

## M.TECH. THESIS ABSTRACTS 2000

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## Microelectronics, VLSI & Display Technology

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*Title* : *A New Approach For Topology Selection Of Analog Circuits*  
*Author(s)* : *Sharma Arun Kumar*  
*Supervisor(s)* : *Mazhari Baquer*  
*Roll No* : *9810406*

***Abstract:***

Owing to steady increase in the number of new application specific integrated circuit (ASIC) designs that include analog functions and their increasing complexity, the need for analog computer-aided design (CAD) tools is being urgently felt. The bulk of the research in the area of the analog design automation is devoted to the issues of “parameter selection”, i.e., selecting optimum device sizes and bias points to meet the specific targets. Although “topology selection” is crucial in designing the high performance analog circuits however little work is reported in this area. In the present work, a new approach is presented for selection of topology from a fixed set of alternatives. The basis of the new approach is in the new definition of a topology, which is characterized as set of analytical equations that describe the constraints among the specifications. Topology selection is done by determining the topology, which while satisfying all the constraints, has minimum area or some other metric. It is shown that this approach encompass within it the traditional qualitative rule-based topology definition and selection methods. The validity of approach is demonstrated with the help of various op-amps like, Miller compensated complementary metal oxide semiconductor (CMOS) operational Trans conductance amplifier (CMOS OTA), simple CMOS OTA and Folded cascode CMOS OTA

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***Title*** : ***A New Approach To Use Of Testability Measures In Improving Test Generation Process***  
***Author(s)*** : ***Jain Ranoo Kumar***  
***Supervisor(s)*** : ***Mazhari Baquer***  
***Roll No*** : ***9810442***

***Abstract:***

generation process in order to cope efficiently with increasing complexity of combinational circuits. Testability measures, which are easy to compute, have been used in the past to improve test generation process. In this work, attempts are made to extend further the use of these testability measures by suitably preprocessing the fault list. One approach in this work is based on the premises that 1) easy-to- test faults can be separated from hard-to- test faults using testability measure and, 2) vector generated for easy-to-test fault can detect some hard-to- test faults. Although these premises appear to be sound, the results are not positive. This is due to poor correlation between the SCOAP testability parameter used and the ease or difficulty in fault detection. The second approach seeks to take advantage of the well-known observed fact that a vector generated for a fault also detects several other faults. If on the basis of some easily computable property or signature of a fault, it can be predicted which all faults are likely to be detected by same test vector then time taken for fault simulation can be reduced by suitably preprocessing the fault list. The SCOAP testability measure is used as a signature of fault for this purpose because equivalent faults in a circuit are found to have equal testability parameter. Results for this approach are positive

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*Title* : *System Level Simulation Of Analog/Mixed Signal Circuits Using VHDL*  
*Author(s)* : *Krishna R B K Murali*  
*Supervisor(s)* : *Mazhari Baquer*  
*Roll No* : *9810437*

***Abstract:***

Top - Down design of complex circuits proceeds in a series of steps from the specification to the layout level. After completion of design, it is important to verify the functionality and various performance indices. The verification is most accurate if it is carried out through simulation at the transistor schematic level. However, this approach becomes intolerable as circuit complexity increases due to large simulation times. As a result, complete system simulation has to be carried out at a higher level of abstraction. This approach, for example is taken in digital systems where both functionality and timing are verified at the gate level and not at transistor level. Such an approach, although needed, is not common in analog circuits due to several reasons including absence of well - defined abstraction levels, large number of performance indices, and until recently lack of a standard language for higher level modeling of analog circuits. This thesis illustrates complete system simulation using the higher level modeling features of a hardware description language. It takes a Serial bit Switched Capacitor Successive Approximation Analog - to - Digital Converter as an example and uses an abstraction level that is one level higher than that of OP - Amps, Comparators and transistor switches, to carry out complete Analog - to - Digital converter simulation in very short times

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*Title* : *An Experimental Study Of Discharge Mechanism In ECDM*  
*Author(s)* : *Kulkarni Anjali V*  
*Supervisor(s)* : *Sharan R& Lal Govind Kumar*  
*Roll No* : *9710425*

***Abstract:***

Electrical discharge associated with electrolysis process causes material removal and can be effectively used for machining of conducting as well as non conducting materials. These processes are known as electrochemical discharge machining (ECDM) processes. Although ECDM is commercially in use, the basic mechanism of the process is not yet completely understood and is still a matter of research investigations. The present work has attempted to measure the time varying temperature and current in the process to reveal the basic mechanism of temperatures rise and material removal and to calculate the efficiency of the process. Experiments are performed using different work piece materials viz., copper, brass, silicon and tantalum. In the case of copper, experiments have been performed using the fractional method scheme with supply voltage ranging from 130V-180V and HCl electrolyte concentration from 1%-5% in volume. For other materials, experiments are performed at supply voltage of 155V and 3% electrolyte concentration. A novel way has been developed to remotely sense the time varying temperature of work piece using a radiation pyrometer. In addition the temperature at different locations in ECDM cell and on the work piece surface are measured using immersion thermocouples, and conventional thermocouples during the ECDM process. The surface features of the discharge treated work piece have been observed under an optical microscope which show the effect of an individual discharge on the work piece and clearly indicate melting and solidification of the material in the discharge affected zone. Energy analysis is performed by comparing the total input energy with associated with the electrolyte in raising its temperature and the total energy associated with the work piece (required to raise the temperature of work piece and for transformation of the work piece material). The energy associated with the work piece gives the measure of the efficiency of the process which turn's out to be low-of the order of 2-6 %. On the basis of the time varying current, a mechanism is proposed for the occurrence and the effects of the discharge. This mechanism provides a consistent reasoning for the use of ECDM process for micro welding purpos

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*Title* : *Modeling Of Extrinsic Base-Resistance Of BJT For ECL And Ac Amplifiers*  
*Author(s)* : *Shukla Sunit Kumar*  
*Supervisor(s)* : *Mazhari Baquer*  
*Roll No* : *9810453*

*Abstract:*

The extrinsic base-resistance is an important model parameter in all the lumped models of BJTs. Its value is often taken as that in the active-mode of transistor operation for non-saturating BJT circuits like ECL and AC amplifiers. Using SPICE simulation for an equivalent distributed-model of an integrated circuit transistor, it's shown that  $R_{bx}$  is not a constant but changes widely during transient and ac analysis for ECL and ac amplifiers respectively. A general model has been proposed and verified for the estimation of lumped extrinsic base parameters ( $R_{bx}$  and  $C_{jex}$ ) in such BJT devices

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*Title* : *Design of Programmable Fir Filter*  
*Author(s)* : *Pawar Sanjay Shivaji*  
*Supervisor(s)* : *Mazhari Baquer*  
*Roll No* :

***Abstract:***

Integrated circuits (IC) technology helps make better digital systems due to its advantages in terms of size, speed and power consumption as compared to discrete components. Today with increasing complexity of digital circuits, the design problem is handled using techniques such as hierarchical design and design abstraction. In design abstraction we start from specifying functional level details at the highest abstraction level and move down the design flow step by step till the lowest level. Typical design abstraction ladder for digital systems include functional, behavioral, registers transfer level (RTL), logic, electrical and layout levels. The complete design process is illustrated in this thesis through an example of 'Programmable FIR filter'. Starting from block level specifications, the system is modeled at behavioral, register transfer level (RTL) and gate level in VHDL and code is verified using test benches and simulation tools at all levels. In physical design, the circuit representation of each component is converted into a geometric representation. In this work, a filter architecture consisting of one multiplier and an adder is used. This architecture is advantageous from resource point of view but takes more clock cycles to process the data.

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*Title* : *Design Of An 8-Bit Microprocessor*  
*Author(s)* : *Dwivedi Ram*  
*Supervisor(s)* : *Mazhari Baquer*  
*Roll No* : *9820407*

***Abstract:***

knowledge of almost all the aspects of design flow. The present day IC technology is the enabling technology for a whole host of innovative devices and helps make better digital systems due to its advantages in terms of size, speed and power consumption as compared to discrete components. A good design is an optimum solution of a problem, realized within the constraints of available technology. The present work is an attempt to understand different aspects of such a typical design process. Modern day design problem is handled using techniques like hierarchical design and design abstraction due to increasing complexity of the circuits. In design abstraction, we start from specifying functional level details at the highest abstraction level and move down the design flow step by step till the lowest level. Typical design abstraction ladder for digital systems include functional, Behavioral, registers transfer level (RTL), logic, electrical and layout levels. The complete design process is illustrated in this thesis through an example of 'Design of an 8-bit Microprocessor'. Starting from block level specifications, the system is modeled at behavioral, register transfer level (RTL) and gate level in VHDL and code is verified using test benches. In physical design, the circuit representation of each component is converted into a geometric representation using Magic and verified. In this work, VHDL codes are verified using the example of multiplication of two 8-bit numbers (using 'shift and add' algorithm of multiplication) while the layout has been verified for all the instructions taken individually. The final layout worked as per our specifications, with a maximum clock frequency of 5 MHz

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*Title* : *An Improved Modeling Technique For CMOS Gates*  
*Author(s)* : *Shah Divyesh Kumar*  
*Supervisor(s)* : *Qureshi Shafi*  
*Roll No* : *9810418*

