modified hydroxyapatite material may have applications in

production of a biocomposite with high interfacial bonding for drug delivery, bone tissue renovation engineering and other biomedical applications.

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REVIEW AND THOUGHTS ON RANKING OF THE UNIVERSITIES.

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ABSTRACT

Ranking of universities in the world is a matter of concern for planners and leaders of any nation. In India huge debate is on to rise the ranking of our universities in global ranking. Many discussions and seminars are now happening now a day on the issue. Credible questions on the existing methods of ranking are put forward. In light of those an attempt has been made to review the existing ranking and to examine the flaws if any. Possible scientific solutions to the flaws so found if any are studied.

Keywords - Ranking, Flaws, Solution, Productivity.

I. NTRODUCTION

The thesis of development is nothing but in enhancing the intelligence capability of any country or any organization. Out of many parameters, one of the parameter for measuring the intelligence capability of any country is decisively the number of high ranked Universities any Country has established. Ranking of the Universities in the world by different statistical organization is not without questions. Even then, on general perspectives, ranking so published by the statistical organizations in different websites provide a clear general reflection of how the Universities of the world stand in respect of each other.

II. BASIC IDEA

In order to have a fair and judicious outlook on the issue of ranking of Universities and to have a review analysis on such ranking, we make a study on the weighted average rank of the Universities over last few years and based on data available on different websites. The formula for calculating average weighted rank is given below:

Weighted average rank over 10 years

$$= \sum_{i=10\ years\ slab} \frac{Weight\ \&\ Rank \times frequency}{Total\ Sample}$$

Example1:

Average weighted rank for University of Harvard, USA is calculated as: 0.5464.

Where Weight & Rank (we have given weight 1-10 in respect of their occurrence) = 10, frequency (Harvard stood 1st for ten years from 2004-10) = 10 and total sample = 183.

Avg. weight rank = 10*10/183= 0.5464.

Example 2:

Average weighted rank for University of California, Berkley is similarly calculated as

= [(10*7) + (8*1) + (7*2)]/183=0.5. (Seven times occurred within 1-10, one time within 21-30 and two times within 31-40)

Our finding reveals the picture as below:

a) The Universities having average weighted rank above 0.5.

Harvard, USA (0.5464), Caltech, USA (0.5464), University of Oxford, UK (0.5464), MIT (0.5464), University of Cambridge, UK (0.5464), Princeton University, USA (0.54), Imperial College London (0.535), Yale University, USA (0.53), Stanford, USA (0.529), University of California Berkley, USA (0.5).

b) Universities having weighted average rank below 0.5 and above 0.4.

Colombia University, US (0.497), Cornell University

US (0.486), University of Chicago (0.474), University of Pennsylvania US (0.469), Tokyo University (0.464), ETH Swiss Federal Institute of Technology (0.459), Duke University US (0.454), University of Michigan US (0.454), Australian National University (0.432), McGill University Canada (0.437), Singapore National University (0.432), Carnegie Mellon University US (0.426), University of California, Los Angeles (0.426), Johns Hopkins University US (0.426), University of Toronto (0.426), Melbourne University, Australia (0.415), Ecole Ploy technique Paris (0.404), University College London (0.404), University of Edinburg UK (0.404)

c) Universities having average waited rank below 0.4 and above 0.3.

University of Hong Kong (0.399), North Western University US (0.383), Peking University China (0.383), Kyoto University Japan (0.366), Paris Ecole Nomale Superieure (0.344), London University School of Economics (0.338), Texas University Austin US (0.328), University of California San Diego (0.327), Sydney University Australia (0.311), New York University US (0.306), Brown University USA (0.3), The Hong Kong University of Science & Technology (0.300).

d) Universities having average weighted rank below 0.3 and above 0.2.

University of Illinois, Urbana US (0.295), Kings College London (0.295), University of Wisconsibn US (0.289), University of Washington (0.284), University of Queensland Australia (0.273), University of Bristol UK (0.251), Washington University St. Louis (0.240), Monash University Australia (0.229), Georgia Institute of Technology US (0.224), New South Wales University Australia (0.219)

e) Universities having average weighted rank below 0.2 and about 0.1.

KU Leuven Belgium (0.185), Tsinghua University China (0.180), Seoul National University Korea (0.174), University of Amsterdam Netherland (0.174), Chinish University of Hongkong (0.169), University of Auckland (0.158), University of Minnesota US (0.147), Ludwing Maximilians Germany (0.147), Karolinska Institute Sweden (0.142), University of California Davis (0.142), Nanyang Technical University Singapore (0.136), Osaka University Japan (0.136), University of Copenhagen Denmark (0.136), Trinity College Dublin Ialand (0.136), Heidalberg University Germany (0.125), University of Warwick UK (0.125), Geneva University Switzerland (0.087), Massachusetts University US (0.120), University of Pittsburgh US (0.114), Rice University US (0.114), Rupreches University Heidelberg Germany (0.114), Utrecht University Netherland (0.114), Ecole Poly Technique Federal Switzerland (0.104), Ohio University US (0.103)

f) Universities having average weighted rank below 0.1.

Korea Advanced Institute of Science & Technology (0.098), Vender Bilt University US (0.098), Case Western Reserve University US (0.098), Georg August University Germany (0.092), University of Southan California US (0.092), Tokyo Institute of Technology Japan (0.087), Adelaide University Australia (0.087), Rotterdam University Netherland (0.087), Rochester University US (0.081), Paris 06/ Pierre and Marie Curie University France (0.071), Dartmouth College US (0.071), St Andrew University UK (0.071), University of Birmingham UK (0.071), IIT India (0.065), Tufts University US (0.065), University of Western Australia (0.065), Uppsala University Sweden (0.065), University of California Irvine US (0.060), University of Zurich Switzerland (0.060), Wageningen University & Research Center Netherland (0.060), Lund University Sweden (0.060), University of York UK (0.060), Durhum University UK (0.060), Sussex UK (0.054), Macquarie University Australia (0.054), Eindhoven Technical University Netherland (0.054), University of Alberta Canada (0.054), University of Nottingham (0.054), University of Glas Gow UK (0.053), Paris Institute of Political Studies (0.049), University of Colorado Boulder US (0.049), University of Sheffield UK (0.049), McMaster University Canada (0.049), Brussel free University Belgium (0.043), Vienna University Austria (0.043), Basel University Switzerland (0.043), University of Science & Technology China (0.038), RMIT University Australia (0.038), Munich University Germany (0.038), Helsinki University Finland (0.038), London University School of Oriental & Amer Study UK (0.032), IIM India (0.032), Nanyang University Singapore (0.032), Aarhus University Denmark (0.032), University of Mary Land College Park (0.032), Vienna Technical University Austria (0.032), University of Purdue US (0.131), University of Nortedame US (0.031), Berlin Technical University Germany (0.027), IIT Kharagpur India (0.027), University of Notre Dame (0.027), University of Fudan China (0.027), Jerusalem Hebrew University Israil (0.027), Lomonosov Moscow State University Russia (0.027), University of Southampton UK (0.026), University of California Santa Cruz (0.021), Yeshiva University (0.021), Dart Mouth College US (0.021), London University School of Oriental & African

