

M.TECH.THESIS ABSTRACT 1990

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Signal processing, Communication & Networks

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Title : *System Identification From Nonuniformly Sampled Data*
Author(s) : *Ranade Abhay C*
Roll No : *8810437*
Supervisor(s) : *Sircar Pradip*

Abstract

In this thesis, a technique has been presented for system identification from a nonuniformly sampled data. In this regard, the idea of Orthogonal Polynomial Approximation is used for signal reconstruction. Accurate parameter estimation is achieved by using the statistical procedure presented here makes use of the subspace separation approach. Singular Value Decomposition (SVD) has been used, in this regard. Furthermore, the ever-present problem of model order selection has been addressed adequately. The technique presented here, was also applied to the special case of uniform sampling. Performance comparison, with a conventional technique, for the case of uniformly sampled data, proved the superiority of the technique given here.

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Title : *ADSA-A Software Package For Automatic Design Of Systolic Arrays*
Author(s) : *Hussain Afzal Syed*
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Supervisor(s) : *Gupta Sumana*

Abstract

This work presents a systematic method for transforming an algorithm, represented by mathematical expressions into a systolic array architecture. Systolic arrays are highly structured architectures tailored to a specific application. They have specific architectural properties such as simple processing elements (cells), simple and regular data and control communication and local cell interconnections. The method consists of three major steps: algorithm representation, algorithm model and architecture specification; the algorithm representation involves the translation of the algorithm into a set of locally recursive equations. In algorithm model step, a Dependence Graph (DG) is obtained from these recursive equations. From this model the computations are first scheduled and then grouped among a set of cells such that the systolic array characteristics are preserved. This grouping of computations is done via geometric projections. The valid projection direction referred to as projection vectors are systematically determined from the DG. In architecture specification step, processor basis corresponding to each valid projection step, processor basis corresponding to each valid projection vector is determined. Then a geometric transformation matrix $T = [AS^T]$ is formed. The design information such as number of cells, operations performed in each cell and data timing are extracted from the transformed index set. Cell interconnections and data movement are extracted from the transformed dependencies. The method produces all possible (partitionable / non-partitionable) systolic solutions for the algorithm under consideration and is the simplest and computationally less intensive of all the existing methods.

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Title : ***Interferometric Fiber Optic Temperature Sensor***
Author(s) : ***Gattani S S***
Roll No : ***8810445***
Supervisor(s) : ***Sircar Pradip&Sharan R***

Abstract

Interferometric fiber optic sensors using single mode fibers are described. The choice of Mach – Zehnder interferometer is explained as well as its application for temperature measurement. Temperature can be monitored by detecting the fringe movement generated due to changes in pathlength in the sensing arm of Mach – Zehnder Interferometer. A Mach – Zehnder interferometer has been setup and fringes have been observed on the screen. A simple detection scheme demonstrates the shift in fringe pattern with change in temperature. Different problems in setting up the Mach – Zehnder interferometer are described. Finally advanced phase detection techniques are reviewed as well as guidelines for future work and potential market areas are discussed

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Title : *Hardware Design Of Basic Isdn Pseudo-Ternary Code Transceiver*
Author(s) : *Chowdhary I S*
Roll No : *8810418*
Supervisor(s) : *Srivathsan K R&Sinha Vishwanath*

Abstract

The present state of development of communication technology is characterized by two main features; namely the digital transmission and processing, and integration of technologies and services. Multi - service terminals are designed to handle more than one kind of information. The ISDN allows voice, text, or data to be transmitted on the same circuit and provides effective integration of technologies and of services (by using multi -service terminals) for communications. The two types of access for the ISDN, Basic and Primary, ensure connectivity of a wide variety of terminal equipments that can possibly be used in the network. Basic access is used for the interconnection of the terminals and switches. The signal that is transmitted on the line is a three level signal, and not a binary signal, which is suitably coded resulting in a pseudo - ternary code. We present outline of our effort to fabricate the pseudo - ternary transceiver in a MSI chip configuration. Reducing the chip configuration to flip - flop and gate levels, while implementing the hardware, has been accomplished. This would further enable the ISDN interface to be fabricated in PLA or FPGA configuration. In our work, apart from recovery of the original data from the three level signal, a robust and a general purpose timing and frame sync recovery schemes has been implemented