***Abstract:***

simulations at each level of the hierarchy. The timing simulators are used for finding out the delay of the designed circuits at the electrical level. Simulators like SPICE give very accurate information regarding the delays, but they are not useful for simulating very large circuits as they consume lot of time. Many simple models have been proposed to develop fast timing simulators, but they have resulted in loss of accuracy owing to the simplified models that they use. Research is going on to attain at considerably accurate as well as efficient models. One such model that has been proposed was studied and the reason for the loss of accuracy pointed out. The complete modeling has been redone with suitable corrections applied and the gain in accuracy with a very minute loss in efficiency is demonstrated

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*Title* : *A Dual Polarized X-Band Antenna Element For Array Applications*  
*Author(s)* : *Mahapatra Aresh Kumar*  
*Supervisor(s)* : *Sachidananda M*  
*Roll No* : *9810407*

***Abstract:***

In the case of a conventional array design, element pattern does not play a vital role in calculating the array factor. Since in practice element pattern is broader i.e. there is no significant directivity, array factor nearly same as the array pattern. But when the radiation pattern had a significant directivity, the element pattern must be take into account while designing array factor. There are few advantages of using directive element in an array. First of all, from the cost point of view, the number of element required is less for a given design specification. Besides this, the more important advantage is that the complexity of feed arrangement can be reduced. There are several different directive elements which can be realized. Some examples of such elements are the conical corrugated horn, the dielectric loaded horn, the log periodic array of dipole, etc. in this thesis we have tried to develop a directive element whose main radiator is a microstrip patch radiator with some parasitic patches to make the element directive which also allows us to shape the radiation pattern. Because of the many advantages, such as the low cost, light weight, low profile structure, the microstrip antenna was selected as a radiator. There are also some disadvantages of the microstrip antenna which is low bandwidth and poor power handling capability. Also studied are improvements in the bandwidth of the antenna element using parasitic element.

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*Title* : *Studies On Laser Ranging Systems*  
*Author(s)* : *Sarimela Valluri*  
*Supervisor(s)* : *John Joseph*  
*Roll No* : *9810460*

***Abstract:***

An extensive study of various range-finding techniques was carried out for both longrange and short-range applications making use of various types of laser sources .Therelative merits and demerits of available laser sources were pointed out. Systemconsideration of the major blocks of a laser range finder was studied. Modern signalprocessing techniques for improving the performance of range measurement at lowpower outputs are considered. Improvement of the SNR at low power levels by usingPulse integration or signal averaging technique is discussed .A digital signal averagescheme was designed and implemented using a high speed 8-bit ADC, RAM, ands DAC.Timing and control-signal generators for the above average were implemented usingslanted digital hardware .For typical receiver outputs signal build up was observed onthe CRO. Improvements to the above design are suggested. Simple transmitter andreceiver circuit schemes were carried out and implemented

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*Title* : *A Microwave Band Pass Filter With Multi-Octave Stop Band*  
*Author(s)* : *Kumar Rajender*  
*Supervisor(s)* : *Sachidananda M*  
*Roll No* : *9810439*

*Abstract:*

A novel method of realizing a microwave band pass filter with multi-octave stop band insuspended stripline/stripline, is presented in this thesis. Generally microwave filters are realized using distributed quarter/half wavelength resonators. These filters have multiple pass bands at odd harmonics of the fundamental frequency which are not desirable for some applications such as multiplexers and diplexers etc. the microwave band pass filter is realized by series combination of low pass and high pass filters. A semi-lumped approach is adopted in which the lumped elements are realized by very short length of transmission lines of appropriate impedances. In this approach, the spurious responses in the stop band are removed to achieve wide stop bands. The filter elements, inductors and shunt capacitors are realized by the short lengths of high and low impedance transmission lines in suspended stripline and stripline structures, respectively. Series capacitors are realized in broad side coupled suspended stripline. Lumped prototype low pass filters are synthesized by using Chebyshev and generalized Chebyshev polynomials. By using filter transformation, the Chebyshev and generalized Chebyshev prototypes are transformed to the low pass and high pass filters, respectively. The lumped elements are then approximately replaced by the corresponding transmission lines to obtain the semi-lumped or transmission line equivalent filters. The theoretical filter characteristics, insertion loss and return loss are analyzed using S-parameters which are found by computing over-all ABCD matrix of the filters. A low pass filter (cut off frequency 4GHz and stop band up to 18 GHz) and a high pass filter (cut off frequency 2GHz and pass band up to 18 GHz) are designed and fabricated. The individual filter responses are measured and compared with the theoretical ones. The response of the bandpass filter (combination of low pass and high pass filters) is also measured and compared with the theoretical results

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*Title* : *FDTD Analysis Of NRD Guide Discontinuities*  
*Author(s)* : *Anand G V R*  
*Supervisor(s)* : *Sachidananda M*  
*Roll No* : *9820403*

***Abstract:***

Difficult, as the modes excited in the vicinity of the discontinuity cannot be predicted. Alternative is to use a computational technique to approximate the behavior of the discontinuity. The Finite Difference Time Domain (FDTD) technique is used to analysis a few Non Radiative Dielectric (NRD) waveguide discontinuities. The three-dimensional FDTD formulation in Cartesian coordinate system is done for the analysis of three NRD discontinuities, open- end, end- coupled gap and the edge- coupled gap discontinuity for millimeter wave frequencies centered at 35 GHz. NRD guides with Alumina ( $\epsilon_r = 9.5$ ) are considered in the analysis. NRD guide dimensions for Alumina, Fused quartz ( $\epsilon_r = 3.8$ ) and Teflon ( $\epsilon_r = 2.1$ ) are calculated for 15- 85 GHz. and tabulated. An FDTD code is written based on the Yee algorithm. Maxwell's equations are discretized using the central differencing scheme for the differential equations. Code written for the simulation is first tested for the problem of diffraction of an incident TM wave by a square shaped conducting obstacle. The results obtained are compared with the published results for a similar problem. The end- coupled gap NRD guide discontinuity is analysed next. The simulation is performed for two different gap widths. From the time-domain data stored through simulation, frequency dependent scattering parameters of the discontinuity are obtained over the frequency range of 33 – 37 GHz. The analysis of the edge- coupled gap discontinuity is carried for two different coupling lengths. Several modifications that could be done to the code are listed

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*Title* : *Digital Communication System Simulation Using LABVIEW As A Simulation Tool*  
*Author(s)* : *Nangia N*  
*Supervisor(s)* : *Chatterjee P K& JohnJoseph*  
*Roll No* : *9810431*

***Abstract:***

Simulation model of various modulation and demodulation schemes used in digital communication systems has been implemented using a graphical programming software, LabVIEW. Data generators, the coders, modulators, AWGN channel, detectors and decoders have been modeled for all the modulation schemes simulated. A signal from a function generator, implemented in LabVIEW, is the input source signal, which has been processed and reconstructed. The effect of channel characteristics in terms of intersymbol interference and probability of error has been highlighted through simulation of zero forcing, preset, and adaptive equalizers. It has been highlighted as to how the inter symbol interference, generated the to channel characteristics, reduce noise margins and lead to higher errors in detection. The probability of error plots obtained for various modulation schemes, the spectra, parameters determined over the link and the results of comparison of various modulated carrier signals in terms of power spectra, phase transitions, or transmission through a band limited channel, match well with the theoretical results

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*Title* : *Isolated Word Recognition System Based On Discrete  
Hmm*  
*Author(s)* : *Ahirwar Anil Kumar*  
*Supervisor(s)* : *Ray G C*  
*Roll No* : *9710408*

***Abstract:***

The solution of speaker independent isolated word recognition using vector quantization and hidden Markov model based analysis along with front end processing is presented in this thesis. Both the vector quantizer and the hidden Markov models need to be trained for the vocabulary to be recognized. In this case such training has resulted in a distinct hidden Markov model for each word in a vocabulary. Recognition consist of computation of probability for each word and selecting the highest. In the thesis linear predictive coding (LPC) analysis is done in the front end processor to convert the speech signal of a frame into some parametric representation (cepstral coefficient). This results in a series of vectors characteristic of time varying spectral parameters of the speech signal. These vectors are grouped into discrete sets by k-means clustering algorithm. During the training process, different HMMs are modeled for different words in vocabulary. During the recognition process Viterbi algorithm is used to determine the HMM within the sets of HMMs that best matches with the observation sequence

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*Title* : *Link Performance Analysis Of An Optical CDMA System Using An Optical Preamplifier*  
*Author(s)* : *Dubey Prabhat Kumar*  
*Supervisor(s)* : *Chatterjee P K*  
*Roll No* : *9810435*