Study UK (0.021), University of Virginia US (0.021), University of leeds UK (0.021), Mexico National Autonomous University Mexico (0.021), William and Mary US (0.016), Stony Brook University US (0.016), Paris 04 Sorbonne University France (0.016), Curtin University of Technology Australia (0.016), Otago University Newzeland (0.016), University of Arizona US (0.016), University of Ghent Belgium (0.015), Freie University Berlin Germany (0.015), University of Groningen Netherland (0.015), State University of New Jersey (0.015), University College Dublin Ireland (0.015), University of Montreal Canada (0.010), Queens University Canada (0.010), University of Utah US (0.010), Royal Holloway University of London UK (0.010), University of Lausanne Switzerland (0.010), Sydney Technology University Australia (0.010), Yeshiva University US (0.010), Gottingen University Germany (0.010), Malaya University Malaysia (0.010), University of Alabama US (0.010), London University Queen Mary UK (0.010), University of Paris Sud (0.005), Cardiff University UK (0.005), La Trobe University US (0.005), Wake Forest University US (0.005), George Washington University US (0.005), Humboldt University Berlin Germany (0.005), Nagoya University Germany (0.005), National Taiwan University Taiwan (0.005), Tohoku University Japan (0.005), Vanderbilt University US (0.005), Stock holm University Sweden (0.005), University of Maastricht (0.005)

The findings as above conclusively provide logical interpretations as below:

- Most high ranked universities belong to developed economies having enriched intelligent resources. Therefore questions on genuinely of the ranking outcomes do not stand in general.
- Educations and economy deservedly go together as high ranked universities belong to developed economies and developing economies are having only a few high ranked universities in their credit.
- The ranking based on average weight as in our calculation does not majorly deviate from those of the absolute ranking made by different agencies over different assessment years. That is how it cannot be said that the absolute ranking has major flaws.

Whatever ranking is noticed in the available systems is based on inputs and outputs. If any flaw exists therefore in the current ranking systems reported elsewhere, the same is nothing but the flaws in measuring quality just in terms of inputs and out puts.

Most of the ranking systems now operative globally are found to be fundamentally based on inputs and outputs. Any ranking the parameters of inputs and outputs, although inputs and outputs are undoubtedly major parameters to reckon with, will not be correct one. A system generating better and higher outputs with lower inputs is always superior to a system generating substantial output with maximum input. Therefore, accreditation and ranking should be based on the productivity defined as:

Productivity = output ÷ input

Productivity in different units may be measured and normalized to have a process of accreditation and ranking. For example a few productivity measurements may be estimated as below:

Productivity of Research may be measured as (average number of publications in SCI journals per faculty member + average number of patent per faculty member) ÷ the Research expenditure in a particular year.

Productivity of students' performance may be measured as average grade (Result) of outgoing students ÷ average rank of the same students admitted, (Rank may be Rank of Joint Entrance Examination).

Teaching productivity may be Teachers-students ratio.

Teachers Quality Productivity = No. of PhD holders ÷ Total no. of Teachers

Similarly, the innovation productivity, the investment productivity, the students' employability productivity, the industrial linkage productivity etc. may be defined and estimated. The idea proposed may be deliberated upon in wider and higher platform to arrive at a conclusive decision.

III. ACKNOWLEDGEMENT

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MODELING AND SIMULATION OF VOLTAGE SOURCE CONVERTER BASED STATIC SYNCHRONOUS SERIES COMPENSATOR

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ABSTRACT

This paper deals with the simulation and modelling of Flexible AC transmission systems (FACTS), devices namely Static Synchronous Series Compensator (SSSC) by using Voltage Source Converter (VSC) by using IGBT's. Total paper discusses the real and reactive power flowing in a two bus system with and without SSSC. Sine PWM (SPWM) technique is used for switching the switches in the SSSC. MATLAB/SIMULINK is used for total simulation. PI controller parameters are used archive balanced voltage across dc link capacitors.

Keywords -AC transmission system, FACTS, SSSC, Voltage Source Converter, IGBT's, Series transformer, SPWM, PI-controller etc.

I. NTRODUCTION

Now a day's a power system is highly complex and interconnected and there is a great need to improve electric power utilization. The power flows in some of the transmission lines are well below their normal limits other lines are overloaded which has an overall effect on deteriorating voltage profiles and decreasing system stability and security. Because of all that, it becomes more important to control the power flow along the transmission lines to meet the needs of power transfer. A two bus system is designed with synchronous generator at one side and load at the other by taking line length and line parameters. A three phase 12-winding transformer is used for series transformer where the primary winding is connected in series with the transmission line and on secondary side three terminals of the transformer is connected to the SSSC and other three terminals are grounded.

II. PRINCIPLES OF POWER FLOW IN A TRANSMISSION LINE

Power flow in a transmission line depends on

- Impedance
- Voltage
- Phase angle

The power flow in a transmission line can be changed by the above three parameters stated the SSSC deals with the term impedance. The SSSC adds external impedance to affect the equivalent power.

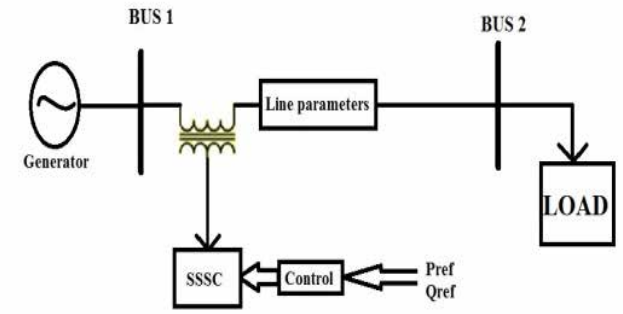

Fig: 1 Block diagram of two bus power system with SSSC connected in series with the system

Power flow between two buses of a lossless transmission line is given by:

$$P_{12} = \frac{V_1 V_2}{X_{12}} \sin \delta_{12} \quad \text{-------- (1)}$$

Where δ12 is difference between d1 andd2
V_1 and δ1 are the first bus voltage magnitude and angle,
V_2 and δ2 are the second bus voltage magnitude and angle,
X12 is the line reactance.

III. THEORY OF SSSC

A Static Synchronous Series Compensator uses a series Voltage Source Converter (VSC), which injects voltage controllable and variable magnitude and phase angle into transmission line through a series transformer to have a rapid exchange of Active and/or Reactive power with the power system. The injected voltage will be almost sinusoidal and in quadrature with the line current.

SSSC operates without any external energy source to supply or absorb Reactive power. The SSSC can supply or absorb Reactive power that means it can provide capacitive or inductive voltage compensation. If injected voltage (Vs) lags the line current IL by 90º, a capacitive series voltage compensation is obtained in the transmission line and if leads IL by 90º, an inductive series compensation is achieved.

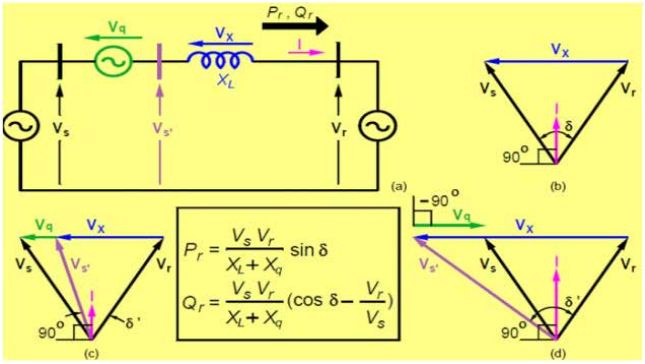

Fig: 2(a) Power transmission system and its series reactance emulator with a compensating voltage, Vq, and phasor diagrams (b) uncompensated line (c) inductively-compensated line, and (d) capacitive-compensated line.