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Title : *Implementation Of An Internet Router For Interconnection Of Lans*
Author(s) : *Kumar Rakesh*
Roll No : *8810435*
Supervisor(s) : *Srivathsan K R*

Abstract

A Router, working at the Network Layer in the OSI model is implemented to interconnect two LANs differing in the lower two layers. The LANs are the IEEE - 802.3 CSMA/CD Ethernet and the IITK Token Ring PCLAN. The protocol used for the network and upper layers is the DARPA's TCP/IP. The source code, which is almost entirely written in C, was obtained from the CMU, USA, to which additions and modifications are made in order to adapt the lower layers of the software for the LANs installed at IITK. The network services presently supported are the 'telnet' (remote login) and the 'tftp' (trivial file transfer protocol).

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Title : *A Programmable Cell For A Systolic Array*

Author(s) : *Subramanian S R*

Roll No : *8810450*

Supervisor(s) : *Biswas R N&Mahanta Anil*

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Title : *Time Series Analysis Of Flicker Noise*

Author(s) : *Kumar Sandeep*

Roll No : *8810443*

Supervisor(s) : *Chatterjee P K&Sharan R*

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Title : *A Flexible Graphics Adapter For Parallel Systems*

Author(s) : *Ganesan S*

Roll No : *null*

Supervisor(s) : *Biswas R N*

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Title : *A Hough Transform Based Devanagari Character Recognition Scheme*
Author(s) : *Hemachandran S*
Roll No : *8810417*
Supervisor(s) : *Mullick S K &Sinha R M K*

Abstract

In this thesis, we discuss the various stages of processing needed for a low level vision to recognize Devanagari characters. We have used selected parameters of Hough transform for discriminating character at the lowest level of classification procedure. A multistage decision classifier is proposed as decision model. The preprocessing scheme generates a thinned and centered character for feature extraction. Different stages of preprocessing are so designed to get an invariant features with respect to size and location. In the first stage of feature extraction, a coarse classification allocates the character to one of the class codes based on the position of end points over the predefined 9 zones in the character frame. In the second stage, the character is subclassified with respect to zero crossing over x - axis and y - axis. The third stage uses the features extracted from Hough transform to identify the character in the subset. The experiment is conducted on 44 selected basic devanagari characters. The system is trained with 10 samples of characters each and feature vector data base is created. An average recognition rate of 97% is observed. In order to reduce the dimensionality involved with normal Hough transform we suggest a refinement over the existing algorithm. This method is able to reduce the feature dimensions by about one half

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Title : *Role Of Deterministic Chaos In Speech Signal Modeling*
Author(s) : *Kumar Arun*
Roll No : *8810406*
Supervisor(s) : *Mullick S K*

Abstract

Various types of regular behaviour of dynamical systems have been known for long. What has emerged recently is that even simple non-linear dynamical systems are capable of complex or apparently random behaviour called chaos. This has implications in signal processing applications where until now the only tool to analyse complex behaviour was based on Koplomogorov's theory of random processes. Viewing complexity as arising out of low-dimensional chaos gives a new tool for analysing behaviour deterministically. The thesis begins with an analysis of speech signals in the form of phoneme utterances for the attractor dimensions and entropies. The dimensions give an idea of the number of degrees of freedom of the system, which in this case is the vocal tract while positive entropy implies that the time-series is chaotic. Analysis in terms of correlation and second-order entropy showed that the attractors are low dimensional and most of the phone time-series are chaotic in nature. The observation that the attractors are low dimensional allows us to use simple deterministic non-linear modeling schemes with few independent variables to model such signals. The performance of the global approximation technique was compared with the LPC (covariance-method) in terms of prediction error for the same model orders for phone time-series. Comparison showed that prediction behaviour of amount of reduction in prediction error depends on the nature of the phoneme; it may be as high as a factor of 10. Another modeling technique called the local approximation technique cannot be used directly for signal processing application because of the requirement of a prohibitively large model order. Therefore, a compromised overlapping neighborhood local approximation technique has been proposed in the thesis and its prediction properties compared with global approximation technique. In 80 % of the cases studied, this technique gives further reduction in prediction error at the cost of higher computational complexity.