*Abstract:*

The spread spectrum code division multiple access (CDMA) allows asynchronous multiple access to a communication channel with no waiting time. The enormous bandwidth of optical fiber satisfies the high bandwidth of fiber, which can be overcome by the optical signal processing elements such as optical amplifiers and optical matched filters. In this thesis we have studied optical CDMA (OCDMA) which is an extension of CDMA in optical domain. An optical preamplifier is placed after the optical matched filter in the receiver to increase the receiver sensitivity. A general optical orthogonal code (OOC) is used which has both cross correlation and autocorrelation bounded by unity. The optical intensity due to the interfering users correlated by the desired user's code at a particular user receiver is a random variable, and the Poisson count process of the detector further modifies its statistics to generate random current whose distribution is evaluated. Thus, by analyzing a typical link in OCDMA system we have plotted the dependence of BER on the weight of OOC, number of users in the system, and input power per user to the receiver, for two different lengths of OOC. The nature of curves obtained is in agreement to the previous works. These plots show that for users with data rate of 155 Mbps an OCDMA system can be designed. The OOC with length 1024, weight 10, can be used in this system and 7 simultaneous users can be accommodated for  $BER < 10^{-10}$ . If the length of code is increased to 4096, then we can accommodate 25 simultaneous users. The fiber span of this system, with optical preamplifier in receiver, is 100Kms. The increase in the fiber span is achieved without deterioration in performance of the system

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*Title* : *Study Of Channel Assignment Strategies For Handoff And Initial Access In Mobile Communication Networks*  
*Author(s)* : *Rao Battula Venkateshwara*  
*Supervisor(s)* : *Sinha Vishwanath*  
*Roll No* : *9810412*

***Abstract:***

An efficient allocation of resources is the key to high system capacity. One of the important engineering issues in cellular communication system is to increase the capacity or carried load by the cellular network. Among the different possible approaches to increase the capacity attention is being paid to the development of an efficient channel assignment strategy for handoff and initial access. The study presents new channel assignment strategy for handoff and initial access in a cellular communication network. The objective here is to improve the network throughput or the probability of call completion. We develop a model based on a non-preemptive priority queuing discipline. New calls, which originate within a cell at a Poisson rate, are queued if all channels are occupied. Handoff requests arrive at a Poisson rate, are queued if no channel available at the time of arrival. As soon as channel available, handoff requests are served first. If the handoff queue is empty, waiting new call will be served. The performance criteria of interest are: probability of call completion, probability of handover dropping, probability of new call blocking and carried versus offered traffic. Our scheme is seen to provide better call completion probability or throughput, less call blocking without effecting the forced termination and delay much, under all traffic conditions

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***Title*** : ***Link Budget Analysis For Digital Satellite  
Communication System***  
***Author(s)*** : ***Bhargava A***  
***Supervisor(s)*** : ***Chatterjee P K& Srivathsan K R***  
***Roll No*** : ***9810401***

***Abstract:***

Satellite communication applications extend to various human activities including data communications, TV broadcasting, information distribution, maritime communication and remote monitoring. Satellite communication has gained popularity owing to its broadcast feature and provision of two-way links using standard Earth stations and VSATs. As compared to terrestrial communication links the satellite provides a wide area of coverage (across countries or continents) and higher bandwidth. In satellite communication the system performance is highly constrained by limited power and bandwidth availability. Constant endeavor is being made to achieve higher and higher transmission rates with the given power and bandwidth. Link budget calculations have been done as part of the hybrid network project undertaken by Electrical Engineering Department, IIT Kanpur. In hybrid networks the forward and return access paths to Internet are split, with high speed link, provide in the reverse direction to significantly improve the overall downloading rate. Typically a digital satellite communication link can be used as the high speed link. The thesis aims at link budget calculations for digital satellite systems using INSAT series and leased (2DT & PAS-4) satellites by doordarshan, India. Typical link budget calculations have been carried out by considering IIT Kanpur as the standard uplink station and a VSAT as the downlink user spread across the Indian mainland

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*Title* : *Resource Allocation In Wideband CDMA Networks For High Data Rate Applications*  
*Author(s)* : *Sharma Gaurav*  
*Supervisor(s)* : *SinhaVishwanath*  
*Roll No* : *9810419*

***Abstract:***

Present generation wireless networks are being designed considering voice as primary traffic. After the advent of the Internet era, demand for high data traffic over mobile networks is increasing. Third generation standards are proposed to meet the increasing data traffic over mobile phone. Code division multiple access (CDMA) is a promising techniques for radio access in the future cellular networks and personal communication systems. CDMA in cellular systems offers some attractive features, such as high spectral efficiency, soft capacity diversity, simplified frequency planning, etc. all the third generation CDMA standards are called Wideband CDMA because of their wider access bandwidth. In case of Internet access, flow of traffic is generally from a remote server to a user terminal, which constitutes downlink traffic for wireless networks. Power transmitted for a user depends on the bit and interference conditions. Base stations are total power transmitted limited. To support multiple bit rate traffic, power allocation at the base station becomes vital. This thesis deals with the problem of resource allocation in the forward link for Wideband CDMA networks. Users with data rate of 9.6kbps, 144kbps, and 384kbps are considered with a system bandwidth of 5MHz, operating in 2GHz band. We have proposed three power allocation algorithms, which are based on the load and interference calculations. Minimization of blocking probability for different user classes is the primary concern of the proposed algorithms.

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***Title*** : ***A Virtual Instrumentation Implementation For Remote Monitoring And Analysis Of Electric Power Substation Parameters***  
***Author(s)*** : ***Murthy Narayana C B N S***  
***Supervisor(s)*** : ***Srivathsan K R***  
***Roll No*** : ***9810415***

***Abstract:***

Geographically distributed networks such as power distribution, water, gas etc. have not seen the widespread use of networked installation for monitoring and control. IIT Kanpur has developed a sophisticated monitoring and control network with associated devices for the electric power distribution sector. Monitoring and control is done from a communication controller. The communication controller can be connected over the Internet. This gives an opportunity for remote visualization of the power distribution utility parameters. The existing interface for monitoring and control and its communication has been developed using objects oriented approaches. It addresses objects in a format that is not compatible with open Internet standards. This interface also lacks live instrument display of utility parameters. The availability of virtual instrumentation based packages such as Lab VIEW enables live instrument display of important utility parameters. The Lab VIEW based interface can communicate with remote systems over the Internet using its TCP/IP features. Further, LabVIEW can be used as an online diagnostic tool with appropriate remote Data Acquisition system. The necessary data structures for the substation elements are assumed to be available in ASN.1 format. In practice this assumption amounts to developing a translator for the data collected in proprietary/non - open format to that of ASN.1 has been done with a Snacc compiler. The front panels of the substation elements are made with the G language code. The user interface is developed in a manner that if a user selects an option at the layout diagram, the corresponding panel pops up on the screen. A trial implementation is done using simulated data for the remote visualization of the electric substation parameters

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**Title** : *Low Bit-Rate Video Coding Using Watershed Segmentation And Control Point Tracking*  
**Author(s)** : *Prabhakar B*  
**Supervisor(s)** : *Gupta Sumana*  
**Roll No** : *9810410*

***Abstract:***

In this thesis we describe the design of a low bit rate video codec based on an arbitrary shaped region based approach. Unlike conventional region - based methods the region shape information is not transmitted in the present approach, as it can be synchronously obtained by segmenting the reconstructed picture at both the encoder and decoder respectively. A local decoded picture is divided into several segmented regions and moving regions are selected based on the frame difference. The algorithm used for spatial segmentation is a multiscale gradient algorithm followed by the watershed transformation which provides accurate segmentation at very low computational cost. A novel corner detection and tracking approach is used for robust motion estimation. Corner points are used to represent each moving region and estimation of their motion through tracking is used to characterize the motion of each moving region. A least squares method is used to estimate the motion parameters. The estimated motion is used to predict the next frame using motion compensated prediction. Finally an efficient method for coding prediction error is also proposed. The algorithm developed was tested on standard sequences. A data rate between 10 - 20 kbps was obtained at a frame rate of 7.5 frames/sec. The PSNR obtained ranges from 38db to 34db for different sequences indicating good quality of reconstructed images

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***Title*** : ***Switching Algorithm For An All-Optical Packet Switch Using Fully Shared Buffer Architecture With And Without Priority Traffic: A Simulation Study***  
***Author(s)*** : ***Kumar Hazari Praveen***  
***Supervisor(s)*** : ***Singh Yatindra Nath***  
***Roll No*** : ***9810423***

***Abstract:***

In first generation optical networks which are in existence today, the electronics at a switching node not only handle all the data intended for that node i.e., header part, but also all the data that is passing through that node i.e., payload part. Researchers realized that if the later part i.e., payload part could be routed through in optical domain, the burden on the underlying electronics at the node would be reduced and thereby one can achieve switching at higher speeds. This has led to 'all - optical' switches, in which data portion of a packet remains in optical format from the source to destination, but header part will be processed using optical or optoelectronic techniques. Presently there exists a limit on the number of wavelengths that can be multiplexed using WDM (Wavelength Division Multiplexing) and hence on the number of buffers that can be used in optical domain. So there is a need for having switching strategies which use buffer efficiently. Keeping these facts in mind switching strategies have been proposed in this work for an all - optical packet switch using shared buffer architecture with and without priority traffic

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*Title* : *An Object Request Brokering Approach For The Monitoring Of Multiple Power Distribution Automation Systems Over Internet*  
*Author(s)* : *Bishnoi Harish*  
*Supervisor(s)* : *Srivathsan K R*  
*Roll No* : *9810422*