IV. VOLTAGE SOURCE CONVERTER

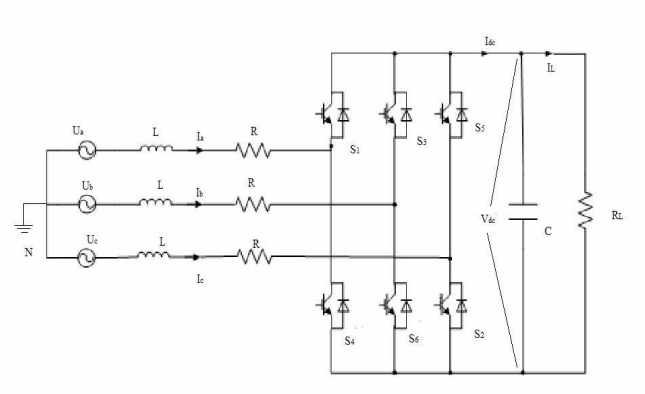

Fig: 3 Voltage source converters with input and output voltages and currents.

Figure shows the circuit diagram of the three- phase voltage source rectifier structure. It is assumed that the AC voltage is a balanced three phase supply, the filter reactor is linear, IGBT's are ideal switch and lossless. Where Ua ,Ub and Uc are the phase voltages of three phase balanced voltage source, and Ia , Ib and Ic are phase currents, Vdc is the DC output voltage, R and L mean resistance and inductance of filter reactor, respectively, C is smoothing capacitor across the dc bus, RL is the DC side load, Ura ,Urb and Urc, are the input voltages of rectifier, and IL is load current.

V. SINUSOIDAL PULSE WIDTH MODULATION

We can get pulses the same as in the case of uniform pulse width modulation, but the width of each pulse is vary in proportion to the amplitude of a sine wave and output frequency of the pulse will be same as the sine wave.

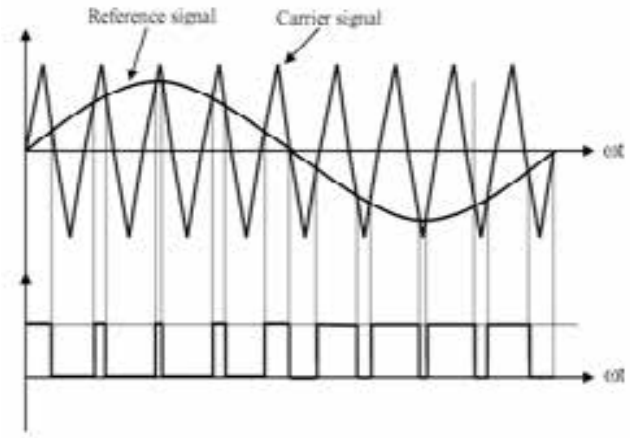

Fig: 4 Sine wave pulse width modulation.

VI. SIMULATION AND RESULTS

A two bus system is designed with a synchronous generator at one end and load at another end and both of them connected by a transmission line of length 100 km. The total simulation is carried out by using MATLAB/SIMULINK. The system parameters [3] are given below. Synchronous Generator Salient-pole rotor 2100 MVA,V =13.8kV, X d =1.305, X d ‘=.296, X d ‘’ =0.252, X q =0.474, X q‘’=0.243, X1=0.18, Td‘=1.01, Td‘‘=0.053,Tq0‘‘=.1,Rs =2.8544e-3 H =3.7,P =32 Transformer 2100 MVA 13800 kV / 500 kV, R 1 =1.8137e-4Ω R 2 =238.1e-3 Ω, L 1 = 0 H, L 2 = 189.47e-3 H, Line parameters R1= 0.01273Ω/km, R0 =0.386Ω/km L1 = 0.9337e-3H/km, L 0 = 4.1264e-3H/km C 1 = 12.74e-9F/km, C0 = 7.751e-9F/km

VII. TWO BUS SYSTEM WITHOUT ANY COMPENSATION

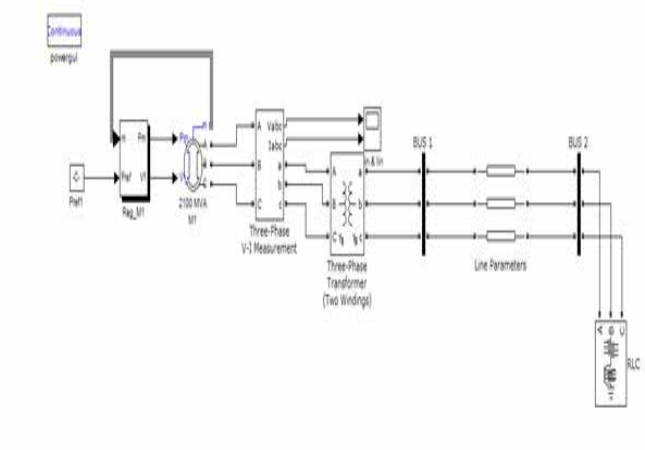

Fig: 5 Simulation of TWO bus power systems without compensation

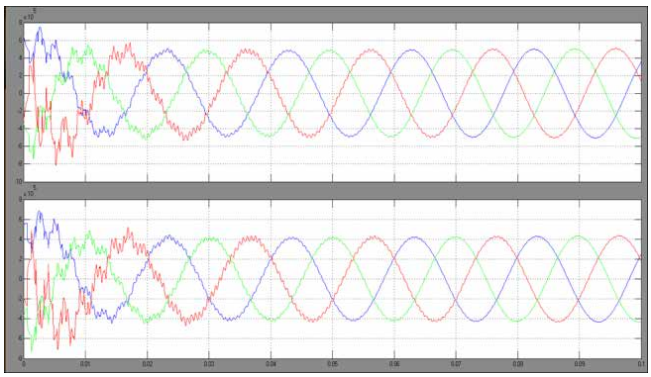

Fig: 6 Voltages at bus-1 and bus-2 for un-compensated system.

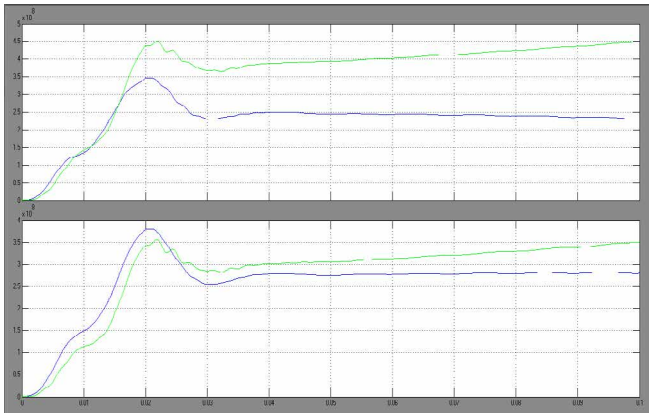

Fig: 7 Real and Reactive power at bus-1 and bus-2 for Un-compensated system.

