

M.TECH.THESIS ABSTRAC 1991

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Microelectronics, VLSI & Display Technology

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Title : ***Design Technology Development And Characterization Of Silicon Photodiodes***
Author(s) : ***Anand Raghbir Singh***
Roll No : ***8910433***
Supervisor(s) : ***Sharan R***

Abstract

The silicon PIN and avalanche photodiodes have found applications in the fibre optical communication, various Defence systems and other scientific experiments. The technology for n + - p detectors using guard - ring technique, has been developed upto breakdown voltage of 300 - 700 V range. These n + - p photodiodes have been characterized at wafer stage with speed of response of the order of 500 ns (performance limited by measurement set - up). Photodiodes of p + - n type have also been made using glass passivated mesa technique. These diodes have been packaged and show very low dark current of the order of 10 - 50 nA and response time better than 20 ns. The mechanisms which limit the performance of n + - p and p + - n photodiodes have also been identified and possible methods of further improvement suggested. A new p + - n photodiode structure is also proposed

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Title : *Computer Solution Of Large, Symmetric And Banded Set Of Ill Conditioned Linear Systems*
Author(s) : *Kapoor Ramjee*
Roll No : *null*
Supervisor(s) : *Muthukrishnan C R*

Abstract

In this thesis a procedure for digital computer solution of large system of linear equations whose coefficient matrix is symmetric and possibly ill conditioned is developed. A bandwidth algorithm using a dynamic storage allocation scheme for minimizing tape operations has been used. The coefficient matrix is packed into a single linear array format. Computational efficiency and power of the scheme has been improved by using a modified version of cholesky scheme which avoids use of square roots and solves non positive definite systems also without the use of imaginary numbers. Two separate programs have been developed for solving well conditioned and ill conditioned systems. The first one (for well conditioned systems) uses single precision arithmetic with double length accumulation of inner products, the second one (for ill conditioned systems) uses full double precision arithmetic. The performance of the two programs on the IBM 7044 data processing system has been discussed

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Title : *Parameter Estimation Of Complex Exponential Signals By Higher-Order Accumulated Moments*

Author(s) : *Mukhopadhyay Sudipta*

Roll No : *8910453*

Supervisor(s) : *Sircar Pradip*

Abstract

In this thesis two new techniques are suggested for parameter estimation of a class of non-stationary signals, consisting of a set of highly damped sinusoids. Accurate parameter estimation is achieved by using the geometrical properties of the signal. In this regard, the idea of employing the higher-order accumulated moments is introduced. The higher-order accumulated moments are fitted into a set of linear prediction equations, and the prediction coefficients are computed. The prediction coefficients are then utilised to form the characteristic equation which is solved for the signal poles. Here for defining the problem, no noise model is chosen. To test the robustness of the method in noise, we do simulation with three damped sinusoids embedded in white Gaussian noise.

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Title : *Studies On Vector Quantizer Algorithms*
Author(s) : *Karthikeyan V*
Roll No : *8910418*
Supervisor(s) : *Chatterjee P K*

Abstract

Vector Quantization is one of the data compression techniques receiving considerable attention nowadays. The goal of such a system is to minimize communication channel capacity or digital storage memory requirements while maintaining the necessary fidelity of the data. Digitization which is needed for security results in bandwidth expansion. Moreover with signals like speech and image. Samples are highly correlated. Vector quantization results in efficient usage of bandwidth and it removes the redundancies of the image and speech signals also. In this thesis various types of vector quantization systems are discussed and their performances are compared. Then the algorithm for the design of optimal codebook as given by Linde, Buzo & Gersho is discussed. Some new methods are discussed for the design of optimal code book: (i) Relative information method, and (ii) Signal to quantization error ratio (SNR) method. Some specific distortion measures which might be less sensitive to both the large and small errors are suggested. Finally the results of these new methods and the existing methods are given, with suggestions for further work.

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Title : ***Importance Sampling Through Distance Measures For Estimating The Probability Of A Rare Event***
Author(s) : ***Gopathy P***
Roll No : ***8910413***
Supervisor(s) : ***Bansal Rakesh K***

Abstract

The problem of reducing the sample size in the Monte - Carlo estimation of the probability of a rare event through importance sampling, a variance - reduction technique, has an optimal solution that is degenerate. Constrained optimal solutions have, therefore, been obtained through ad hoc approaches in many specific contexts. In this thesis, guided by Kodayashi's theorem on the simultaneous minimization of all Ali - Silvey distances by the so called least favourable pair (in terms of Bayes's risk) in a composite binary hypothesis testing problem. Constrained optimal solutions that minimize the variance of the importance sampling estimator are given for some group and exponential families. Using a lemma of Huber (1965) for a given pair to be least favourable, the asymptotic optimality of the biasing distribution obtained by a shift through threshold is established for the location family. In the second part, importance sampling for Hall's Minimum probability ratio tests (MPRTs) is studied in the spirit of siegmund's results for sequential tests.

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Title : *Some Aspects Of Morphological Operations For Image Analysis*
Author(s) : *Salim Mohammad*
Roll No : *8910424*
Supervisor(s) : *Siddiqui M U*

Abstract

Morphological opening and closing operation have been studied object from the viewpoint of analysis the contents of binary images for extraction of desired objects. Multilevel (Grayscale) dilation and erosion have been studied from the implementation view point. Morphological opening and closing does the filtering operation, which depends on the geometry of the image and the structuring element used. Opening filters out small peaks and island, while closing fill up valleys and holes. These properties have been used to extract solid objects; straight lines of different inclinations, and to further classify these objects based on their morphological closing index. Antiextensivity property of opening causes some loss of minor details of the object during extraction. It has been illustrated that the growing operation defined here extracts the object precisely. Morphological Closing Index has been defined to classify objects (solids, curves etc) depending upon their morphological closure properties. Classification and extraction of objects by closing becomes ambiguous if the minimum separation (between adjacent objects) condition discussed is not satisfied. Morphological closing and opening have also been used to classify and extracted as structuring element. Multilevel dilation and erosion operations have been studied from the implementation point of view. A method to represent multilevel images in terms of a number of binary images has been proposed. It has been shown that by using this representation (decomposition) of multilevel images, and some properties of dilation and erosion, multilevel dilation and erosion can be implemented in terms of a number of binary dilations and erosions, which are simpler implement and faster as well. Based on this, a parallel processing architecture for implementation of multilevel dilation and erosion, whose processing elements perform binary dilation and erosion, has been discussed.