***Abstract:***

Traditional standards and approaches for monitoring and control of distributed industrial utilities such as Power Distribution Automation, Gas, Water etc. were proprietary or restricted to physical industrial specifications. With the rapid growth of Internet, there has been increasing demand for open frameworks to support remote monitoring of such geographical distributed industrial utilities over Internet. This requires monitoring information to be described in platform independent structures or open objects. In recent years open frameworks for platform independent description of objects has been made possible through standards such as Abstract Syntax Notation (ASN.1), Common Object Request Broker Architecture (CORBA), Distributed Component Object Model (DCOM) and others. This thesis proposes an object request brokering (ORB) approach for remote monitoring of multiple power distribution automation systems over Internet, which allows management applications to address distributed objects (field attributes) without concern of their actual physical location. This provides a unified management of a collection of power distribution networks. This ORB approach is designed to be an application process over an SNMP framework. Such an approach enables logical monitoring queries presented as request on objects defined over real time information from multiple objects to be processed and communicated. A brief review on those aspects of the power distribution automation (PDA) plant developed by IIT Kanpur under TDM project relevant to the thesis is presented. The present implementation of power distribution network collects the status information from process plant in DNP format and displays them on associated GUI. Since information exchanged using DNP are not universally interpretable, to support monitoring over Internet, there is a need for description of status information in Internet compatible ASN.1 structures. In this thesis necessary modules have been developed to describe the PDA data into ASN.1 to support monitoring of mainstation elements of IIT Kanpur power distribution network over Internet. An SNMP proxy - agent with the concerned MIB has been implemented in the thesis, which listens for object requests from SNMP manager and transfers the instance (value) of requested MIB object back to the SNMP manager

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*Title* : *A Novel Forwarding Scheme In Hiperlan/2 For Enhanced Communication*  
*Author(s)* : *Major HS Vandra*  
*Supervisor(s)* : *Sinha Vishwanath*  
*Roll No* : *9810421*

***Abstract:***

Transmission capacity and data rates every day. At the same time, the users expect better quality. The emerging Wireless LANs (WLAN) aim to satisfy these needs of the users. There the project broadband radio Access Networks (BRAN) at the European Telecommunications Standards Institute (ETSI) is standardising a new generation of WLANs in the A High Performance Radio LAN (HIPERLAN) family. The HIPERLAN Type 2 which is currently being standardised will provide data rates up to 25 Mbps with mobility and full quality of service support. The basic protocol stack and the scope of the HIPERLAN/2 standard will compare the specification of a physical layer and a Data Link Control (DLC) layer. The HIPERLAN/2 DLC Layer is composed of three major functional entities: the Medium Access Control (MAC) layer which applies a centrally controlled concept for the medium access. The Radio Link Control (RLC) protocol which defines all the DLC information which is transmitted via the radio interface and the Error Control (EC) protocol that is responsible for secure transmissions of the user data. In HIPERLAN/2 there can be scenarios when a user is beyond the acceptable range of an Access Point (AP). This can result from heavy attenuation on the direct link either due to increased distance or due to impairments in the radio path. For example the former can often arise due to the user mobility and the latter can be encountered while attempting to operate from another office in a complex. This thesis is aimed to tackle such scenarios which might be temporary or deliberate. In the thesis the HIPERLAN/2 MAC protocol is extended to function as a forwarder. The purpose of the forwarder is to forward traffic to remote users, which are unable to communicate with the AP directly. In the thesis, forwarding for HIPERLAN/2 is based on a time sharing concept, wherein the forwarder shares the MAC Frame to forward traffic to the remote user. The concept is implemented into HIPERLAN/2 simulator, developed in the Specification and Description Language (SDL). The theoretical analysis done is verified through simulations. A network was setup with a AP, forwarder and a remote mobile user in the simulator and the simulating scenario was made close to the real environment by the use of different software tools. The results, conclusions drawn and a reference to the future work have been included in the thesis

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***Title*** : ***Implementation Of Reliable Multicast Transport Protocol For Remote Tutor***

***Author(s)*** : ***Dutta Alpna***

***Supervisor(s)*** : ***SinghYatindra Nath***

***Roll No*** : ***9810404***

***Abstract:***

reported. The Remote Tutor is a MS Windows based tele- seminary tool, which is capable of creating a virtual classroom, comprising of a teacher and students. The members of the classroom could be geographically distributed according to the span of the network. In Remote Tutor, the student and teacher can interact with each other using graphics, video, text and annotations. The teacher can play a recorded lecture file, which consists of audio, video and the timestamped sequence of commands to create objects, open files etc. the transmission of these commands requires reliability to avoid disturbances, which destroys the overall effect of classroom during an on going session. The reliability requirement of such type of data is fulfilled by implementing a Tree- based Reliable Multicast Transport Protocol (TMTP) on top of the transport layer. TMTP takes the advantage of the IP multicast for packet routing and delivery. However, for the purpose of scalable flow and error control, it dynamically organizes the participants into hierarchical control tree. The tree consists of Sender, Domain Managers (DMs) and Group Members (GMs). A common source code is written for all three modules i.e., Sender, DM and GM, with corresponding flags to initialize them at the start of execution. The program has been tested for all the three modules, using a maximum of three routers in the network. The performance with such an environment has been found to be satisfactory

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**Title** : *Computational Bit EFFOR Rate Analysis Of An All Optical Packet Switch Based On Fiber Loop Buffer Memory*  
**Author(s)** : *Deshmukh Dhaval Kumar*  
**Supervisor(s)** : *Singh Yatindra Nath*  
**Roll No** : *9810417*

***Abstract:***

Telecommunication Networks. This requires high capacity networks and nodes. Nodes of such networks will be fed by input links with bit rates ranging from 155 Mbps to 2.5 Gbps which requires switching capacities of several Tbps. In the existing networks routing and multiplexing is performed electrically, optics being confined to transmission only. Although electronic technology can achieve high switching speeds, but it is not well matched to transmission bandwidth of fiber optic links, and the switch bandwidth could become a bottleneck. One possible solution is all- optical packet switches. Implementing static buffers is a problem for all optical switches and various methods have been proposed to store packets in optical mode. In this work, Fiber Loop Buffer Memory switch architecture has been considered in which multiple packets can be stored on different wavelengths in a fiber loop. Inside the loop, SOA switches are used along with a Multiplexer and Demultiplexer both of which significantly attenuate the signal. An EDFA is used to amplify the signal in loop. EDFA and SOA introduce ASE noise. These noises deteriorate the Bit Error Rate at the receiver. In this work bit Error Rate analysis of this switch has been carried out, using the computational models of different components used in the switch and by having a receiver at the output of the switch. 8x8 and 16x16 switches are considered for different number of wavelengths, under different load conditions. It leads to the conclusion that higher the number of packets in loop, better is the BER performance at the receiver, and hence higher number of recirculations possible in the loop. Further the gain in loop should always be maintained equal to loss for optimal switch performance i.e. to maximize the recirculations limit

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**Title** : *Exploitation Of Overlapping Coverage Area For Performance Improvement In Microcellular Communication Systems*  
**Author(s)** : *Gupta Nitin Kumar*  
**Supervisor(s)** : *Sinha Vishwanath*  
**Roll No** : *9810433*

***Abstract:***

stations plays an important role. Especially in small- cell high capacity microcellular configurations. Due to overlap some mobile users may have access to multiple base stations. In case of blocking call from these users can be transferred to alternate base station. This is called “directed retry”. Although this scheme can be used to decrease the failure probability for overlap users, there are variations in the failure probabilities experienced by overlap and non- overlap users. Channel restriction can be used to balance these probabilities. Analytical and simulation model for this is studied and examined the advantages gained in terms of reduced forced termination probability and fairness in the call failure probabilities experienced by the users located in different regions. Performance can be further improved if “channel rearrangement” or “directed hand- off” is used along with the channel restriction. Simulation study of this scheme has been done in this thesis. Results indicate that we have more balanced call failure probabilities with channel restriction and channel rearrangement at the cost of increase in mean failure probability at the high load. Substantial improvement in forced termination probability is achieved with channel rearrangement. Finally, we discuss the possibility of scaling down the number of guard channel with channel restriction to achieve the desired effect of reduced forced termination probability.