VIII. TWO BUS SYSTEM WITH COMPENSATION

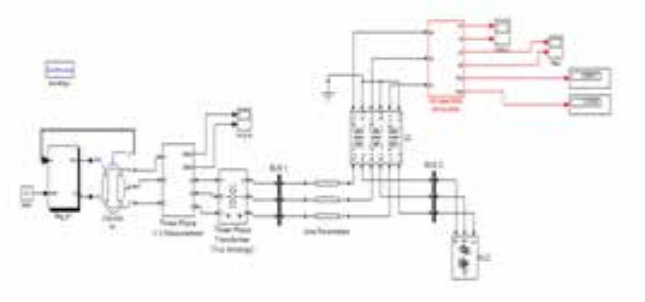

Fig: 8 Simulation of TWO bus power systems with SSSC

Here the SSSC is connected in series with the transmission line with a 12-pulse transformer. In 12-pulse transformer can access every terminal of all the windings. A1, B1, C1 are connected with the transmission line they are one end of the primary winding and a1, b1, c1 are again connected to the transmission line which are other three terminals of the primary winding. In secondary winding of the transformer A2, B2, C2 are connected as input to the SSSC and other three terminals a2, b2, c2 are grounded.

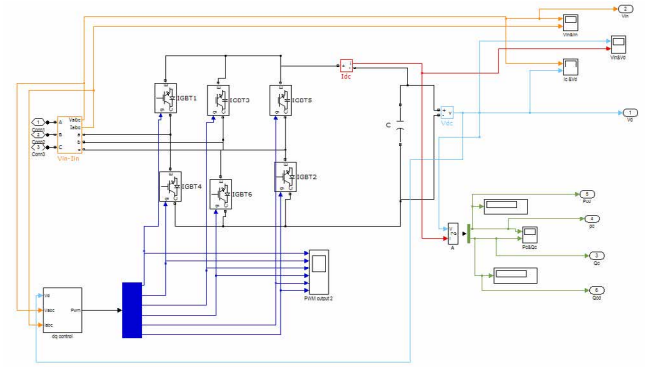

Fig: 9 Simulation of Sub-system of SSSC

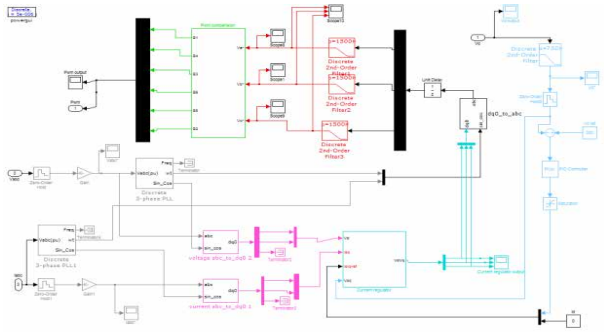

Fig: 10 Simulation of sub-system of closed-loop controller for SSSC

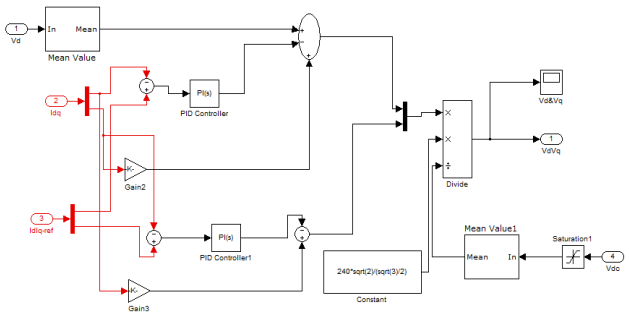

Fig: 11 Sub-system of current regulator in the closed-loop controller for SSSC

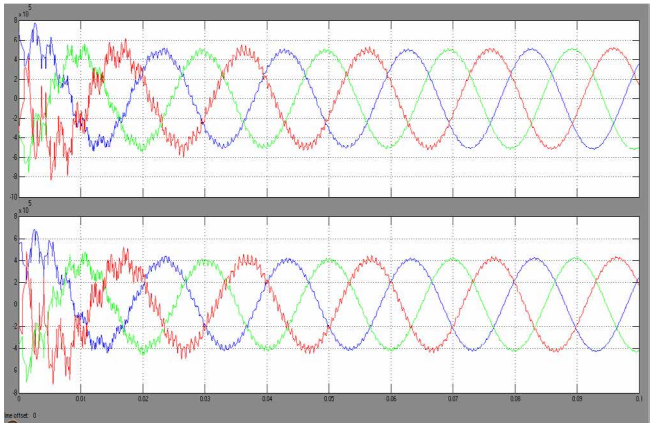

Fig: 12 Voltages at bus-1 and bus-2 for compensated System.

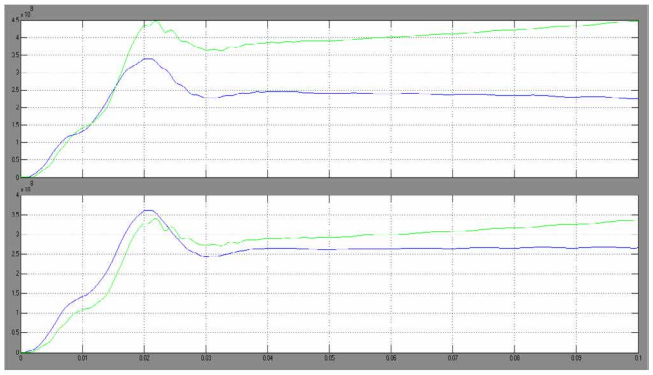

Fig: 13 Real and Reactive power at bus-1 and bus-2 for compensated system

IX. HARD WARE IMPLEMENTATION

Here a single phase voltage source converter is been implemented by using MOSFET's and SPWM technique is used to control the switches

Fig: 14 Hard ware setup of single phase voltage source converter

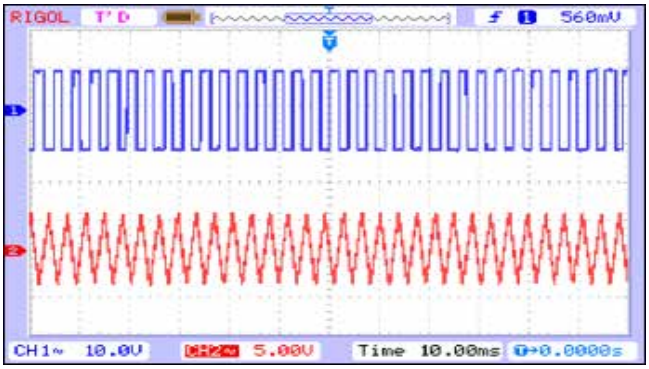

Fig: 15 Output PWM pulses after comparison and carrier wave output

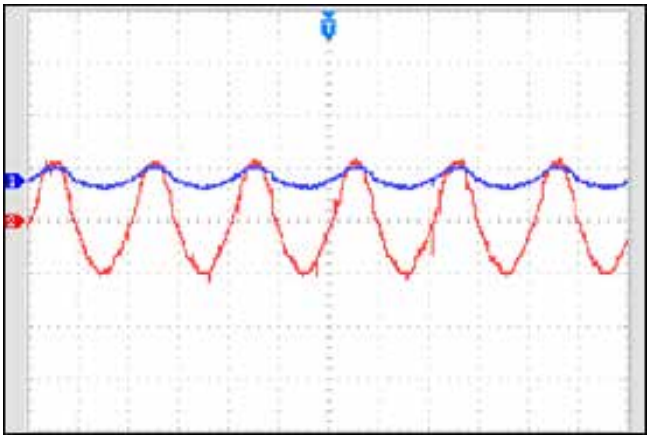

Fig: 16 Output and input of single voltage source converter

X. CONCLUSION

This paper presents a two bus power with generator at one bus and load at another. It presents a load flow of two bus system and real and reactive flow in the system. It presents a design and control strategy of SSSC. Result of a two bus

system is compared with and without SSSC. So when the load is changing and SSSC is connected the reactive power will be decreasing when compared with two bus system without SSSC. Hardware implementation for a single phase voltage source converter is done in the paper with SPWM technique for switching the switches in voltage source converter. The SPWM pulses are generated by using analog circuits.