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Title : *TV-Compatible Graphics Adapter For Pc*

Author(s) : *Maurya C B S*

Roll No : *8910406*

Supervisor(s) : *Biswas R N*

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Title : *Separation Of Glottal Wave And Vocal Tract Transfer Functions By Successive Iteration*
Author(s) : *Singh Taranjit*
Roll No : *8910454*
Supervisor(s) : *Ray G C*

Abstract

A speech signal $S_r(z)$ of a sustained vowel can be represented in frequency domain as the product of $P(z)$, $G(z)$, $R(z)$, where $P(z)$ is the transfer function of train of impulses, $G(z)$, is the glottal wave transfer function $V(z)$ is the vocal tract transfer function and $R(z)$ is radiation load transfer function mathematically, $S_r(z) = P(z), G(z), V(z), R(z)$ The radiation load component of speech signal is due to conversion of the volume velocity of sound coming out of lips into the pressure waves received at the microphone placed in distant field. This conversion is in the form of a differential relationship between volume velocity and sound pressure. To remove the effect of this component a process called the inverse filtering using a digital integrator had been suggested by many authors but in the present case a conventional analog digital integrator (of the form $1/1-az^{-1}$) suggested by them. The speech signal then can be represented as $S(z)=P(z), G(z), V(z)$ of equivalently $S(z)=P(z), H(z)$ Where $H(z)=G(z), V(z)$ $P(z)$ component of $S(z)$ was separated out using a technique called homomorphic deconvolution. This removal of $P(z)$ was carried out in the laboratory using a FFT analyzer. In other words, $H(z)$ was recovered from $S(z)$ and was transferred to PC through a GPIB interface. The $G(z)$ and $V(z)$ components are found to be superimposed in frequency domain and are therefore difficult to separate. Their separation is what the thesis has endeavoured to achieve. L. R. Rabiner and Ronald W. Sohafer showed that a loss less vocal tract system divided into N identical sections, can be characterized by a set of its area function or, equivalently, reflection coefficients. Mathematically $V(z)$, the vocal tract transfer function is $\sum_{k=0}^{N-1} \prod_{k=0}^{N-1} \frac{1 - \alpha_k z^{-1}}{1 - \alpha_k z^{-1}}$ Using this $V_a(z)$ the glottal wave transfer function $G_a(z)$ was obtained by simple mathematical division of $H(z)$ by $V_a(z)$ in the frequency domain. The $G_a(z)$ so obtained was represented by synthetic glottal wave transfer function and was utilized to separate the individual $V_i(z)$ from $H(z)$. By their successive iteration and using the relation between linear predictor coefficients and PARCORS, the area functions of the individual vocal tract were determined from $V_i(z)$. This helped in reconstruction of individual vocal tract. This reconstruction is of immense help in diagnosis of pathological disorders.

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Title : *Implementation Of ISO IP Router*
Author(s) : *Daigavane Shrikant B*
Roll No : *8910451*
Supervisor(s) : *Srivathsan K R&Barua Gautam*

Abstract

This project aims at the design and development of an ISO - IP router as an additional stack in existing ARPA/IP bridge and router developed at IIT Kanpur. This will allow us to interconnect two LANs at Network Layer interface. The LANs connected may differ in their lower two layers ie. They may be using different media and Link level protocols. The router is based on ISO 8473 Connectionless Network Service protocol and implements ISO 9542 ES - IS routing exchange protocol for the exchange of routing information between End systems (user's system) and Intermediate System (router). Physically, an IS or a router is a node with two or more network interface cards one for each network to which it is connected. In order to properly implement an appropriate Routing Information Base, all ISs maintain a table of known, directly attached Ess. All ESs also maintain a table of currently used paths and information received from the IS. The RIB is updated depending upon the information received in the Routing PDUs. Each system maintains a local timer, after expiration of which a routing information PDU is sent. To ensure that RIB does not store bad or unused routing information a timer (HT) is associated with each RIB entry. Upon expiration of HT the entry is flushed out of RIB. The approach used for network layer routing is as defined in the OSI routing framework. The global OSI environment consists of a number of administrative domains. Some authority is responsible for organizing ESs and ISs into appropriate routing domains. The implementation supports variable length Network layer addresses for the systems. The software is portable to the extent that it uses the standard ASN.1 syntax for the information representation.

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Title : *Simnet : A General Purpose Network Simulation Package*
Author(s) : *Dalal Sanjeev Kumar*
Roll No : *8910445*
Supervisor(s) : *Bose Sanjay Kumar&Srivathsan K R*

Abstract

A general-purpose simulator SIMNET for the performance study of individual and interconnected network has been developed. The event scheduling approach has been used to model various MAC protocol. The simulator software has written in FORTRAN77. The simulator allows the characteristics of every user (in the network) to be specified in an asymmetric network. For a symmetric network, where all user all users are identical the characteristics of only one user need to be specified. Individual nodes may be placed at any desired location in the network or they may be placed at uniformly distributed points on the communication medium. SIMNET supports the Token Ring (simplified version as well as the IEEE 802.5 standards with or without priority) the CSMA/CD (ETHERNET IEEE 802.3 standards) and the Ring/Bus protocol (an improved version of the Token Ring method) with/without priorities. Individual networks may be specified to have any of the above media access protocols. Various parameters of the access method may be separately specified or the appropriate IEEE 802.3/ 802.5 standards may be used for the simulation runs. Simulation of individual networks may be run with a limit of 100 nodes per network. SIMNET allows the simulation of interconnected networks where upto 10 component networks may be specified with any of the access protocols mentioned above any pattern of interconnections between the components networks may be simulated. Traffic components flowing from individual one network to another may be separately specified. SIMNET provides complete statistics on the mean packet deals and maximum buffer size requirements at each node. Statistics averaged over all the nodes in each network is also provided. The overall delay throughput behaviour of the network may also be studied. For interconnected networks SIMNET provides details on the behaviour of the bridge/router between individual networks i.e. its buffer requirements and the delay going through the bridge/ router; this information is provided along with the details of the behaviour of each component network and that of each node on these networks.