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Title : *Quantized Receivers For Detection Of Weak Signals In Noise Mixtures*
Author(s) : *Basu Ranjan*
Roll No : *8810438*
Supervisor(s) : *Rao P R K*

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Title : *The Iear Process In Image Coding*
Author(s) : *Dixit Asutosh*
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Supervisor(s) : *MullickS K*

Abstract

Modern vcommunication practices make uses of image data the forbidding volume of suchdata make it that methods for image data compression be considered. Certain modules for describing non-gaussian time series have been studied in literature. Gibson, [1], considered the IEAR (1) process, a first order are process in whichthe excitation is absent with a probability p. It was shown that the structure of thisprocess makes it amenable to data compression purposes and a predictive variable lengthcompression scheme for the coding of this process was designed. Hear, a new process,IEAR-IC (1) process has been constructed, and the feasibility of these two processes inimage source modeling and coding have been explored. A large number of configurationsin which compression schemes based on these processes can exit in an image codingenvironment have been identified and the compression performances of various schemescompared. Both adaptive and non-adaptive methods have been considered. Comparrsonhas been made with 3-bit DPCM. It has finally been shown using experimental evidence that the scheme yielding thebest overall compression performance turns out to be a non-adaptive scheme which codesthe predication error values, obtained on using a predictor coeffecient of value 1.0 using asimple variable length coding scheme. The above scheme turns out to be identical to theuse of the same coding scheme in the case of closely related DPCM scheme

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Title : *Adaptive Rectangular Wave Modulator For Video Signals*
Author(s) : *Kanmani R*
Roll No : *8810420*
Supervisor(s) : *Chatterjee P K*

Abstract

Rectangular wave modulation (r.w.m.) is a form of asynchronous delta modulation scheme. In this work, the principle of operation of the rectangular wave modulator has been studied, and a system designed for video signal inputs. The designed modulator and demodulator circuits have been implemented in the laboratory and tested for transmission of standard video signals. The tests confirmed that video can be successfully transmitted using r.w.m. The r.w.m. cannot track signals having slope beyond a certain value creating slope overload noise, which limits its performance significantly. Thus the r.w.m. has an optimum input signal level for maximum output signal-to-noise ratio (SDNR). To overcome the above drawbacks of the r.w.m., the modulator system is made adaptive to signal slope variation. An adaptive r.w.m. also has been designed and implemented. The adaptive r.w.m. is found to have higher signal handling capacity, better signal-to-noise ratio and also require lesser transmission bandwidth. The adaptive r.w.m. system can be used for video transmission through optical fibers. A channel bandwidth of 25MHz is adequate for video transmission using r.w.m.

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Title : *Estimator-Correlator Receivers For Discrete-Time Signals*
Author(s) : *Mathur Amit*
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Supervisor(s) : *Rao P R K*