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**Title** : *Improvement In Error Performance Of Turbo Codes*  
**Author(s)** : *Kumar Bhuwanendra*  
**Supervisor(s)** : *Sinha Vishwanath*  
**Roll No** : *9810413*

***Abstract:***

In recent years iterative concatenated decoding has regained popularity starting with the remarkable results presented in a paper by a group of French researchers. They introduced a new family of convolutional codes, nicknamed “Turbo codes” after the resemblance with the turbo engine. A turbo code is built from parallel concatenation of two recursive systematic codes linked together by nonuniform interleaving. Decoding is done iteratively by two maximum - a - posteriori decoders, each using the decoding results from other one. For sufficiently large interleaver size, the error performance seems to be close to Shannon limit. In this thesis we examine the performance of turbo codes on the additive white Gaussian noise channel. The influence of the size of encoder memory, different type and size of interleaver on decoding is examined. A new dynamic decoding algorithm is proposed which uses variable number of iterations. A modification to odd - even interleaver has been suggested. Principle of turbo code has been extended to an encoder, which uses three recursive systematic convolutional encoders. We show that odd - even interleaver performs better after modification. We also show that dynamic algorithm requires less time as compared to the other algorithm for achieving the same error performance and that the extended turbo code can achieve better results with small interleaver size

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*Title* : *An Improved Serial Search PN Code Acquisition Scheme For Low SNR Ds-CDMA Systems*  
*Author(s)* : *Warsi Rehan Ahmad*  
*Supervisor(s)* : *Chaturvedi Ajit Kumar*  
*Roll No* : *9810443*

***Abstract:***

In this dissertation, the problem of PN code acquisition for DS-CDMA systems operating in low SNR environments has been investigated. Among the various techniques, Serial search code acquisition technique has been used and improved upon. The modified strategy has been analyzed from mixed and adaptive threshold detection point of view in unfaded environments, characterized by Nakagami-m fading. Important acquisition parameters namely mean (  $\bar{t}_{acq}$  ) and variance (  $\sigma^2_{acq}$  ) of acquisition time have been derived using the signal flow graph technique. The results obtained demonstrate that for low SNR, improvement of one order of magnitude is possible in the aforesaid acquisition parameters when compared with existing techniques

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***Title*** : ***A Simulation Tool For Evaluating Power Control Schemes In DS-CDMA Cellular Environment***  
***Author(s)*** : ***Sharma Amit***  
***Supervisor(s)*** : ***Chaturvedi Ajit Kumar***  
***Roll No*** : ***9810405***

***Abstract:***

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*Title* : *Implementation Of A Rake Receiver For A CDMA Cellular Environment*  
*Author(s)* : *Sahu Pravas Ranjan*  
*Supervisor(s)* : *Chaturvedi Ajit Kumar*  
*Roll No* : *9810436*

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**Title** : *M Vision : A Software Package For Content Based Indexing And Retrieval Mpeg Video*  
**Author(s)** : *Jamal Yusuf*  
**Supervisor(s)** : *Gupta Sumana*  
**Roll No** : *9820410*

***Abstract:***

With the availability of a tremendous amount of video data on the internet, there is an increasing need for robust indexing and search mechanisms to enable effective use of video data. Users do not want to waste their resources unnecessarily browsing endless data after downloading to see if it matches their requirements. Some form of description of the content of the video is essential to support content based functionality. Content based approaches are broadly classified into compressed domain and un-compressed domain techniques. The major advantage of compressed domain technique is that these techniques avoid the unnecessary overhead of decompression. In compressed domain we work on so called DC images which are extracted directly from the compressed MPEG bitstream. Though the DC images are 8 times smaller than the original uncompressed image in both horizontal and vertical directions, they retain the global features of the uncompressed image. The computation of DCT (Discrete Cosine Transform) is completely avoided. Common scene change detection algorithms are then applied to these DC images to get the key - frames (the frames where a scene change is occurring). In the approach adopted in this thesis, we extract DC images from the compressed bitstream, apply the scene change detection algorithms and identify the key - frames in the sequence. These key frames are displayed to the user. The user then captions the frames using text and this textual description of the video file is entered into a database. Any descriptive text query is then matched only to this database and the corresponding video file is retrieved. The process of indexing and retrieval is made simple by integrating the work in the form of Mvision, a GUI (Graphical User Interface). Mvision makes the indexing and retrieval of video signals a very simple job even for the inexperienced user. This interface is written in Tcl/Tk. Three different algorithms namely. Pixel difference (grayscale), pixel difference (color) and histogram difference are implemented for scene change detection. The choice of the algorithm to be used for scene change detection as well as threshold for identifying a scene change is left to the user. The approach has been tested on a wide variety of video files. The results obtained are quite good with color difference algorithm giving the best performance in terms of segmentation of video. This is because color adds to the detail in the DC image. The drawback of the approach is that gradual scene changes are skipped since DC images from only the intra frames are extracted. Uncompressed domain technique holds the advantage of being able to support much finer queries (in term of trajectory of an object, object shape, object color, image etc.). Compressed domain analysis is very fast and coupled with text captioning of the key frames, provides a reasonably good approach to content based indexing and retrieval of video

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*Title* : *Application Of Steiner Designs To Frequency Hopping Spread Spectrum Systems*  
*Author(s)* : *Chakrabarti Sibapada*  
*Supervisor(s)* : *Chaturvedi Ajit Kumar*  
*Roll No* : *9810448*

***Abstract:***

A slow frequency hopping code diversity system with a bandwidth efficient modulation scheme based on combinatorial theory of balanced incomplete block (BIB) design – the Steiner design has been proposed. The proposed system uses more than one frequency bins simultaneously to transmit a Steiner symbol. The system performance is evaluated and compared with the M - ary Frequency Shift Keying (MFSK) slow frequency hopping code diversity system for a multi - user environment considering non - fading and frequency non - selective slowly time varying Rayleigh fading channel. Due to the error correcting capability and inherent frequency diversity of the Steiner design, at high SNR the Steiner system shows performance comparable to that of the MFSK system, while requires lesser bandwidth. However, the Steiner system with more number of active elements per block improves the bit error rate performance for a fading channel, but the bandwidth efficiency is reduced. The performance of the system has also been studied with matched frequency hopping, an efficient addressing technique for slow frequency selective dispersive channel

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*Title* : *Implementation And Performance Analysis Of Dynamic Resource Management Schemes In Leo Satellite Systems*  
*Author(s)* : *Kanth Manepalli Lakshmi*  
*Supervisor(s)* : *Sinha Vishwanath*  
*Roll No* : *9810427*

***Abstract:***

The satellite systems have a unique characteristic of large coverage area that makes it possible to realize a truly global mobile network. The two most serious constraints of a satellite network are the available bandwidth and restricted power. The capacity of a satellite system is relatively much smaller than a terrestrial system due to the above constraints. In addition to this, the satellite networks are burdened with a large handover traffic due to their high relative velocity. This work deals with dynamic resource management techniques in the non-geostationary mobile satellite networks. The work addresses the problem of bandwidth management by Reshuffle algorithm, which attempts to increase the capacity of the system by rearranging active connections to free a channel for an incoming request. The aim of this scheme is to improve the capacity of the system by using the available bandwidth efficiently. The problem of serving large handover traffic, an unique feature of mobile satellite networks, is addressed by a Dynamic resource reservation scheme which attempts to dynamically asses the requirement of resources to handle the handover traffic and reserve them. The aim is to prevent as many forced terminations as possible, thereby, improving the performance of the system. The above stated schemes are simulated and compared with the systems that don't these schemes. The results show that these schemes improve the performance of the system dramatically

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*Title* : *Watermarking Of Digital Images*  
*Author(s)* : *Agrawal Manisha*  
*Supervisor(s)* : *Gupta Sumana*  
*Roll No* : *9820405*

***Abstract:***

The huge success of the Internet allows for the transmission, wide distribution, and access of electronic data in an effortless manner. Content providers are faced with the challenge of how to protect their electronic data. This problem has generated a flurry of recent research activity in the digital watermarking of electronic content for copyright protection. Here we have used. In this work, we have used the digital watermark that not alter the perceived quality of the electronic content, while being extremely robust to attack. We have taken still images as our digital data to be watermarked, for resolving rightful owner of the original image, we have used two watermarking techniques for digital images. One is based on utilizing visual models that have been developed in the context of image compression. These models are used to determine image dependent upper bounds on watermark insertion. This allows providing the maximum strength transparent watermark that, in turn, is extremely robust to common image processing and editing such as JPEG compression, rescaling, and cropping. Watermarks are detected without using the original image, which is a crucial requirement for the particular application of resolving rightful ownership. Another technique for the digital watermarking of still images is based on the concept of multiresolution wavelet fusion. Here also the original unmarked image is not required for watermark extraction.

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**Title** : *Experimental Study Of The Scale Transform Based Features In Continuous Digit Recognition*  
**Author(s)** : *Kandpal Yogesh Kumar*  
**Supervisor(s)** : *Umesh Srinivasan*  
**Roll No** : *9820409*

***Abstract:***

We have studied the use of scale transform based cepstrum as an alternative to widely used Mel cepstrum in the signal processing front end of speaker-independent speech recognition systems. Speaker-independent recognition systems are systems that are trained to recognize speech from many speakers and are, therefore, useful in applications such as telephone based railway enquiry or directory assistance. There is a large difference in performance between speaker-dependent and speaker-independent systems for the same recognition task. This degradation in performance of speaker-independent system is largely due to the variability introduced by inter-speaker variations. This variation among speakers occurs mainly due to differences in vocal tract lengths. It is a commonly held assumption that such differences in vocal tract lengths can be approximated by a linear scaling of the frequency axis. One of the fundamental properties of the scale transform is that its magnitude is invariant to linear scalings in frequency domain and may, therefore, be useful as an acoustic feature in speech. In this thesis we do an experimental study of the application of scale transform to improve the performance of speaker independent continuous digit recognition. The digit recognizer uses a continuous density Hidden Markov Models based system and is implemented using the development environment provided by a toolkit obtained from Oregon Graduate Institute. In the first set of experiments, we compare the performance of Scale transform based Cepstral Coefficients (STCC) and the Mel Filter bank based Cepstral Coefficients (MFCC). This is done by simply replacing the MFCC features with STCC features for the digit recognition task. The performance of STCC is much lower than MFCC. One possible reason for this degradation is that the STCC features are correlated, and therefore, may not be modeled accurately with a mixture of Gaussian densities with diagonal covariance matrices that are used by the HMM based system. In the second set of experiments, we describe simple methods to approximately decorrelate the STCC feature so that it can be accurately modeled in the HMM based system having diagonal covariance matrices. We show that by using decorrelated STCC features we can obtain a performance that is close to MFCC. This suggests that with a more appropriate model parameterization (i.e. using HMM models with full covariance matrices) the performance of STCC can be significantly improved and may therefore be a robust and practical alternative to MFCC.