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TWO NEW SCHEMES OF AGGRESSIVE PACKET COMBINING

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ABSTRACT

Aggressive Packet Combining (APC) scheme is well established in literature for receiving correct packet in high error prone wireless link. In APC three copies of a packet are transmitted and receiver does bit wise majority decision to get correct copy. Major research challenge of the APC is if two or more copies of the packet become erroneous at a particular bit location the operation of the majority logic fails to correct the error. To address the above drawbacks of the APC, we propose in this paper two new methods of correction in APC mode.

Keywords - Packet Combining Scheme, Conventional Aggressive Packet Combining Scheme (CAPC), Throughput, Bit error rate, sequential mode.

I. NTRODUCTION

In order to combat errors in computer/ data communication networks, ARQ (Automatic Repeat Request) techniques [1-5] with various modifications as applicable to in various communication environments are used. Leung [7] proposed an idea of Aggressive Packet Combining scheme (APC) for error control in wireless networks with the basic objective of fast error control in relatively higher noisy wireless networks. APC is well established and studied elsewhere [3-10].Several modifications of APC are also reported elsewhere [2-13]. The modifications are due to increasing throughput, tackling various error syndromes and enhancing fast correction. In APC and/ or modified APCs, two or more copies of the packets are transmitted. Copies received by the receiver either error free or erroneous are used in receiver to correct errors by applying Packet Combining schemes differently in different situations. However in original APC, if an error at same locations of erroneous packets, the application of the majority logic as an original APC fails to correct the error. To address the stated problem of APC we propose two new protocols of APC. Analytical results establish that the proposed new schemes are superior to original APC.

II. REVIEW OF PACKET COMBING SCHEME

Chakrabotry [11] suggested a very simple and elegant technique known as packet combining scheme (PC) where the receiver will correct limited error, one or two bit error, from the received erroneous copies. As per Chakraborty's proposal:
It is assumed that an original packet "10101010" is to be transmitted between a sender and a receiver. The packet erroneously received by the receiver is "00101010". The receiver requests for retransmission of the packet and keeps the copy that has been received erroneously as well. The transmitter retransmits the packet, but again the packet is received by the receiver erroneously as "11101010". Chakraborty suggested that the receiver can correct the error by using two erroneous copies. After making a bit wise XOR operation between erroneous copies, the receiver can locate the error position. The operation can be identified by an example given below:

First erroneous copy = 00101010
Second erroneous copy = 11101010
XOR 11000000

The error locations are identified as first and/or second bit from left. Chakraborty suggested that the receiver can apply the brute method to correct error by changing received "1" to "0" or vice versa on the received copies followed by the application of error decoding method in use. In the example the average number of brute application will be ½ and in general 2n-1 if n bits are found in error. Several modifications of PC have been studied elsewhere [12-13] by Bhunia's.

III. REVIEW OF CONVENTIONAL APC

Aggressive packet combining scheme is a modification of MjPc (Majority Packet Combining) [14].To illustrate APC it is assumed that an original packet 10101010 is transmitted between a sender and a receiver. In Aggressive Packet combining Scheme (APC) the three copies of packet are sent for each packet between a source and a destination. The majority logic is applied bit to bit on three copies of packet. In table: (1) we have shown different possibilities of APC. In Case (1) there is no error in transmitted three copies. In Case (2) receiver receives two copies of correct packet and one copy with an error, so the correction is possible by majority logic. In Case (3) and Case (4) errors are present in two or more copies in which case correction is not possible.

Table: 1: Different cases of Aggressive Packet Combining Scheme

Case 1	Case 2	Case 3	Case 4
Copy-1= 10101010 Copy -2= 10101010 Copy-3= 10101010	Copy-1= 00101010 Copy -2= 10101010 Copy-3= 10101010	Copy-1= 00101010 Copy -2= 00101010 Copy-3= 10101010	Copy-1= 00101010 Copy -2= 00101010 Copy-3= 00101010
Correction Probability is (1-P3)	Correction Probability is (1-P2) P	Correction Probability is (1-P) P2	Correction Probability is (P3)
Correction not required.	Correction possible	Correction not possible	Correction not possible

IV. NEW BASIC IDEA

(Scheme 1)
In the original APC, three copies of a packet are transmitted sequentially. We propose to transmit three copies of each of three packets in a row of original stream of data in a sequential mode as below:

Packet – 1 first copy (Cp11)
Packet – 2 first copy (Cp 12)
Packet – 3 first copy (Cp 13)
Packet – 1 second copy (Cp 21)
Packet – 2 second copy (Cp 22)
Packet – 3 second copy (Cp 23)
Packet – 1 third copy (Cp 31)
Packet – 2 third copy (Cp 32)
Packet – 3 third copy (Cp 33)

(Scheme 2)
In this scheme of transmission we propose to transmit three copies of each of three packets of the stream of original data are to be sent in a different sequence mode as below:

Packet – 3 first copy (Cp13)
Packet – 2 first copy (Cp 12)
Packet – 1 first copy (Cp 11)
Packet – 1 second copy (Cp 21)
Packet – 3 second copy (Cp 23)
Packet – 2 second copy (Cp 22)
Packet – 2 third copy (Cp 32)
Packet – 1 third copy (Cp 31)
Packet – 3 third copy (Cp 33)

Or such random but previously pre assumed pattern known & agreed upon between transmitter & receiver.

V. ANALYSIS

Let us assume an original packet (may be called first packet) “10101010” be sent in original APC. Let us assume three copies of the packets are received with error occurrence location in 2nd bit from left in all the copies. The application of majority logic as in original APC now fails to correct error as below;

Copy-1”11101010”
Copy-2”11101010”
Copy-3”11101010”

11101010 (correction fails)

Suppose three original packets are “10101010” (first copy as previously), 11011101” (second copy) and “11100111” (third copy), for the proposed schemes are sent with copies each. Assume the error locations in copies are second, third and sixth from left respectively. In the proposed schemes, as illustrated below, the correction is now made possible.