Abstract

The estimator detector interpretation of the optimum test for the detection of random signals or signals with random parameters, has been used to conduct a study in a discrete time framework of two classical problems detection of Doppler shifted sinusoidal signals and detection of non Gaussian random signals in white Gaussian noise. For additive white Gaussian noises, the interpretation is known to lead to the well known estimator correlator structure for the ideal receiver. Such a structure facilitates the use of a simple known signal detector correlator in the case of white Gaussian noise along with a suitable estimator of the signal of interest more importantly, the concept allows the use of otherwise well known signal estimators for reasonably good sub optimum realizations of the receiver. This philosophy has been used to obtain a receiver structure, for the detection of a Doppler shifted sinusoid in white Gaussian noise, in which the estimator is realized by a discrete time extended Kalman filter. A performance analysis of the receiver so obtained has been carried out using random simulations, and a comparison done with the performance of two other similar receiver structures proposed elsewhere, it is found that the receiver under study does not offer any advantages over the existing schemes. Finally, a study of the problem of detection of discrete time random signals in white Gaussian noise has been undertaken with the idea of using the already known results for the Gaussian signal case. A complicated form for the optimum test statistic is derived which, while not giving an estimator correlator structure, does permit a segregation in terms of an estimation operation followed by detection operation. Under low SNR conditions the likelihood ratio is found to give a structure very similar to the estimator -correlator

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Title : *On Are Of Local Detectors Under Non-Gaussian Linear Models*
Author(s) : *Singh D B*
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Supervisor(s) : *Bansal Rakesh K*

Abstract

Based on fixed number of observations, locally optimal detectors (LOD) have existed under various noise models, with weak dependence, as modeled through an ARMA process. While their implementation is straightforward for fixed length of observation, sequentially their implementation poses great difficulty. In this thesis by imposing the condition of stationarity and invertibility on the ARMA models, sequentially implementable LOD is derived under ARMA model driven by non - gaussian iid process and it is compared with other local detectors under various noise models on the basis of pitman ARE. By sequentially we mean here recursively.

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Title : *Group Algebraic Study Of Permutation - Invariant Filters*
Author(s) : *Rao R Hari Prasada*
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Supervisor(s) : *Siddiqui M U*

Abstract

Group algebraic approach to the study of P - I filters is considered. Classification of P - I filters based on the ideals in group algebra is proposed and the possibility of equivalent realization of cyclic permutation invariant (P - I) filters in terms of abelian P - I filters is investigated. It is shown that such realizations are possible only for those P - I filters which are invariant relative to both cyclic and abelian permutation groups of same degree. Equivalent realizations are obtained on the basis of Mixed - Radix (MRX) mapping and mapping based on Chinese - Remainder theorem (CRT) for integers. Complete characterization of such filters is given for both of these mappings. Implementational advantages of realizing cyclic P - I filters as abelian P - I filters from the point of view of structural concurrency are pointed out. In the group algebra representation of a signal space, the space consisting of all n - length real - valued sequences, a P - I filter is a mapping from group algebra into an ideal of the group algebra. A class of P - I filters that maps elements from a group algebra into an ideal is itself shown to be an ideal. As a consequence, cyclic P - I filters are classified based on the ideals in cyclic group algebra and abelian P - I filters are classified based on the ideals in abelian group algebra. An expression for the number of conjugacy classes in abelian group algebra is given and its significance to the above classification is pointed out. This classification is instrumental in the identification of filters that are invariant under both cyclic and abelian permutations. Such filters are interpreted as elements of cyclically closed ideals in abelian group algebras and are called cyclically closed abelian P - I filters. MRX mapping provides a basis to the characterization of such ideals. From these ideals, a complete characterization of cyclically closed abelian P - I filters is obtained. Whenever the orders of component cyclic sub groups are pairwise relatively prime integers, mapping based on CRT for integers is considered and it is shown that any cyclic P - I filter, whose dimension is a product of pairwise relatively prime integers has, an equivalent abelian P - I filter realization. It is shown that the same samples domain CRT mapping relates the respective transform domain coefficients. Therefore, in the transform domain, this equivalent abelian P - I filter realization has an implementation advantage over traditional cyclic P - I filter realization using Good - Thomas FFT algorithm in respect of address shuffling.