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Title : *Simnet : A General Purpose Network Simulation Package*
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A general-purpose simulator SIMNET for the performance study of individual and interconnected network has been developed. The event scheduling approach has been used to model various MAC protocol. The simulator software has written in FORTRAN77. The simulator allows the characteristics of every user (in the network) to be specified in an asymmetric network. For a symmetric network, where all user all users are identical the characteristics of only one user need to be specified. Individual nodes may be placed at any desired location in the network or they may be placed at uniformly distributed points on the communication medium. SIMNET supports the Token Ring (simplified version as well as the IEEE 802.5 standards with or without priority) the CSMA/CD (ETHERNET IEEE 802.3 standards) and the Ring/Bus protocol (an improved version of the Token Ring method) with/without priorities. Individual networks may be specified to have any of then above media access protocols. Various parameters of the access method may be separately specified or the appropriate IEEE 802.3/ 802.5 standards may be used for the simulation runs. Simulation of individual networks may be run with a limit of 100 nodes per network. SIMMET allows the simulation of interconnected networks where upto 10 component networks may be specified with any of the access protocols mentioned above any pattern of interconnections between the components networks may be simulated. Traffic components flowing from individual one network to another may be separately specified. SIMNET provides complete statistics on the mean packet deals and maximum buffer size requirements at each node. Statistics averaged over all the nodes in each network is also provided .The overall delay throughput behaviour of the network may also be studied. For interconnected network s SIMNET provides details on the behaviour of the bridge/router between individual networks i.e. its buffer requirements and the delay going through the bridge/ router; this information is provided along with the details of the behaviour of each component network and that of each node on these networks.

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Title : *Design and fabrication of burst error correcting PCM MUX.
Encoder for telemetry*
Author(s) : *Mishra Hari Kant*
Roll No : *8910414*
Supervisor(s) : *Chatterjee P K&Sinha Vishwanath*

Abstract

The design and fabrication of a PCM - Mux. - Encoder with Burst - error - correcting features for radio - telemetry has been considered here. The system is developed specially for captive flight testing program and the parameters for measurements are mostly for R&D phase. The design and implementation of a 16 channel PCM - encoder is described. Bit rates ranging from 16 KBPS through 256 KBPS are provided in the system. This system has been designed for an existing EXPRT - Telemetry - data - reduction system. In certain flight tests, the telemetered data is usually corrupted by burst of errors due to high noise environments. An Interlaced cyclic burst error correcting scheme is implemented to improve the error rate performance of the system. A 4th degree interleaving is implemented and a design for suitable extension upto 7th degree is suggested for the correction of burst errors upto length - seven

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Title : *Image Processing In Radon Space*
Author(s) : *De Parthapratim*
Roll No : *8910426*
Supervisor(s) : *Mullick S K*

Abstract

The present work is a study of image processing algorithms in the Radon domain. The image is converted into a sequence of projections which are then processed individually. The image is then reconstructed from the processed projections. This reduces the dimensionality of computation from two to one. Proposition is verified computationally. The method has applications in performing two –dimensional operations that are computationally intensive. It is particularly suited for processes involving block – matrix inversion. As an example, it is applied to spectral extrapolation of limited Fourier data. A discrete version of the Radon transform (DRT) is studied. The DRT is defined for periodic vector – sequences as a matrix multiplication. The matrix has block – circulant nature, enabling fast direct and inverse transforms to be computed. It is seen that a discretisation of the Radon’s analytical formula does not give an exact inverse. The DRT has the advantage that it can be inverted exactly

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Title : *Study Of Nonlinear Digital Filters For Image Processing*
Author(s) : *Rao Manne Venkata Subba*
Roll No : *8910420*
Supervisor(s) : *Gupta Sumana*

Abstract

This work is a study of some of the nonlinear filters used in image processing. A second -order 2 - D Volterra filter has been designed and its performance is compared with other conventional filters for different noise models. The matrix representation used for the output of the Volterra filter in this design is amenable to decomposition techniques, leading to efficient realizations. Various decomposition techniques have been applied over the quadratic matrix of the Volterra filter and the effect of approximation has been studied. Various efficient realizations of quadratic part have been obtained using decomposition techniques. By further imposing few additional conditions in the design of filter coefficients, a highly efficient realization has been obtained using SV - LU decomposition technique. A new method of designing 2 - D Volterra filter, using reversion method of solving nonlinear differential equations, has been considered. Also, a decision directed Volterra filter has been studied. Finally, an adaptive length median filter has been considered for the removal of impulse noise and its performance is compared with ordinary median filters of fixed sizes and generalized mean filter and contraharmonic filter.

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Title : ***Spatio - Temporal Pattern Recognition With Artificial Neural Networks***
Author(s) : ***SitaramYadavalli***
Roll No : ***8910460***
Supervisor(s) : ***Rao P R K&Mullick S K***

Abstract

In this thesis we discuss various issues in spatio - temporal pattern recognition using connectionist paradigms. We present a new back - propagation algorithm for training a class of neural networks for recognising patterns in space and time. The network we propose is a linear filter artificial neuron system. The basic unit uses an artificial neuron followed by a linear time - invariant or time -varying causal filter. Filter could be of recursive or non - recursive type. The neural unit uses a quadratic time - weighted output deficit error function which has to be minimised in the training phase. We present a learning algorithm to minimise the error by suitably adapting the filter parameters as well as the weights of the network using a gradient based error minimisation technique. The constraints on the filter parameters to ensure stability have also been derived. Computer simulations have been carried out extensively to evaluate the performance of the system on temporal and spatio - temporal pattern recognition in a variety of cases. Results on robustness of the network as well as convergence of the algorithm based on empirical observations have also been discussed.