Scheme- I:

Sender		Receiver	Majority logic
First transmission	Cp11-“10101010” Cp12-“11011101” Cp13-“11100111”	Cp11-“10101010” Cp12-“11011101” Cp13-“11100111”	Cp11-“10101010” Cp21-“10101010” Cp31-“10101010” --- 10101010 (corrected copy)
Second transmission	Cp21-“10101010” Cp22-“11011101” Cp23-“11100111”	Cp21-“10101010” Cp22-“11011101” Cp23-“11100111”	Cp12-“11011101” Cp22-“11011101” Cp32-“11011101” --- 11011101(corrected copy)
Third transmission	Cp31-“10101010” Cp32-“11011101” Cp33-“11100111”	Cp31-“10101010” Cp32-“11011101” Cp33-“11100111”	Cp13-“11100111” Cp23-“11100111” Cp33-“11100111” --- 1100111(corrected copy)

Scheme- II:

Sender		Receiver	Majority logic
First transmission	Cp13-"11100111" Cp12-"11011101" Cp11-"10101010"	Cp13-"11100111" Cp12-"11011101" Cp11-"10101010"	Cp13-"11100111" Cp23-"11100111" Cp33-"11100111" ---------- 11100111(corrected copy)
Second transmission	Cp21-"10101010" Cp23-"11100111" Cp22-"11011101"	Cp21-"10101010" Cp23-"11100111" Cp22-"11011101"	Cp12-"11011101" Cp22-"11011101" Cp32-"11011101" ---------- 11011101(corrected copy)
Third transmission	Cp32-"11011101" Cp31-"10101010" Cp33-"11100111"	Cp32-"11011101" Cp31-"10101010" Cp33-"11100111"	Cp11-"10101010" Cp21-"10101010" Cp31-"10101010" ---------- 10101010 (corrected copy)

VI. SIMPLE MATHEMATICAL JUSTIFICATION

We assume error syndrome (X) of first copy repeats in second copy and / or third copy in which case conventional APC fails to correct error. Say the probability of repetition is r. Now the proposed schemes will fail only when the repetition further repeats for many times (like further in three (03) copies and / or further in six (06) copies in scheme –I). The comparison of repetition probability then becomes as:

In normal APC = r

In proposed scheme I = r2 (3 copies further) or r3 (6 copies further).

This indicates repetition probability of error syndrome is much lower in proposed scheme.

VII. CONCLUSIONS

In this paper, two new schemes of APC are proposed & studied. These schemes provide better correction capability. Simulation study will be made in future research.

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REGRESSION TEST CASES MINIMIZATION FOR OBJECT ORIENTED PROGRAMMING USING NEW OPTIMAL PAGE REPLACEMENT ALGORITHM

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ABSTRACT

Regression testing remains one of the most laborious and costly software testing activities in software maintenance. Its laboriousness and costing increases with increasing number of test suits and interfaces with new environments: need to changed re-testing strategy. The strategy related to development the re-testing technique. Developed technique eliminated the redundant cases from test suites with minimized effort implementation. Another two testing strategy related to regression testing, one is test cases selection and other is test cases prioritization technique. Huge number (Test suits of existing software + Test suits of developed or changed software) of test suits are evolved in each maintenance and modification. This huge number of test suites contains with redundant test cases. The redundant test cases come from validated or existing soft ware. The aim of elimination of test cases is to identify the redundant test cases which are not affected by modification. The modified version (after elimination of redundant test cases) of test cases does not prone the new error of the existing validated software. An import research problem, in this context, is the new developed algorithm to minimize the test suites. As a result this developed algorithm would minimize the regression testing time and effort without disturbance of thoroughness of regression testing. Researchers have proposed different regression test minimization technique for different program paradigms such as Procedural program, object oriented program, web based program etc. Our approach is to implement the new optimal algorithm for regression test suites minimization for object oriented programming.

Keywords - Divide and conquer algorithm, Optimal Page Replacement algorithm, Logic based transition relationship.

I. NTRODUCTION

Software maintenance is related to the modification of software. The modification is done after delivered to the customer. The modified program need to improves the performance and adopt the new environments. Therefore, validated software need to re-test again (e g. Revalidation) is called regression testing. The aim of Regression testing is to ensure that there are no new errors have been introduced in the previously validated software. As well as the regression testing need to satisfy the new user requirements quickly and reliably. Each modification of software evolved huge number of test cases and making interface with new environments. As a result, re validation of modified software becomes high expensive, time consuming and laborious work. Almost half of the software maintenance cost is accountable for regression testing. So minimization of the re-testing effort is a major challenging activity in regression testing in software development life cycle.

Regression test suites minimization for object oriented programming is a very complicated task than procedural programming. Little bit of modification in OOP may affect among the large number of classes throughout the program due to inheritance, polymorphism, dynamic behavior of objects etc. Puzzling behavior of objects oriented programming improves the quality of software development but also make complexity of regression testing. Different approaches published in the literature [8, 14, 16, 17, 18] relating to regression test minimization. Three different regression testing techniques are considered for object oriented programming. First is Test case minimization technique [1, 2, 3, 8, 19] by which the redundant test cases are removed. The reduced Test suites have the fault detection capabilities. Second is a test suites prioritization [14, 18, 20]. Third is test suites selection [4, 12, 17]. In this paper we have approached the Regression test cases minimization for Object Oriented programming based on new optimal algorithm. This new optimal algorithm is made by the combination of divide and conquers algorithm plus optimal page replacement algorithm. The page replacement algorithm can manages the virtual memory through optimization technique. The optimal policy selects for replacement the page that will not be used for longest period of time. It is impossible to

implement because we need to know the future. But it has better optimization capability than other algorithm. Divide and conquers algorithm increases its efficiency and helps to remove the redundant test cases from test suites during regression test cases minimization. Illustrative example has been given to established the effectiveness of our proposed algorithm in our paper.

II. RELATED WORKS

Shin Yoo et al. [14]

In this work, the test cases minimization problem has explained as a Np complete problem. Test cases minimization problem has been explained mathematically as follows: T is the test suites. Test requirements r1 , r2 ,……..rn must be satisfied to provide adequate testing of modified program P* in fig. 2. T1, T2, ……Tn are subsets of T. One associated with each r1 s such that any one of the test cases tj belonging to Ti can be used to achieve the requirement ri . Here s is the specification of test cases. Representative set Ti developed from T satisfies all r I s .This problem is considered as minimal hitting problem [17, 18]. Development of different heuristic searches solved the minimal hitting set problem. Fault detection capabilities of different developed Heuristics search (GE heuristic, GRE heuristic) is better test suite minimization technique. How this type of technique can be implemented for object oriented programming is not clearly mentioned. Lien et al.[10] approached additional testing criteria to break the ties in the minimization process. Test suites minimization is a NP complete problem. The problem can be solved in a polynomial time [7]. Bharti et al.[1] approaches regression test reduction technique based on Genetic algorithm and Bee colony Optimization Technique. This work can cover the maximum faults during re-testing. The proposed technique is not evaluated with other regression test reduction technique for object oriented programming. Dmitry et al [3] approaches a new model introduction between validated and re validated software. The new model making interface between two models and reduced the test suites. How this model can detect the faults from object oriented programming has not explained.

III. PROPOSED APPROACH

Class is a basic unit of testing for OOP. Method is a basic unit for testing a class. Any modified code makes impacts on certain places of existing methods among classes. Our proposed approach in test suites minimization based on new optimal algorithm coupled with logic based dependency analysis of test cases in object oriented programming. Sequence of our proposed approach is given below:

A. We are collects the test cases from affected classes. It is shown in step.1 of fig.1. The unaffected class means modified program do not harm due to dynamic behavior of objects.