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Title : ***Image Reconstruction From Projections With Tikhonov - Philips Regularization***
Author(s) : ***Nagaraj T R***
Roll No : ***8810457***
Supervisor(s) : ***Rathore R K S& MullickS K***

Abstract

Image reconstruction from projections is the process of obtaining the reconstruction of a distribution from its line integrals. Algebraic methods of image reconstruction are based on discretizing the Radon transform and then solving the resultant algebraic system. This is in contrast to the Transform methods which are based on analytic inversion formulae. The Transform methods are generally faster than the algebraic methods with reasonably good reconstruction and hence are the favoured methods in practice. In this context it is interesting to study algebraic methods which have computation of the same order as the Transform methods. The algorithm which is the topic of the present thesis, the Tikhonov-Philips regularization, given certain storage, has this kind of computational complexity. In this thesis the Tikhonov-Phillips regularization method is implemented and its performance evaluated. The evaluation is in terms of the visual reconstruction and certaherrors. The erros are compared with those obtained with the convolution back projection algorithm

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Title : *Computer Simulation Of Nuclear Detectors For Digital Signal Processing*
Author(s) : *Saxena Vishal*
Roll No : *8510463*
Supervisor(s) : *Biswas R N& Mahanta Anil*

Abstract

Electrical Circuit Modelling of nuclear detector behaviour under various electronic instrumentation environments for nuclear experimentation has been undertaken. The insight gained has been utilized to develop a software simulation package for nuclear detector response. A specific electronic instrumentation environment has been adopted for determining the impact of simulation on spectral distributions of energy of radiation as a test-case. Factors affecting resolution in pulse height spectra have been studied with a view to evolve simulation tools for testing the efficiently of digital signal processing algorithms.

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Title : *Interactive GPIB Controller*
Author(s) : *Malhotra P*
Roll No : *null*
Supervisor(s) : *Biswas R N*

Abstract

An attempt has been made to develop a controller for instrumentation systems linked by a General Purpose Interface Bus (GPIB), It has been designed to operate as system controller on the GPIB with the capability of assigning TALKERS, LISTENERS and handling bus management. By incorporating the microprocessor 80S5 it has been made Interactive via a teletype. This system has a MONITOR program and GPIB programs residing in EPROM* A 2K~byte RAM is provided for handling and processing data acquired through GPIB, The MONITOR features are - DISPLAY memory, ENTER into memory and RUN" (start program execution) from the desired memory location. The GPIB routines can also be called through the MONITOR, The GPIB routines are so structured that they can get their operands either through prompting messages via the teletype or directly from predetermined memory locations. Such an interactive-controller should find extensive use in sophisticated test and measurement systems

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Title : *A Generalised Scattering Matrix Representation Of Slot Radiators Excited By A NRD Guide*
Author(s) : *Ramani C*
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Supervisor(s) : *Sachidananda M*

Abstract

Programmable Logic Arrays (PLAs) presently occupy an extremely important role as digital subsystems and though they offer many advantages, they also present new testing problems. Conventional testing techniques are not cost effective and tend to become impractical, particularly for large PLAs. A recent approach to the testing of PLAs is the use of Built - in Self - Test (BIST) technique wherein the extra logic which makes the PLA testable is placed on chip. This approach eliminates some of the limitations of the conventional approaches and can be integrated with CAD. It is the most suitable method for field testing. Faults peculiar to the PLA – crosspoint and bridging faults have been discussed in detail. It has been shown that all faults can be modeled as crosspoint faults. A design for a BIST system which is being called as BIST - PLA has been proposed. The method adopted is counting of the number of crosspoints on each row and column of the PLA. If the count on each line tallies with the true expected value, the PLA is fault-free. If the count on any line does not match, the PLA is declared to be faulty. To implement such a method, the PLA has to be reorganized. The extra logic consists of shift registers and counters. The shift registers enable one row and column at one time. By shifting the enabling signal across a line, they provide the incrementing signal to the counters. Decoded PLAs is one of the area reduction techniques. The design of the BIST - PLA has been extended to PLAs having two bit decoders at their input, a software package has been developed to generate the BIST - PLA. Given the personality matrix of the PLA, the software is able to generate the diagrams for extra logic and the PLA