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*Title* : *Shape Recovery In 2d-3d MRI Medical Images Using Level Set Method*  
*Author(s)* : *Joshi Anand Arvind*  
*Supervisor(s)* : *Sharma Govind*  
*Roll No* : *9820402*

***Abstract:***

This work presents a framework for shape recovery based on ideas developed by Osher & Sethian for interface motion. In this framework, shapes are represented by propagating fronts, whose motion is governed by a “Hamilton-Jacobi” type equation. This equation is written for a function in which the interface is a particular level set. Unknown shapes are modeled by making the front adhere to the object boundary of interest. The resulting equation of motion is solved using a narrow-band algorithm designed for rapid front advancement. This technique can be applied to model arbitrarily complex shapes, which include shapes with significant protrusions, and to situations where no a priori assumption about the object’s topology can be made. We demonstrate the scheme via examples of shape recovery in 2D and 3D from synthetic and low contrast medical image data.

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**Title** : *Three Phase Load Flow And State Estimation Of Power Distribution Networks*

**Author(s)** : *Vyas Anuj*

**Supervisor(s)** : *Sachchidanand*

**Roll No** : *9710410*

***Abstract:***

Methods have been developed for solving practical power distribution systems, for determining system variables such as voltage profile and other related quantities. These methods involve three phase load flow routine and three phase state estimation routine which are used in distribution automation software to determine the current state of the system. The developed methods take into consideration all the aspects of practical distribution networks related to modeling of distribution components and other modifications that are valid in case of distribution networks as compared to power transmission networks. The developed routines use the data, carrying the information of field conditions, to estimate the state of the system, which paves the way for all further control tasks to be performed by the Distribution Automation Software.

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*Title* : *Production Forecast Models For Renewable Energies*  
*Author(s)* : *Telage Tulasi Mohan*  
*Supervisor(s)* : *Kalra Prem Kumar&Stenzel Ing Jurgen*  
*Roll No* : *9810455*

***Abstract:***

In the last years many countries in the world have opened their power markets, to allow competition between power producers. At the first look, it seems that the renewable energies to not have a chance in those deregulated markets, because they are more expensive than the conventional one and some of them are having problems because of fluctuations in the production. In this thesis the fluctuation problems is addressed and forecast models for the production of renewable energies mainly wind and photovoltaic are developed. This will help the trading of these renewable energies in deregulated power market. For forecasting the production of renewable energies, fuzzy, neural network and regression models are utilized and tested with the actual measured data

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***Title*** : ***Simulation And Pc-Based Implementation Of A Four Quadrant Direct Torque And Flux Controlled Induction Motor Drive System***

***Author(s)*** : ***Chada Srinivas***

***Supervisor(s)*** : ***Das Shyama Prasad***

***Roll No*** : ***9810449***

***Abstract:***

In the present work torque and the flux of an induction motor are directly and independently controlled by using “Direct Torque and Flux Control (DTFC)” method. A synchronous link converter (SLC) is used as the front end converter for obtaining unity power factor at all operating conditions at source side including the regenerating modes of the induction motor drive. Thus the drive is capable of operating in all the four quadrants. Hysteresis current control scheme is used to control the synchronous link converter. In DTFC the torque and the flux of the induction motor are controlled by selecting the appropriate voltage vectors from switching logic table which is made with the help of the torque and the flux status. The real time control algorithm of the drive system has been implemented with a PC, which uses ACL-8112PG data acquisition card for data transfer

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**Title** : *Optimal Power Dispatch In Deregulated Market Considering Congestion Management*  
**Author(s)** : *Kumar Perveen*  
**Supervisor(s)** : *Srivastava S C*  
**Roll No** : *9810434*

***Abstract:***

The electric utility industry is undergoing rapid changes due to restructuring and deregulation. The significant feature of these changes is to allow for competition among generators of electricity, to offer a low price, higher quality and more secured product. The changing nature of the electricity utility industry has brought many new practices to power system operation. The deregulation of electricity market has been accompanied by variety of problems. Under a competitive environment, generation is not centrally dispatched, but, rather, it is based primarily on the transactions agreed to in the open market. In the market situation, the difficulty lies in ensuring the negotiated transactions, particularly under congestion. In a competitive power market, the task of an independent system operator (ISO) is to ensure full dispatch of the contracted power. However, if it causes the line flows exceeding their limits, thus threatening the system security, the ISO makes decision on the curtailment of the contracted power. An optimal power dispatch (OPD) model has been presented in this work to minimize the curtailment of the contracted powers in a power market having bilateral, multilateral as well as firm contracts. A strategy has been suggested for allocation of transmission losses among various market participants. Role of flexible AC transmission system (FACTS) devices on reducing the transmission congestion and curtailment of the contracted power has also been studied. Study has been conducted on modified IEEE - 14 bus system and UPSEB - 75 bus system. The proposed OPD results show that higher premium price of willingness to pay by a group lower the curtailment in the desired transaction of that particular group. The suitable placement of FACTS devices is helpful in reduction of transmission congestion. Loss allocation strategy suggested in the present work is quite simple and non-iterative

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**Title** : *Analysis Of Dc-Dc Buck-Boost Converter Using Walsh Function Technique*  
**Author(s)** : *Gupta Shobhit*  
**Supervisor(s)** : *Joshi Avinash*  
**Roll No** : *9810447*

***Abstract:***

Walsh functions, a complete set of orthonormal functions are finding increasingly use in communication systems because of having certain common features of Fourier analysis. Walsh functions along with Block Pulse functions can be used to solve differential equations. Thus, a Buck-Boost converter dynamics represented in the differential equation form has been analyzed using Walsh functions technique. The study of converter switching between continuous and discontinuous mode of operation and vice-versa has been performed by Walsh functions technique. Extensive simulation results are given

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*Title* : *Analysis Of Buck-Boost Converter Using Multifrequency Averaging Technique*  
*Author(s)* : *Singh Satya Prakash*  
*Supervisor(s)* : *Joshi Avinash*  
*Roll No* : *9810445*

***Abstract:***

A detailed analysis of modeling and behaviour of Buck - Boost converter based on frequency selective averaging is done. The models are based on representation of voltages and current as time varying Fourier Series, and focus on the dynamics of dominant Fourier coefficients. Truncating to keep only dominant terms provides powerful base for simulation, even if converter does not satisfy a small ripple condition. Unlike the well known State Space Averaging method, the model discussed here will be valid for high as well as low switching frequencies. Systematic simplification of the frequency averaged model yields a condensed model.

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*Title* : *Evaluation Of Pruning Algorithms*  
*Author(s)* : *Mishra Tanmay Kumar*  
*Supervisor(s)* : *Kalra Prem Kumar*  
*Roll No* : *9810457*

***Abstract:***

An intelligent system is expected to take its own decisions taking into consideration firstly, past experience and secondly, the knowledge acquired by a common man regarding the operation of the system. To achieve this objective, neural network & fuzzy logic were developed. Neural network imitates the functions of the smallest biological entity of human brain, the neuron. It can be used for prediction of future, classifying objects, storing the information like a memory etc. fuzzy logic gives a mathematical shape to human inference of a situation. These methods can be realized by computer simulations very easily. But, for real life applications, artificial neural network, fuzzy logic need to be implemented as analog, digital or hybrid (analog/digital) hardware. One of the most important features of artificial neural systems is that they perform a large number of numerical operations in parallel. These operations involve, among others, simple operations as well as nonlinear mappings and computation of derivatives etc. it is very difficult to predict actual number of nodes, connections to start with. This is because small number of weights may not be able map input - output relationship exactly and on the other hand, high number of weights increase the hardware cost. To optimize the weight connections and number of nodes without affecting the network's generalization capability, researchers suggested network growing and network pruning algorithms. Network pruning method is proved to superior than network growing method in literature. The former aims to delete the excess weight connections, hidden nodes, input variables which are having less important in network's input - output behavior. One of the most popular neural network model, is the multi - layer feed - forward network using back propagation algorithm. Due to supervised nature of the learning method, it has been applied to various fields such as data compression, image processing and speech recognition. In this thesis, an attempt has been made to implement various pruning algorithms available in literature with the feed - forward back propagation network and compare the results. Results with different activation functions, different learning rates, network architecture are tried to get optimum solutions. Some of the input pruning methods are also reviewed in this thesis

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***Title*** : ***Temporal Neural Network Models For Time-Series Forecasting***  
***Author(s)*** : ***Malepati Murali Mohan***  
***Supervisor(s)*** : ***Kalra Prem Kumar***  
***Roll No*** : ***9810430***

***Abstract:***

Time series like other systems can be a manifestation of deterministic or probabilistic behavior or a mixture of both. The neural network should learn to model the system dynamics. For a neural network model to fully exploit transient or contextual information, it must identify the temporal structure underlying the data. Memory less networks is inadequate for temporal pattern processing. Temporal model must be chosen to adequately manifest the vital characteristics. Temporal neural network models such as Tapped delay line neural network and Finite Impulse Response neural networks are discussed for Time series prediction. Analysis and methodology are discussed in the context of the some classical problems. Results of the two networks show that Finite Impulse Response network performs better on chaotic time series data.