B. Collection of test cases (from affected classes and modified program) is rearranged by divide and conquer algorithm. Step.2 showed the location in Fig.1. The divide and conquer algorithm merge the test cases in such a way that the same test cases are placed nearer to each other.

C. The test suites are arranged as per page frame number. We have assumed the page frame number is 3. It is details explained in step.2.

D. Merging of test cases defined the transitive relationship of test cases. This logic based dependent transitive relationship of test cases defined the coverage of fault prone area or whole modified program.

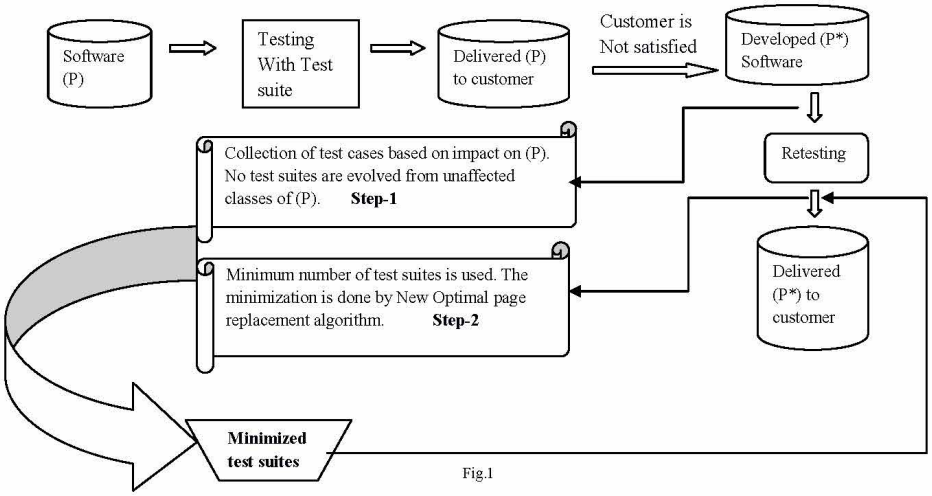


Fig.1

E. Finally redundant test cases are eliminated by optimal page replacement algorithm.

This algorithm manages the virtual memory by minimized page faults rate. During minimization of fault rates it acts on referenced strings. These referenced strings referred to memory and compute the number of page faults and page replacement of those strings. In this paper we have shown in step2 how divide and Conquer optimal page replacement algorithm acts on the controlled test suites (referenced strings) and yields the minimized test suites.

STEP -1: Affected classes in modified program.

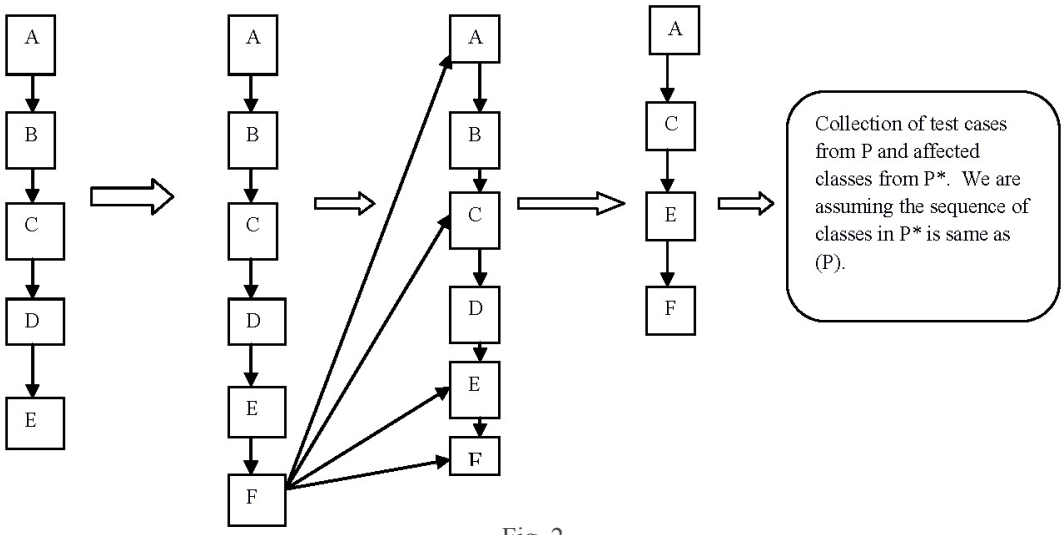


Fig. 2

New class (F) impacted on
(P*) and the harm classes are: A
A, B, C, D, E are C, E. F Remaining classes are
Multilevel inheritance If customer is not satisfied (B, D) not harmed.
Classes in Program (P). Then Modified Program (P*) with
It is delivered to customer. Addition of New Class (F)

Step-2: Test suites minimization Problem:
In fig.2, P* is a modified program under test. P* having test suites T and S be the specification. A set of test case requirements (t1, t2,-------t n) of T that provide the desired adequate testing of the program P*. Now T1, T2, ----Tn are the subsets of T and individual test case is denoted by t. P*(t) is executed with input t. We have to be find out the subsets of Ti from the test suites T that satisfies all the ti s.

Divide and Conquer optimal page replacement algorithm has been using for Test suites minimization:

1. Minimum number of test case generation {
2. Initialization of Test cases;
3. Evaluate the Test cases {
4. Divide and conquer technique as per number of page Frame;
5. Each division would follow the same sequence of Previous test cases;
6. **If** (Current test suites followed the previous page frame)
7. **Then** replaced the test cases that will not be used for Longest period of time;
8. **Else** Go to 4;
7. **End if**

   }

}

Implement of Traditional Optimal page replacement algorithm for minimization of test suite:

In Fig.2, P* is a modified software under test. A is an impacted class. We assume the software P having test cases in **A = {a0, a1, a2, a3, a4}**. Class A (affected class showing in Fig. 2) having test cases including redundant test cases in modified software P*. We are considering here a single class A. **T= {(a7, a0, a1, a2), (a0, a3, a0, a4), (a2,a3,a1 a5)}**. Here representing the test cases as memory representing /

referenced strings.

Reference String: a7, a0, a1, a2, a0, a3, a0, a4, a2, a3, a1, a5

Test suites represented as Page frame = 3

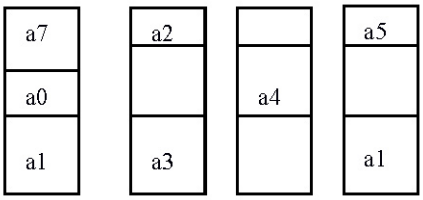


Fig. 3

Page faults: 8 Nos. (a7, a0, a1, a2, a3, a4, a5, a1)

It is seen that redundant test cases (a1) is remains in traditional Optimal Page fault algorithm. This redundancy increases with increasing modified numbers.

Our Proposed Divide and Conquer Optimal Page Replacement algorithm generating minimized test cases: software P* is A= {a7, a0, a1, a2, a0, a3, a0, a4, a2,a3,a1 a5}

a) Divide the Test suites (Generating from P*) as per page frame number : Page Frame = 3

a7, a0, a1, | a2, a0, a3, | a0, a4, a2, | a3, a1, a5.