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Title : *Deconvolution By Combined Predictive And Homomorphic Filtering*
Author(s) : *Hosur Prabhudev I*
Roll No : *8810428*
Supervisor(s) : *Mahanta Anil*

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Title : *A Broad Band Double Balanced Mixer*
Author(s) : *Swain Niranjan*
Roll No : *8810425*
Supervisor(s) : *Sachidananda M*

Abstract

This project was started with an aim of designing and fabricating a broad band double balanced mixer using a diode quad. Two different configurations are adopted for the work. The first configuration consisted of microstrip feed line with CPU junction as ring quad driver and slot line as transmission line to launch an even mode in the CPU. The design of various transitions with impedance transformers, Power divider and uncoupled junctions of microstrip line and slot line are carried out based on data available. However, lack of sufficient data led to formulation of empirical design. The above mixer gave good performance over 2.5 GHz to 4.5 GHz. The diode quad is designed for operation up to 3 GHz and hence the noise figure was found to be high at higher frequencies. If a diode quad designed for 10GHz operation is used in the same circuit it is expected that much better noise performance can be obtained over larger band width. The circuit elements seemed to give larger mismatch losses at higher frequencies. The reason for poorer performance is mainly due to the lack of precision etching. Presence of several transitions from microstrip to slot line, power divider etc, give rise to some VSWR at each of which combine to deteriorate the mixer performance. The second configuration to improve upon the first one was adopted in which some of the previous drawbacks are eliminated. This configuration consisted of driving a quad by asymmetrical π double strip transmission line kept physically orthogonal to achieve isolation between LO and RF signals. This configuration also uses transition from microstrip to double strip transmission line with impedance transformation. The design details of transition from a microstrip to double strip line is not available in literature. Therefore, an empirical formula is derived for the transition region where the line has two strips of different width. The performance of the mixer is found to be better from 2GHz to 6.5GHz. However, the mismatch in the circuit at some frequency is found to be high. This may be due to resonance at these frequencies. The conversion loss is within 6 dB from 2 GHz to 5 GHz. The measured noise figure is below SdB from 2GHz to 3GHz. The noise figure is within 10 dB from 3GHz to 5GHz, The second configuration is found to have better performance than the first configuration.

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Title : *An Interface System For Digital Signal Processor*
Author(s) : *Shera R S*
Roll No : *8810431*
Supervisor(s) : *Mahanta Anil*

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Title : *Microprocessor (8086) Based Protection Scheme For Power Transformers*
Author(s) : *Jain Rajeev*
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Supervisor(s) : *Singh L P*

Abstract

The responsibility of modern power transformer protection system to provide a comprehensive coverage for more contingencies poses big challenge in the design of digital relays. This is because of certain problems associated with the transformer magnetizing and over voltage inrush currents, tap changing provision etc. In view of the importance of choice of filters, Haar functions have been used to implement FIR filter. A system has been configured around intel - 8086 microprocessor to realize the digital relay. The possibility of optimum hardware requirement and high speed of operation along with versatility is demonstrated. Tap changing and variable bias factor have also taken into account. The proposed microprocessor based relaying scheme is efficient, reliable and fast in operation. The scheme has been designed fabricated and tested in the lab on a single phase transformer and it is found that it can operate in nearly 10 ms on 50 Hz base.