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Title : *Fast Computation Of Two-Dimensional Transforms*
Author(s) : *Babu Dhulipala V R C*
Roll No : *8910409*
Supervisor(s) : *Gupta Sumana*

Abstract

Fermat Number Transforms are preferred for the computation of cyclic convolution of sequences over the discrete Fourier transforms because they require less number of multiplications. But for long sequences FNT's have the word length constraint. So, they are implemented in two (or multi) - dimensions. In this thesis, discrete Radon transforms are used for the computation, mainly, of two - dimensional Fermat Number transforms. This approach uses specific number of one - dimensional FNT's which are much less than those needed for direct computations. The main feature is that the computation of all these one -dimensional FNT's are completely independent, which makes it more suitable for parallel processing. Implementation of this procedure on systolic and SIMD (single Instruction Multiple Data) architectures is shown.

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Title : *Very High Frequency Circuits For Fibre Optic Communication Link*
Author(s) : *Krishna Kocherla Murali*
Roll No : *8910419*
Supervisor(s) : *Chatterjee P K*

Abstract

In the present work an attempt has been made to design and fabricate LASER transmitter and receiver circuits for 565 Mbps. Fibre optic communication link. A Phase Locked Loop for bit synchroniser applications in 140 Mbps. Systems was also developed. The optical power for logical zero and the peak power of the Laser diode are kept constant by simultaneous control of the bias and modulating currents. Receiver circuit is based on a p - i -n photodiode and is designed to have a bandwidth of 580 MHz. Performance of transmitter and receiver were tested with graded index fibre of length 6 km.

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Title : *Chaotic Models For Signal Representation*
Author(s) : *KumarSandeep*
Roll No : *8910442*
Supervisor(s) : *Bansal Rakesh K*

Abstract

Study of simple non - linear systems has shown that they are capable of exhibiting complex or apparently random behaviour called 'chaos'. In contrast to stochastic models, viewing complexity as arising out of low - dimensional chaos gives an alternative tool for analyzing complex behaviour deterministically, and physicists and biologists alike are turning to deterministic (chaotic) models to interpret complex phenomena. Through a study of certain class of maps and the associated invariant measures the link between determinism and apparent randomness is further clarified. Applications are suggested especially in the generation of random numbers. Signal estimation techniques in this framework utilizing Lyapunov exponents are suggested. Reconstruction of attractors in the presence of noise is attempted using mutual information functionals. Algorithms for estimating the invariants (e.g. dimension, Lyapunov exponent etc.) are implemented. These algorithms are then applied to synthetic data. The thesis concludes with suggestions for further work in this new approach towards signal modelling.

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Title : *Signal Representation And Data Compression Using Partial Realizations*
Author(s) : *Venugopal Eyyunni*
Roll No : *8910410*
Supervisor(s) : *Mullick S K*

Abstract

Partial realizations of sequences over a finite field are obtained, using Berlekamp -Massey algorithm in both one dimension and two dimensions. This representation is applied to compress the image data. It has been established, that, through deterministic modeling of a stochastic behaviour, data compression cannot be achieved. However, by employing a fidelity criterion it was shown that some compression can be achieved. The introduction of error bound to two - dimensional sequences could not be done because of some implementation problems. To get an optimal representation in the one - dimensional case, the problem was shown to be NP - hard.

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Title : *Damping Of Subsynchronous Oscillations In Series Compensated Systems Through Static VAR System Control*
Author(s) : *Manoj Kumar*
Roll No : *8520404*
Supervisor(s) : *Gupta Sumana& Varma Rajiv K*

Abstract

A new concept of Static var system (SVS) control is proposed in this thesis. An SVS located at the midpoint of a long series compensated transmission line is employed for simultaneously achieving the twin objectives of mitigation of subsynchronous oscillations of the turbine generator and improvement of power transfer capacity across the line. The effectiveness of different locally derivable SVS auxiliary control signals is investigated for damping both the low frequency zeroth and subsynchronous torsional modes, together. The various signals considered are SVS Bus Frequency, Magnitude of Line Current (LC), Line Active Power, Line Reactive Power, Computed Internal Frequency (CIF) and composite [CIF+LC] signal. These studies are conducted for widely varying levels of series compensation including the critical compensation levels with different generator power outputs and transmission line lengths. The overall system is linearized and eigenvalue analysis is utilized to predict system stability. The eigenvalue analysis results are correlated with those obtained from damping torque analysis.

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Title : *A Software Environment For Analysis And Simulation Of Dsp Systems*
Author(s) : *Tripathi S K*
Roll No : *8910440*
Supervisor(s) : *Mahanta Anil*

Abstract

A software environment for analysis and simulation of DSP systems is presented. This is a software which offers facilities for signal processing on digital data and provision for simulation and testing of a DSP system. User can generate data sequences from software library or read disk files, process or manipulate data sequences in desired form, display the result by graph - plot and store it in software buffers or files for later use. User can also define a DSP system in a number of standard ways to study its behaviour in time and frequency domain. Input quantisation and coefficients quantisation effects can also be studied. The facility to simulate a DSP system in terms of block diagram flow graph is provided for studying and experimenting with types of systems and its parameters. The software has been developed for an IBM compatible PC with a hard disk and a Hercules /CGA/EGA graphics card. Turbo Pascal version 5 has been used to write the software with graphics support of Turbo Pascal Graphics Toolbox.

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Title : *Deconvolution Of Time-Varying Seismic Data*
Author(s) : *Nath Satyaki*
Roll No : *8910447*
Supervisor(s) : *Mahanta Anil*

Abstract

Seismic deconvolution is used to locate petroleum and oil at deep reservoirs in the earth sub - surface. the time - varying nature of the seismic wavelet necessitates time - varying processing of seismic data. short - time homomorphic filtering combined with least square wave - shaping is used to recover the reflector series. Various factors related to LS inverse filtering are investigated. The adaptive filters are used to effectively track the time -varying wavelets. A more general pole - zero wavelet necessitates the use of adaptive IIR filters to exactly model the ARMA – process Issues related to stability monitoring and convergence for the adaptive IIR adaptive IIR filter are studied. The low - pass filtering of the wavelet due to earth absorption increases the eigen value spread of the input auto -correlation matrix. This is a severe problem for the LMS adaptive algorithms. RLS adaptive filter shows good convergence characteristics as well as low misadjustment. The use of fast time - varying forgetting factor in fast RL S algorithms is indicated.