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***Title*** : ***Comparison Of Statistical And Neural Network  
Methods For Time-Series For Forecasting***  
***Author(s)*** : ***Prasad B***  
***Supervisor(s)*** : ***Kalra Prem Kumar***  
***Roll No*** : ***9810409***

***Abstract:***

One of the greatest challenges for human beings is to perceive the future so that we can get ourselves prepared for it. The future of a process or a phenomenon depends on the past observations, which are used to construct the time-series forecasting model. Traditionally, statistical models or stochastic models were employed to model a time-series. The recent trend is applying Artificial Neural Network methods. In this present work, a comparison of the performances of the statistical and Neural Network methods for time-series forecasting is presented for some classical problems. Box-Jenkins approach is used for the statistical modeling. The Neural Network models studied are Back Propagation through time and time delayed Neural Networks

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**Title** : *Model Analysis For Voltage Stability And Design Of Fixed And Dynamic Shunt VAR Compensation For The Northern Grid Of India*  
**Author(s)** : *Singh Jainendra*  
**Supervisor(s)** : *Sachchidanand &Prabhu S S*  
**Roll No** : *9810426*

***Abstract:***

deficient in reactive power support and thus, has experienced severe voltage disturbances and collapses in the recent years., In this thesis Q- V model analysis of the NREGI system is done to (1) identify areas/buses where compensation is required using participation factor analysis (2) determine the kind of compensation, i.e., fixed or dynamic shunt compensation, and (3) determine the rating of the compensating devices (fixed capacitors and SVCs). Analysis is carried out for the base case and critical line outages. Two possible SVC locations and some additional fixed shunt compensation for regions having poor voltage profiles are suggested. Other alternatives for strengthening the system, such as additional lines in parallel with the existing main trunk lines and series compensation of the major trunk lines, are also analyzed. It is concluded that dynamic shunt compensation is the best possible option available. Continuation power flow analysis (using PFLOW software) is done to determine the steady state voltage stability margin of the system. Any additional compensation, if needed in order to maintain system voltage stability following an increase in the system loading levels, is determined. The thesis also shows that with just one additional SVC of adequate rating installed at Moradabad 400 kV bus, voltage collapse seen in recent times can be avoided. It is suggested that there is an urgent need for installing this SVC.

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*Title* : *Development Of A Classifier For Non-Stationary Disturbances In Power Systems*  
*Author(s)* : *Raja Mohammedi*  
*Supervisor(s)* : *Kalra Prem Kumar&Stenzel Ing Jurgen*  
*Roll No* : *9810438*

***Abstract:***

The classification of disturbances of power systems is the important task in automated power quality assessment system. This thesis work is mainly concentrated on the design of a classifier for disturbances in power systems. It uses characteristic features of disturbances to design and evaluation of the classification system. The simulation of the classifier is done with artificially generated data of disturbances using known ranges of various disturbances features. Various classification techniques like probabilistic, fuzzy, neural network and geometric are tested to design the suitable classifier for power quality disturbances classification. The suggested classifier uses parallel classification structure of three selected classifiers. The requirements of the classifier include assessment of the type of disturbance, quality of classification and adaptability to new unknown disturbance. The sequential classification approach is also implemented for superimposed disturbances classification

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*Title* : *A Long Term Voltage Stability Analysis Using Dynamic Load Model*  
*Author(s)* : *Chauhan Kalpesh I*  
*Supervisor(s)* : *Srivastava S C*  
*Roll No* : *9810416*

***Abstract:***

Due to the stressed operation of the power system, the power utilities are facing the problem of voltage security and voltage instability. A power system becomes more imminent to voltage instability due to the outage (contingency) of any branch of its transmission network. Appropriate modeling of loads is of primary importance in voltage stability studies. This thesis deals with the modeling of loads consisting of static as well as dynamic load models. The impact of different load models on the voltage stability has been compared. In addition, the effect of over excitation limiter (OXL) and transformer under load tap changer (ULTC) on the voltage stability are also investigated along with the different load models. Dynamic analysis provides most accurate replication of the time response of the power system. Accurate determination of the time sequence of the different events leading to system voltage instability is essential. Two power system networks, one a 11 - bus test system and the other 39 - bus New England test system have been chosen for the case studies and long - term dynamic analysis have been carried out. The simulations have been done with the NETOMAC (Network Torsion Machine Control) software developed by Siemens AG, Germany. The simulation results show that following the outage of transmission line, voltage collapse can be observed with the long - term dynamic effects of ULTC and OXL. Incorporation of different load models leads to different voltage stability scenario

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**Title** : *Experimental Investigation Of Electrical Properties Of Ambient Plasma*  
**Author(s)** : *Banwari*  
**Supervisor(s)** : *Arora Ravindra*  
**Roll No** : *9810411*

***Abstract:***

The electric strength of a gas is greatly influenced by its pressure. In the high pressure and high vacuum regions, a gas acquires very high electric strength. However, there exist a pressure range in between the two mentioned above in which a gas loses its electric strength significantly, accompanied with a transition in the process of insulation failure from spark breakdown to glow discharge. In this pressure range a gas can be easily ionized and made conductive with the help of very small electric fields. The attainment of high conductive with the gas is due to its transition from normal to plasma condition and since this happens at ambient temperatures, this plasma is popularly termed as “Ambient Plasma”. It is this ambient plasma state which has been investigated for its electrical properties in this work for atmospheric air. The objective of the work has been as under. • Validation of Paschen’s law in weakly nonuniform fields and determination of its limiting point on pd scale near the Paschen’s minimum. • Determination of pressure range in which inception of ambient plasma is possible. • Study of ambient plasma, its nature as a circuit element and qualitative investigation of its electrical properties under ac and dc voltages. • Estimation of pressure range for maximum conductivity of ambient plasma. Since the phenomenon of ambient plasma or glow discharge occurs near the Paschen’s minimum, a brief review of Paschen’s law and its limitations have been presented in chapter six before proceeding to the experimental work described in chapters eight and nine. Starting with an introductory remark on gaseous dielectrics and their behaviour at different pressures in chapter one, a brief description is given to the topics of ‘vacuum’ and ‘plasma’ in chapter two in order to provide a base for the subject of the thesis. In chapter three, basics of the kinetic theory of gases are presented while chapter four deals with fundamental concepts in gaseous electronics. In chapter five a brief presentation of electric fields and their classification is made. Chapter seven describes the experimental setup and details of the instruments used. The results and conclusions of this experimental work are presented in chapter ten along with scope of future works. The results of this experimental work confirm that the Paschen’s law is valid in weakly nonuniform electric fields also. The pressure range for the glow discharge in the atmospheric air is found to be between 25 and  $1 \times 10^{-4}$  Torr. The Paschen’s law for atmospheric air fails at about 25 Torr i.e with the inception of glow discharge. The transition of the process of insulation failure of a gas from spark breakdown to glow discharge is a function of gas pressure alone and not that of ‘pd’. The ambient plasma exhibits a negative voltage-current characteristics showing a negative dynamic impedance in the normal and subnormal glow modes. Impedance offered by an ambient plasma has resistive as well as inductive components. The most suitable pressure range for the ambient plasma in air is found to be between 1 and 0.0076 Torr where the glow can be started with minimum efforts. The highest conductivity of ambient plasma in air is observed between 0.304 and 0.152 Torr. This pressure range of atmospheric air is the best for voltage clamping action. The glow inception voltages in this pressure range is found to be considerably higher as compared to the voltage required for maintaining it. This property of glow discharge makes it suitable for triggered switching devices. Apart from the gas itself, the characteristic of the light emitted from a glow discharge is dependent upon the potential gradient and the pressure of the gas.