▼

a7, a0, | a1, a2, | a0, a3, | a0, a4 , | a2,a3, | a1 a5.

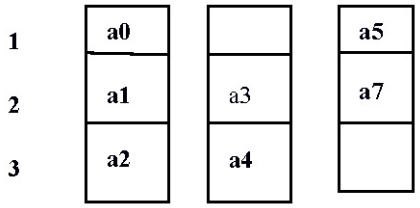
▼

$$\frac{a0, a1, a2}{1} \mid \frac{a3, a4, a7}{2} \mid \frac{a0, a1, a2}{3} \mid \frac{a3, a0, a4}{4} \mid \frac{a5}{5}$$

b) Groups which contains with nearly same reference strings / test suites are brought to nearest places.

$$\frac{a0, a1, a2}{1} \mid \frac{a0, a1, a2}{3} \mid \frac{a3, a0, a4}{4} \mid \frac{a3, a4, a7}{2} \mid \frac{a5}{5}$$

Implement Optimal Page Replacement Algorithm:



Page Faults number / Test suites is reduced to7 nos.

Developed Test suites **T = {(a0, a1, a2), (a3, a4), (a5, a7)}** can execute the program P*.

According to optimal page replacement algorithm, the test suites are replaced which are not used in longest period of time. If the test suites (a0, a1, a2) used in future then it is produced the redundant test suites during regression test suites minimization. Therefore, it is need to elimination. The existing page frame has been declaring that the existing test cases can be future useable. The future useable pages contains with test cases can be used for fault detection [5] of modified program P*.

Puzzling characteristic of object oriented programming (e g. Inheritance, encapsulation, polymorphism etc) lead the complex relationship among programming elements. This type of behavior making difficulties to analysis the dependency. The dependency relationship of classes in OOP is Generalization relations [12]. So, generic test requirements are necessary[12]. The generalization relation is not reflexive (R), not symmetric (S), but is **transitive (T)**. We can approach the logic based transitive relationship for satisfying modified program P*. Now we have got the reduced test suites from the above developed algorithm is:

Reduced test suites is **T= {T1, T2, T3 ------Tn }**, Where

T1 = {a0, a1, a2}

T2 = {a3, a4}

T3= {a5, a7} [Generated from class A after modification e g. P*]

As per logic on dependency analysis, Frame number of optimal page replacement represents the test suite. Each test suites contain with three test cases.

Test cases in class **A →{a0, a1, a2 }** (validated from P)

{a0, a1, a2} T [Modified test suites in program P*. Class A* is a affected class during modification]

Modified **T** → Class A*

Therefore, Class A* is being executed with test cases **a0, a1, a2**. The similar transitive dependency based relationship will be prove the execution of modified Class A* by **{a3, a4}**.

Now we are considering subsets of **T3 = {a5, a7}**.

Class A* [Modified class executed by] → **{ T1 , T2}**

{T1, T2 } [Transitively related with T3 . Because they are in same class **A*]** → **T**3

Therefore, Class A*→ **T3** .

As a result, the affected class A* is being executed with the Test suites **T = {(a0, a1, a2), (a3, a4), (a5, a7)}**.

This logic based Transitive relationship has been supported by our proposed algorithm of section b).

$$\frac{\{a0, a1, a2\}}{1} \rightarrow \frac{\{a0, a1, a2\}}{3}$$ [Redundant is removed]

Test case {a0, a1, a2 } is generated after removing redundancy.

$$\frac{\{a0, a1, a2\}}{3} \rightarrow \frac{\{a3, a0, a4\}}{4}$$

Test case {a3, a4} is generated after removing redundant a0.

$$\frac{\{a3, a0, a4\}}{4} \rightarrow \frac{\{a3, a4, a7\}}{2}$$

Test case a7 is generated from test suite **{a3, a0, a4}**.

$$\frac{a3,\ a0,\ a4}{2} \rightarrow \frac{\{a5\}}{5}$$

Test case a5 is generated from **a3, a4, a7**.

Benefits from our proposed algorithm:

Impact based test suits minimization followed by Divide and conquer Optimal page replacement algorithm minimizes the Soft ware requirements specification, Designing, coding, Testing and maintenance. Our novel optimal page replacement algorithm can optimize the results. It solves the complex problem with mathematical recursion. Divide and conquer algorithm increase the efficiency of optimality power of optimal page replacement algorithm. Optimal page replacement algorithm is also known as optimal deterministic algorithm (Wikipedia, The free Encyclopedia). It has the capacity to guess the best solution (e g. to guess which page of memory to be replaced for writing to disk and to minimize the total number of page misses). The deterministic algorithm computes the same output as given a particular input through the same sequence of states. But optimal page replacement algorithm alone cannot remove the redundant test cases from P*. Therefore, we have combined the benefits of two Algorithms and have made a new algorithm which has been using for removing the redundant test cases during retesting. Our proposed technique may be more effective in order to removing the redundant test cases than existing using of greedy algorithm [14, 17, 18], heuristic search algorithm [2, 14], greedy heuristic algorithm [17], genetic algorithm [8, 9], bee colony and genetic algorithm hybridization [1, 13, 19]. Greedy technique can solve a general optimization problem but it fails to deliver the solution in larger problem. This technique leads to optimize the problems but the solution yielded by greedy algorithm is not optimized [7]. The heuristic search algorithm does not search the possible path of the solution at each step. It searches only nearer to our goal states [7]. Of course we could not be sure that nearer to our goal states is the accurate result. It could be that we are really nearer to our goal state. Developed version of Heuristic search algorithm may be generate the accurate results. Test suite reduction by Genetic algorithm is a good approach. But it is a cumbersomeness and time consuming process. Large number of random population, multipoint crossover stages, mutation stages makes the algorithm complex. Any soft computing based test suite minimization could not generate the accurate result as compare to hard computing system. The hard computing technique computes the optimized value based on mathematical results. This type of new algorithm (based on mathematical induction and recursion technique) could be applied for retesting the large software for getting the accurate results. Our proposed test suites minimization techniques can coverage the maximum affected classes and yields the minimum size of test suites (as per frame size). Higher coverage revealed more faults and effective test suites than size of test cases [5, 18].

As per S. Yoo et al [14], the effectiveness of the minimization of this proposed algorithm is =

$$\left\{1- \frac{\text{Number of test cases in the reduced test suite}}{\text{Number of test cases in the original test suite}}\right\} \text{ X } 100\%$$

Number of test cases in the reduced test suite

1 x 100%

Number of test cases in the original test suite

Number of test cases in the original test suite

Effectiveness of minimization in Traditional Optimal page replacement algorithm is= (1- 8 / 12) x 100%= 33%. Effectiveness of minimization in our proposed Optimal page replacement algorithm is = (1-7/12) x 100% = 41.7% which is 9% .more than traditional optimal page replacement algorithm.

IV. CONCLUSION

Our approach may be help to reduce the regression test suites minimization for object oriented program. Divide and conquer algorithm merges the test cases. The merged test cases covered the transitive relationship among the classes of modified program. Optimal page replacement algorithm having optimization capacity. This algorithm optimized the test cases. It replaced which will not be used for longest period of time. The future used of test cases means generating of the redundant test cases. Therefore, number page faults representing the reduced test suites. Logical based transitive relationship dependency of test cases can predict the faults prone area from modified program..

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