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Title : *Radiation From Slot On Co-Axial Line*
Author(s) : *Seetharam V*
Roll No : *8910456*
Supervisor(s) : *Sachidananda M*

Abstract

The problem of a coaxial transmission line with a axial slot on the outer cylinder configured so as to unify the feeding and radiating structures is investigated. Two such configurations were considered. Whereas in the first configuration, the slot is excited by means of a transverse discontinuity introduced to the axial slot, in the second configuration slot excitation is achieved by a reactive stub placed close to the axial slot and penetrating into the coaxial line. The first configuration is studied analytically and the second experimentally

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Title : *Analysis Of Vivaldi Antenna*
Author(s) : *Sharma N Srikanth*
Roll No : *8910425*
Supervisor(s) : *Sachidananda M*

Abstract

This thesis presents an analysis of a vivaldi antenna. It is a broad band antenna realised in a printed form. The most commonly used numerical technique. “The moment method” is discussed. Its implementation is explained by applying it to some simple structures like a dipole and a rectangular microstrip antenna. An IBM-PC compatible A-D card is fabricated and used to measure the approximate form of current distribution on the antenna. The theory of the sampling probe is presented. Finally the antenna is made to fit in an elliptic cylinder coordinate system and approximate form of bases functions given based on the experimental results

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Title : *Design And Implementation Of Algorithms For A Linear Systolic Array*
Author(s) : *Sharma Ajay Kumar*
Roll No : *8910401*
Supervisor(s) : *Mahanta Anil*

Abstract

A 32 - bit floating point Systolic Array Signal Processor (SASP) is currently under development. The processor is a linear array of processing elements that takes inputs from one end and produces outputs at the other end. The present work reports design and implementation of systolic algorithms for a variety of application in the area of signal & image processing and scientific computing. These algorithms are tested on the SASP Simulator. The simulation studied show that under program control, a typical 10 - ce II processor can perform many algorithms including two dimensional convolution, matrix multiplication and complex FFTs at a peak computation rate of 200 million floating point operations per second (MFLOPS), thus efficiently meeting the real time applicati on demands. Based on simulation studies, several enhancements in the SASP architecture are suggested, which will remove the deficiencies of the present architecture.

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Title : *Design Of Primary Feeds For 17 GHZ Los Link Antenna*
Author(s) : *Rao B Srinivasa*
Roll No : *8910404*
Supervisor(s) : *Sachidananda M*

Abstract

In this thesis a study is conducted on the design of two different antenna configurations for a line-of-sight (LOS) link use in the Ku band. Designs of paraboloid and parabolic cylinder are carried out. In these design aperture field configurations are considered and far field calculations are carried out based on the aperture fields. Polyrod fed conical horn is a low cost feed for the paraboloid. So this horn is designed and fabricated. Different coaxial to wave guide transition are tried and printed ridges type of transition is found to be best among the lot. Printed dipole array is a low cost feed for the parabolic cylinder. Due to lack of the test facilities in Ku band, a study of the dipole is carried out in the 10 GHz band and the dipole is fabricated. A study is carried out on the dipole array and the array design is taken up. Feed network for the array is considered and a corporate type feed is designed.

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Title : *A Remote Dos Disk Server On Unix Machine*
Author(s) : *Maniyar Shyam N*
Roll No : *null*
Supervisor(s) : *Bose Sanjay Kumar & Joshi Avinash*

Abstract

A Remote DOS disk server running under UNIX has been designed and implemented. It is built as a layer above the UDP/IP protocol and termed as trivial block transfer protocol, TBTP. The client software is built over the UDP/IP protocols of the PC/IP package. The PC/IP is an implementation of the TCP/IP suite of protocols for the IBM PC developed at M.I.T. the service is provided by a daemon server process running on the UNIX machine. The server software is built using the socket interface for network communication provided by the BSD systems. Each user has a login name and is authenticated by a password during logging in. the server can support multiple simultaneous login sessions. Each user has a home directory under which at the dosdisks created by him will reside. Each user has a disk quota allocated by the system administrator of the disk server. The administrator is a privileged user who will create users, user groups, allot disk quotas and carry out other administrative duties. To access a remote dosdisk, a user must map a remote drive number to the dosdisk. The client software will assign an unused drive letter on the client machine to the remote dosdisk. A user map to any dosdisk on the server provided he has the necessary right. The owner of a dosdisk may grant access rights to individual users or user groups. Protection is provided by having an access control list, ACL for each dosdisk. In case a client machine crashes, it is possible to re-establish the connection with the disk server by logging in again.

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Title : *Sequence Control Of Single Phase Half-Controlled Converters In Traction*
Author(s) : *George K S*
Roll No : *8910412*
Supervisor(s) : *Dubey G K*

Abstract

The performance of single stage, half - controlled and fully controlled thyristor converters used in traction are well known with respect to VAR demand and harmonic generation. Compared with single stage converter schemes, sequence control of half - controlled thyristor converters gives better performance when regeneration is not required. In this thesis, the analysis and performance of sequence control of two stage half - controlled converters has been presented and different methods have been developed for further improvement in power factor and reduction in harmonics. The improvement in system performance by Fixed - Capacitor Thyristor Controlled Reactor (FC - TCR) and Fixed - Filter Thyristor Controlled Reactor (FD - TCR) is explained. This fixed capacitor in FC - TCR scheme is divided into various sections tuned to different harmonics and used in FF - TCR scheme. In FF -TCR scheme, the filters have the dual function of supplying leading reactive power and reducing harmonics. Suitable filters in FF - TCR scheme are designed such that power factor is improved and trouble due to harmonics is avoided. The design methods and performance of filters are described. The performance and analysis of sequence control with single stage and two stage TSC in combination with suitable filters is explained. The analysis of sequence control with equal pulse width modulation is done and high - pass filters, which keep the harmonics within limits are designed

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Title : *Design And Simulation Of Bicmos OPAMP*
Author(s) : *Ramanath D*
Roll No : *8910407*
Supervisor(s) : *Hasan Mohammad Mozaffarul*