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***Title*** : ***Breakdown Properties Of Atmospheric Air For Short Gap Distances In Extremely Non Uniform Field With Switching And Lightning Impulse Voltages***  
***Author(s)*** : ***Choudhary Jagdish***  
***Supervisor(s)*** : ***Arora Ravindra***  
***Roll No*** : ***9810425***

***Abstract:***

Laboratory investigations are carried out to study the insulation breakdown strength of air in extremely non uniform field. Ub50 Breakdown characteristics and average field intensity characteristics are obtained for three electrode configurations with three types of impulse voltage waveshapes, si1, si2 and li by impulse generator. Effect of electrode configuration, shape of voltage and its polarity are analysed in extremely non uniform field. Propagation characteristics as propagation time and propagation velocity are also studied. During the course of experimental investigations accurate measurements of magnitude of impulse voltage and propagation time were accomplished with the help of digital oscilloscope

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***Title*** : ***Sensitivity Analysis Of Neural Networks***  
***Author(s)*** : ***Reddy C Sudheer***  
***Supervisor(s)*** : ***Kalra Prem Kumar***  
***Roll No*** : ***9810451***

***Abstract:***

modeling over past one decade. Among the different neural network architectures, feedforward neural networks are most widely used. In the present thesis work, sensitivity analysis of feedforward neural networks is studied with different function- approximator feedforward neural networks, with sinmoidal activation functions. Sensitivity of a neural network is defined as the change in the network performance, due to changes in the parameters of the network. Among these parameters, weights and inputs are most important. In this thesis work, network's performance with respect to variations in the weights and inputs is studied. Input sensitivity analysis is the sensitivity analysis of the networks, for input variations, other parameters remaining constant. In the present work, input sensitivity analysis has shown to be very useful approach to know better, how a feedforward neural network is able to approximate the derivatives of the functions, for whose approximation, the network has been trained. In the example networks considered, large feedforward neural networks are shown to be better approximators of derivatives of the functions. Weight Sensitivity Analysis is the sensitivity analysis of the network, for variations in the weights, other parameters being constant. When a neural network needs to be implemented in hardware with a digital architecture, the weights are to be implemented using fixed number of bits. So, the weights need to be quantized, which in turn adds perturbations to the actual weights. This problem is considered for the weight sensitivity analysis of different function- approxiamtor feedforward neural networks. It has been shown that there should be trade off between the size of the network, and the number of bits used to represent each weight. A simulator is developed, as a part of the present work, which can be used for performing sensitivity analysis of a feedforward neural networks with sigmoidal activation functions. This simulator can also be use for training a three- layer feedforward neural network

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***Title*** : ***Fast Compensation Of Flicker And Reactive Power In Arc Furnace Systems With Controlled Current Sources***  
***Author(s)*** : ***Joshi Avinash***  
***Supervisor(s)*** : ***Vishvajit***  
***Roll No*** : ***9810461***

***Abstract:***

Arc furnaces are probably one of the worst kinds of load on the power system. Arc behavior is often very random, giving rise to large amount of harmonics and a poor voltage profile at the Point of common coupling. Besides this, the system also suffers from flickering of incandescent lamps at loads connected on the same bus. To overcome these problems an arc model has been structured so as to simulate an arc furnace installation. The system is compensated with S.V.C as well as controlled current sources. The results indicate that the current compensation scheme studied in this thesis gives considerably better results than the conventional compensation approach using S.V.C's. the level of flicker has been reduced to a great extent (80 - 85%), indicating the effectiveness of the scheme for fast compensation of flicker and reactive power.

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***Title*** : ***Least Cost Generation Expansion Planning For Northern Region Electricity Board Network Considering Greenhouse Gas Mitigation***  
***Author(s)*** : ***Rout Ullash Kumar***  
***Supervisor(s)*** : ***Srivastava S C***  
***Roll No*** : ***9810458***

***Abstract:***

standard of a country. In most of the Asian countries, particularly in India, there is shortage of enough generating plants to meet the required peak demand. Continuous addition of power plants require the generation expansion planning to be carried out at regular intervals. The traditional generation expansion planning has been based on the least cost strategy. Increased awareness to both the local and global environmental problems has forced the planners to include various mitigation criteria in the generation expansion planning also. In the present thesis, an attempt has been made to include greenhouse gas mitigation, especially carbon dioxide, in the planning methodology. The Northern Regional Electricity Board (NREB) network. For the present generation expansion planning study, three alternative scenarios have been considered. These are the least cost generation expansion planning, least cost generation expansion planning with the efficient technologies and the least cost generation expansion planning with mitigation of Greenhouse Gas (GHG) as constraint. Emission mitigation target of 5% and 10% have been considered over the conventional least cost generation expansion planning results. Various sensitivity analyses have been carried out for the above three cases with the variation of different parameters, such as discount rate, fuel prices, power demand, supply-side capital cost and the efficiency of the efficient technologies. The results show that the least cost generation is possible with the installation of efficient technologies i.e. the PFBC and IGCC. This also reduces the emission levels. The emission mitigation target can be fulfilled by the installation of more number of CCGT and nuclear plants. The power generation from these plants are somewhat costlier than the PFBC and IGCC plants.

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**Title** : *Real And Reactive Power Pricing In A DE-Regulated Electricity Market Including Facts Devices*  
**Author(s)** : *Verma Ravindra Kumar*  
**Supervisor(s)** : *Srivastava S C*  
**Roll No** : *9810440*

***Abstract:***

Transmission pricing has been an important issue on the ongoing debate about power system restructuring and deregulation. Purpose of the pricing is to recover cost of transmission, encourage efficient use and investment. In competitive environment, electricity can be treated as a commodity which can be bought, sold and transmitted taking into account its time varying values and costs known as ‘spot pricing’. It originates from the economic theory of marginal cost pricing. Conventional studies have represented the response of consumers as demand function and the optimal operating strategies have been based on minimizing the operating cost of power system. Whereas, in the present study, response of consumer is taken as inverse of demand function i.e. benefit function. Location based marginal cost pricing concept has been utilized in this work and nonlinear programming problem is formulated to determine real and reactive power prices, with an objective to maximize the net social welfare within the system constrains. Increased system control capability can be obtained with the installation of FACTS devices. FACTS devices modify the network parameters and change the power flows thus increase the available transfer capacity (ATC). Present study focuses on the ability of FACTS devices to reduce the overall operating cost and their impact on transmission pricing. Two types of FACTS devices have been considered viz. Static VAR Compensator (SVC) and Thyristor Controlled Series Compensator (TCSC). Spot prices at different buses, wheeling rates, real and reactive power transmission losses in the system have been computed, both with and without considering the FACTS devices. The studies have been conducted on modified IEEE 14-bus system and also a practical 75 bus Uttar Pradesh State Electricity Board (UPSEB) system

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*Title* : *Comparison Of Various Compensatory Neuron Models*  
*Author(s)* : *Tallapudi Murali Krishna*  
*Supervisor(s)* : *Kalra Prem Kumar*  
*Roll No* : *9810456*

***Abstract:***

The neuron model proposed by McCulloch & Pitts has a combination of aggregation and activation functions. This model requires a large no of neurons in the standard neural network to solve any problem. To overcome this difficulty compensatory neuron models have been proposed which form the basis of compensatory neural network architecture. A total of seven compensatory neuron models have been investigated in conjunction with selfscaling scaled conjugate gradient algorithm. The performance of one neuron model has been compared with the standard neural network with scaled conjugate gradient learning algorithm to show the efficacy of the compensatory model. These compensatory models are also compared and discussed in the work.

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**Title** : *An Investigation Of Partial Discharge Inception Voltage In Air And SF6 Gas*  
**Author(s)** : *Halder Partha*  
**Supervisor(s)** : *Arora Ravindra*  
**Roll No** : *9910458*

***Abstract:***

Stable partial discharges in dielectrics take place only under extremely nonuniform field conditions. In enclosed gaseous dielectrics, for example gas insulated system (GIS), extremely nonuniform fields are not acceptable, as the resultant corona may degenerate the dielectrics. It is therefore desired the Schwaiger factor must be within a limit and the field remains weakly nonuniform. However, if the nonuniformity in the field increased streamer corona may incept. In this work the partial discharge inception voltage has been investigated in air and in SF<sub>6</sub> gas with the same electrode configuration system for increasing gap distance with ac power frequency voltage. Literature study revealed that a lot of work has been performed for the investigation of PDIV with pointed, sharp electrodes. The type of PD at such electrodes is glow corona, which takes place with avalanche discharge of below critical amplification due to steep fall of potential gradient at the sharp electrodes. In this work, electrode configuration chosen are rod - plane, where the fall of potential gradient is comparatively not so steep, giving rise to streamer corona with avalanche discharge of above critical amplification. Experiments in air have been performed to be able to compare the performance of needle -plane and rod - plane electrode system. PD inception observed on needle - plane electrode was at lower voltages than that of rod -plane electrode. These give rise to glow and streamer coronas respectively. It could be observed that on varying the gap distance, it does not affect the Pd inception voltage level much and the plot shows the flat characteristic in both the cases. Breakdown voltages for 6 and 8 - mm rod electrodes are much higher than the Pd inception voltage in air and the difference between them increases with increasing gap distance. It is also observed that audible PD i.e. hissing sound is produced at much higher voltage than the measured PD. This concludes that PD occurs at lower voltage but human ear can realize it at higher voltage only. Experiments in SF<sub>6</sub> gas were performed only for measurement of partial discharge inception voltage for 6mm rod -plane electrode system with variable gap distance at variable pressure. Like in air, in this case also PDIV characteristics were also measured to be flat. When the pressure was increased the value of PDIV also increased and when the pressure was decreased then the value of PDIV also decreased. It was observed that at constant pressure with increase in gap distance PDIV value increases but not too much. After a certain gap distance at all pressures it was observed that value of PDIV becomes steady i.e. no increase in PDIV value with increase in gap distance is marginal. For same gap distance whenever pressure increases PDIV also increases upto a certain gap distance. It was also observed that in SF<sub>6</sub> at normal atmospheric pressure, PDIV value is greater than that in air for the same gap distance and this value increases with increase in gas pressure. So, it proves that SF<sub>6</sub> gas has higher PDIV than that of air.

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