Abstract

Inherent merits of Bipolar and CMOS technologies are being combined to realize BiCMOS analog circuits with superior performance [1-3]. Since OPAMPs are used in a variety of systems, an attempt has been made to design and study the performance of an OPAMP using BiCMOS technology. The SPICE simulation results show considerable improvement in the open-loop gain, CMRR, unity gain frequency (UGF) and slew rate. The details of the OPAMP design and simulation results are presented in this thesis. The BiCMOS OPAMP simulation results show 125 dB open-loop gain, 105 dB CMRR, 20 MHz of UGF with a phase margin of 65° and 44 V/ μ sec of slew rate. The OPAMP is designed using 5 micron BiCMOS technology and is expected to operate with ± 5 V power supply voltage and the power dissipation is 24mW

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Title : *Bidirectional Power Converter Control At Unity Power Factor Operation*
Author(s) : *Tewari Ramendra Kumar*
Roll No : *8810436*
Supervisor(s) : *Dubey G K*

Abstract

The present work involves the development of the expressions for unity power factor operation of the converter and then establishing the control requirements of the bi-directional power converters. A hardware control scheme has been developed for the bi-directional converter with unity power factor operation. The firing pulses for all the six switches of the bi-directional power converter are obtained for various load conditions. It is experimentally verified that the switching pattern corresponds to unity power factor operation

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Title : *Expert Systems Applications To Automatic Control Systems*
Author(s) : *Phatak S V*
Roll No : *8910441*
Supervisor(s) : *Hole K E & Kalra Prem Kumar*

Abstract

This thesis presents an extensive literature review for the expert system applications to control engineering. It includes the classification of various approaches used for the design of the controllers for SISO and MIMO systems. The fixed set of parameters used in the conventional algorithmic approach can be made into a variable set of parameters and decision making incorporated at each step. This idea has led to the development of EXPERT SYSEM REDUCED INSRUCTION SIMULATOR. The simulator follows a set or sequence of operations at each stage of decision-making. Forward and backward chaining would be available, so that the not too expert. Control engineer could query the system and it would give answers at each stage. Also an attempt could be made to incorporate at the end of the design process a comparison of this end product with the conventional controller and fresh rules formulated in the rule-base for improving the system response. Again, it is possible that in conventional controller design but when operated at the extremities could give rise to abnormal outputs. It is possible to avoid such situations using expert control. In the second part of the thesis an attempt has been made to apply expert control. The study was carried out on an application to an example in the power system. The two area interconnected power system was chosen for the study. PID controller configurations and variable structures system controller configurations applied to two area interconnected power system were used for the study. Gain scheduling along with switching was used to improve the performance of the system. It is seen that the use of VSS control structure reduces settling time of the system to external disturbances as well as keeps the values of undershoot and overshoot to minimum. The various controller, configurations are applied to the two areas considered i.e., thermal-thermal and hydro-thermal, the system responses have been compared with those published elsewhere.

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Title : *On Modeling And Coordinated Control Of HVDC System*
Author(s) : *Kar Indra Narayan*
Roll No : *8910417*
Supervisor(s) : *Ghosh Arindam*

Abstract

The design of a controller for a nonlinear system requires the operating point stability analysis of the system. For this, a perturbed linearized system model is required to describe the system dynamics. Converter-controller-load system is highly nonlinear system and the operation of the converter is also discrete in nature. In the first part of the thesis a linearized discrete-time model of single converter system is developed based on modified z-transform method. This model is then extended to the two terminal hvdc system for the stability analysis. The results obtained for the single converter model are subsequently compared with the results obtained by multirate sampling method. The improvement of stability boundary is achieved through rate feedback composition. In a multiterminal hvdc system, inverter is generally situated at the far end of the rectifier. In this case Conventional first order current controller located at the local end is not very effective to control the inverter current due to the dynamics of the line. Under such situation control schemes based on the knowledge of inverter current and other state variable of the system are necessary. The main objective of this thesis is to design coordinated control schemes for a two terminal hvdc system. The purposes of these control schemes are to enhance the transient response of the system and to minimize the communication network. To design a coordinated control scheme for a two terminal hvdc system, the knowledge of the inverter current and other state variables is essential. For this purpose, a discrete time reduced order observer is designed to estimate the unobservable states. These states are then used for the proposed state feedback control schemes. The return difference function of the observer based control system is calculated to study the system robustness properties. The performance of the reduced order observed and the proposed controllers are studied through digital computer simulation.

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Title : *Study Of Ac Voltage Instability In HVDC Ststems*
Author(s) : *Gafoor Shaik Abdul*
Roll No : *8910448*
Supervisor(s) : *Singh L P&KalraPrem Kumar*

Abstract

This thesis basically deals with ac voltage collapse of AC - DC - AC systems. Major thrust of the work has been to investigate the influence of various control scheme at inverter end of the hvdc system, on the limits of voltage stability. It has also been investigated that the short circuit ratio (SCR) levels of ac systems of sending and receiving end ac systems influence the ac voltage stability limit greatly. To make conclusions the influence of the various types of loads at the inverter ac system has been studied. It is well known that the inverter of hvdc systems absorbs reactive power and hence, to compensate for reactive power static var compensators (SVC) are used. The influence of SVC at both the terminals to enhance the stability limit under various control schemes of the inverter has been reported. Further artificial commutated converters (ACC) have been suggested in literature for hvdc systems. These converters can operate at higher power factor, reducing the reactive power demand. Hence this converter has been considered as inverter and as well as rectifier to evaluate the performance of various controls at the inverter. The performance of ACCs and SVCs has been compared

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Title : *An Investigation of Electromagnetic Interference Caused by Different Types of Coronas in Air*
Author(s) : *Srivastava R K*
Roll No : *null*
Supervisor(s) : *Arora Ravindra & Kalra Prem Kumar*

Abstract

Corona or stable partial discharge in free air occur in the power system under extremely nonuniform field condition. Three types of corona can be distinguished according to their occurrence under given electrode conditions. These are known as Glow, Streamer and Leader corona. Whereas glow and streamer corona are allowed to take place at free electrodes, the leader corona takes place only in the form of surface discharge or tracking in the power system. Generation of all three types of corona leads to electromagnetic interference (EMI) to communication systems-In this work a detailed description of the types of fields, coronas and the conditions under which they may occur is described. Experimental investigations have been performed to analyse the extent of EMI caused by three types of coronas separately. EMI measurements have been made with the help of a spectrum analyzer using Biconical and Spiral Log Cone type antennae designed for 25 to 200 MHz and 200 to 1000 MHz respectively. Suitability of spectrum analyzer for this kind of investigation has been well established. Interference on the actual TV screen have also been recorded. EMI due to glow and streamer corona were predominant upto 460 MHz and 160 MHz respectively. Leader corona, which could be produced in our laboratory in the form of surface discharge or tracking, can cause interference up to 1000 MHz. As regard the field intensity of EMI measured in terms of spectral intensity $\text{dB}^{\mu\text{V}}/\text{m MHz}$ was measured to be maximum due to leader corona

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Title : *Rigorous Analysis Of Waveguide Structures Decomposable Into Rectangular Domains*
Author(s) : *Inderjit*
Roll No : *8910415*
Supervisor(s) : *Sachchidanand*

Abstract

Wave guide structures, having inseparable solutions in the known coordinate systems, have been analyzed by decomposing them into domains supporting separable solutions. Domain decomposition is done in two ways : one, in such a way that all the external wall boundary conditions are explicitly satisfied and the other. Keeping in view that the number of domains is minimized. The results obtained using the two have been compared. It is seen that the former way is much more rigorous and versatile. The later gives accurate results only under conditions, when the energy distribution is such that the energy near the boundary walls, not taken into account explicitly, is very small fraction of the total energy.

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Title : *An Algorithm For Shortest Routes For A Net*
Author(s) : *Kalari, Venkata Subbarao*
Roll No : *8910457*
Supervisor(s) : *Hasan Mohammad Mozaffarul*

Abstract

An algorithm to find the M shortest routes for a net is presented. The algorithm runs in $O(n \log n + Mn)$ time in the worst case, where n is the number of vertices in the channel graph. This is achieved by mapping the channel graph into an auxiliary graph with $|P|$ vertices, where P is the set of pins in the net. This reduces the problem to that of finding the M shortest spanning trees of the auxiliary graph. The routes are obtained by replacing the edges of the spanning trees by their corresponding shortest paths in the channel graph. The algorithm can utilize electrically equivalent pins to minimize the routing length of a net.

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Title : *Microprocessor Based Travelling Wave Relaying Scheme For EHV/UHV Transmission Lines*

Author(s) : *Gupta Dheeraj*

Roll No : *8910408*

Supervisor(s) : *Singh L P&Srivastava S C*

Abstract

UHS relaying based on traveling wave phenomena is an important area of research in the field of power system protection. The continual increase in the demand of electric power has in turn resulted in the enormous growth in size and complexity of the modern power system. The economic, efficiency and other considerations have necessitated the location of the large generating stations in remote areas, interconnected with EHV/UHV transmission lines over large distance for bulk power transfer. This in turn requires the development of a fast, reliable and economic protection scheme, which on one hand will ensure system security and reliability and on the other hand will improve the system transient stability and enhance its power transfer capability. With the advantages in breaker technology and the development of UHS circuit breaker, it has become imperative to develop a UHS relaying scheme. It is in this context that the relays based on traveling waves (i.e. the transient disturbances which occur in a short time interval just after the occurrence of the fault) have a great potential as UHS relays in future. It is with this motivation that the present thesis aims to develop a microprocessor based relaying scheme based on traveling wave phenomena. A sample power system networks taken and simulation studies performed to establish the feasibility of the proposed protection scheme.

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Title : *Optimal Reactive Power Despatch Using New Loss Formula*
Author(s) : *Kumar Sanjay*
Roll No : *8910443*
Supervisor(s) : *Singh L P & Srivastava S C*

Abstract

In the present context of energy crisis all over the world, particularly in developing countries, the importance of reducing system transmission loss is significant. This can be achieved by proper allocation of reactive powers. The optimal scheduling of reactive power also known as optimal reactive power despatch not only leads to the minimization of system active power loss but also improves the system voltage profile. Further, it also reduces line and equipment loading and results in increased power transfer capability. With the introduction of modern energy management system, this function is required to be performed on line at the interval of 3 to 5 minutes which necessitates the use of fast algorithms. The present thesis identifies this need and attempts to suggest certain improvements in this direction. Efficient loss formulations and their on-line updating is required while solving optimal reactive power despatch problem. A new set of loss formulae for real and reactive power losses have been developed in this thesis and a fast scheme of updating the loss coefficients have been suggested. A set of exact coordination equations have been developed using the suggested loss formula for optimal reactive power despatch and have been solved using classical technique which is found to be extremely simple and fast.

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Title : *Coordination Of P.S.S. And S.V.S. Stabilizers Based On Robustness Consideration*

Author(s) : *Sharma L N*

Roll No : *8920403*

Supervisor(s) : *Prabhu S S*

Abstract

This thesis demonstrates the significant benefits in the dynamic stability improvement of a power system, consisting of a synchronous generator connected to an infinite bus through a transmission line, by reactive power modulation at the generator terminal and at the mid-point of the transmission line, simultaneously. Reactive power modulation at the generator terminal is achieved by incorporating power system stabilizers while at the mid-point of the transmission line it is achieved by means of static var compensator having an auxiliary controller. This thesis proposes a method to design and coordinate P.S.S. and S.V.C. stabilizer. The benefit derived in the robustness by such coordinated application of PSS and SVC is also demonstrated. A suitable model for dynamic stability analysis of a single machine connected to the infinite bus through a transmission line with static var compensator at the mid-point of the transmission line is also proposed. The procedure followed here is simple. A set of P.S.S. is designed assuming that S.V.C. is not having an auxiliary controller. Similarly a set of S.V.C. stabilizer is designed assuming that PSS is not connected in the system. The design point chosen is the same for both designs. The PSS and SVC stabilizer so designed are then coordinated so that when both are connected in the system a further improvement in the region of robustness is obtained. Pole placement technique is used for the stabilizer design and a sector criterion for Eigen values is used for robustness. The proposed method has been tested for various combinations of control signals.

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Title : *A Study Of A Model Reference Adaptive Power System Stabilizer*

Author(s) : *Kumari Raparla Aruna*

Roll No : *8910439*

Supervisor(s) : *Prabhu S S*

Abstract

This thesis presents a study of state feedback model reference adaptive control technique using Lyapunov's second method for the design of power system stabilizer (PSS). The reference model incorporates the desired characteristics of system performance. A numerical power system problem has been considered and an adaptive PSS designed for it. Detailed simulation study of the behaviour of the controlled system has been done at various operating conditions and system strengths to establish the efficacy of the procedure. Since all the state variables are not available in practice, and since even the system parameters are not known, reconstruction of the state variables by the usual procedure is not possible. Here, since if the adaptive system works properly, the controlled system tends towards the reference model due to the adaptation process, it was felt that observers based on reference model parameters and plant outputs may work satisfactorily. Detailed numerical experimentation has established that a third order observer, which uses only the angular velocity signal from the generator, cascaded with the state feedback adaptive controller gives highly satisfactory results.

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Title : *Assessment Of Static VAR Stabilizer Inputs Based On Robustness Consideration*

Author(s) : *Gopal K Raja*

Roll No : *8920402*

Supervisor(s) : *Prabhu S S*

Abstract

Conventionally power system Stabilizers (PSS) are used for the improvement of Dynamic stability of power systems . Dynamic stability can also be improved by using auxiliary controllers in static Var Systems(SVS) .This thesis considers the problem of designing the most suitable signal FOR svsauxiliary controllers for dynamic stability improvement. The input signals considered for these controllers are line power at SVS bus frequency, Computed Internal Frequency(CIF) and a combination of line power and SVS bus frequency . The controller is designed for each case using partial pole placement technique for bus system with an svsat the midpoint of the transmission line and it is modeled on the dynamic output feedback. The power system considered is a single machine –infinite Heffron-philips model. In the method proposed here, the SVS auxiliary controller is designed at a particular chosen point in the P-Q plane, (P and Q represent respectively the real and reactive power outputs of the generator) and the region in P-Q plane in which the auxiliary controller shows satisfactory performance judged on the basis of a sector criterion for system poles is determined for each input signal . Each input signal . Each region is the region of robustness associated with the corresponding signal. The most efficacious signal for SVS auxiliary controller for dynamic stability improvement is determined by comparing the regions of robustness obtained with each signal.

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Title : *Design Of LQG/LTR Auxiliary Controller For A Static VAR System*
Author(s) : *Patil Krishna*
Roll No : *8920405*
Supervisor(s) : *Varma Rajiv K & Ghosh Arindam*

Abstract

This thesis presents an auxiliary controller to improve the power system damping and the power transfer over a long transmission line. A power system comprising a single machine connected to infinite bus through a long transmission line is considered. The line is compensated at the mid - point with a static var system. The auxiliary controller design is based upon the full state feedback using LQG/LTR design principle. The auxiliary controller utilizes measurements available locally at the SVS bus. Two LQG/LTR controllers are designed corresponding to stable and unstable regions. It is shown that with a single LQG/LTR SVS controller a significant enhancement in power transfer is achieved to the extent that the entire network capacity is utilized.

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Title : *Study Of HvdC System With Non-Conventional Controls And Converters*

Author(s) : *Routray Aurobinda*

Roll No : *8910405*

Supervisor(s) : *Kalra Prem Kumar & Srivastava S C*

Abstract

The advantages offered by the HVDC systems have proven the technology as one of the viable ways to transfer the power over long distances. However, it has been observed in literature that the conventional controls at the rectifier (constant current control) and the inverter terminal (constant extinction angle control) have drawbacks especially when one of the connected AC system is weak. Therefore various other non - conventional control schemes have been suggested to overcome these shortcomings. In this thesis an attempt has been made for a detailed comparative study of such non - conventional schemes at the inverter end in case of point to point and multiterminal systems. The study indicates that some of the non - conventional controls like Reactive current control and Reactive power control gave satisfactory response and in most of the cases are superior to the conventional extinction angle control. The reactive power compensation has become an integral part of the HVDC systems feeding to the weak AC systems. It has been suggested that the hybrid converters can eliminate the use of the compensating equipments like SVC and other types of compensators. These configurations use Artificially commutated converters as one of its converters. In this thesis a HVDC link has been simulated with an ACC at the inverter end and detailed transient and dynamic studies have been carried out to establish the feasibility of such types of converters. Apart from compensation of reactive power it has been shown in this thesis that it also minimizes the dynamic overvoltages. The harmonics generated in hvdc systems needs considerable attention. The conventional need huge bulky AC and DC side filters to separate out these harmonics. Therefore PWM schemes employing forced commutation are to be considered for their inherent capability of eliminating harmonics and providing reactive power support. In this thesis an SPWM scheme has been used as an alternative to the line commutated converter at the inverter end. It has been found that apart from eliminating the AC/DC side harmonics it gave a better transient response compared to the links with LCC and ACC at the inverter end. Further the work has been extended to a Three Terminal system where the conventional control at one of the inverters is replaced by various other non - conventional controls such as Reactive current, Reactive power and AC voltage controls and the performance has been evaluated for various normal and abnormal conditions. It has been shown that the Reactive current controller exhibited better performance than the conventional and other tested non - conventional controllers.

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Title : *Study Of SVS Controllers In Single And Multimachine Power Systems*
Author(s) : *Hiremath Nilesh S*
Roll No : *8920401*
Supervisor(s) : *Varma Rajiv K*

Abstract

This thesis deals with the problem of enhancing power transfer capacity in both single machine and multi machine power systems using static VAR system Auxiliary Controllers. Various SVS auxiliary control signals are examined which can be realized using locally measurable electrical quantities. The efficacy of both individual and composite signals is investigated in maximizing the power transfer capability. Two case studies are performed one on a single machine system and another on a two machine system which is the simplest manifestation of a multi machine power system. The power system is linearized around an operating point and eigenvalue analysis is employed to predict system stability. The various control signals are ranked based upon their performance. It is shown that a composite signal based on computed internal frequency (CIF) of the concerned generator can improve the power transfer capacity across the line to the extent of its thermal limit

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