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Title : ***Robustness Considerations In Adaptive Power System Stabilizer Design***
Author(s) : ***Madhu G N***
Roll No : ***8810416***
Supervisor(s) : ***Prabhu S S***

Abstract

This thesis considers design of robust adaptive power system stabilizers using angular velocity deviation w , angular acceleration deviation \dot{w} and both w and \dot{w} (two input PSS). The design is viewed as a pole placement problem utilizing output feedback. The solution proposed is new, simple and easy to implement. The conventional nonadaptive PSS works satisfactorily as long as the system operating conditions do not change significantly. There is always a certain amount of stability robustness in the system with such PSS. By properly choosing the closed loop eigenvalues to be assigned, the PSS can be designed to provide the required degree of stability robustness. In the method proposed here, a set of PSS is designed and the exact region in the P-Q plane, (where P and Q represent respectively the real and reactive power loading of generator), in which each PSS shows satisfactory performance is determined. Each region is the region of robustness associated with a particular PSS. The individual PSS are so designed that the union of the robustness regions associated with them cover a large portion of the P-Q plane, the total number of individual PSS is small and the feedback gains in the PSS are not large. If a particular operating point happens to be within the region of robustness of a PSS, then that PSS is chosen for the purpose of stabilization. As long as the operating points lie within this region, the same PSS continues to operate. Stability robustness is also used to determine the efficacy of various input signals used in PSS design. It is shown that this approach gives a simple and straight forward method to determine which particular input or inputs should be used for PSS. This is a new contribution in the area of PSS design. The proposed method has been tested in detail using digital simulation, including consideration of different system strengths. As is customary, we have used an approximate model of the synchronous generator which neglects damper windings in PSS design. The results obtained have been validated by studying the system behaviour with the PSS developed by using a detailed synchronous machine model

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Title : *Built - Self - Testing Of PLAS*
Author(s) : *Popli R K*
Roll No : *8810430*
Supervisor(s) : *Hasan Mohammad Mozaffarul*

Abstract

Programmable Logic Arrays (PLAs) presently occupy an extremely important role as digital subsystems and though they offer many advantages, they also present new testing problems. Conventional testing techniques are not cost effective and tend to become impractical, particularly for large PLAs. A recent approach to the testing of PLAs is the use of Built-in Self-Test (BIST) technique wherein the extra logic which makes the PLA testable is placed on chip. This approach eliminates some of the limitations of the conventional approaches and can be integrated with CAD. It is the most suitable method for field testing. Faults peculiar to the PLA — crosspoint and bridging faults have been discussed in detail. It has been shown that all faults can be modelled as crosspoint faults, A design for a BIST system which is being called as BIST-PLA has been proposed. The method adopted is counting of the number of crosspoints on each row and column of the PLA. If the count on each line tallies with the true expected value, the PLA is fault—free. If the count on any line does not match, the PLA is declared to be faulty. To implement such a method, the PLA has to be reorganized. The extra logic consists of shift registers and counters. The shift registers enable one row and column at one time. By shifting the enabling signal across a line, they provide the incrementing signal to the counters. Decoded PLAs is one of the area reduction techniques. The design of the BIST-PLA has been extended to PLAs having two bit decoders at their input. A software package has been developed to generate the BIST-PLA. Given the personality matrix of the PLA, the software is able to generate the diagrams for extra logic and the PLA.

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Title : *An Ms-Dos File Server For A Pc-LAN*
Author(s) : *Cyriac Cigy*
Roll No : *8810409*
Supervisor(s) : *Joshi Avinash*

Abstract

. This thesis discusses the development of a file server for the IIT - K PC - LAN, a token ring local area network for low - cost interconnection of IBM - compatible personal computers. Individual PC users are provide with transparent access to the MS - DOS file system maintained by the server. To a user, the remote file system appears to be on a virtual drive on his local machine, and can be accessed as easily as a local drive. Users are provided with facilities for sharing one another's files on the server, while also being able to exercise control over how and to what extent this can be done. In addition to the actual server, the software developed includes a redirector module for each client PC, a network driver and a utility package

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Title : *Evaluation Of Uncertainty Representations For Robot Models*
Author(s) : *Kumar P N*
Roll No : *8810427*
Supervisor(s) : *Hole K E*

Abstract

Evaluation of various uncertainty representations for linearized robot models is carried out in this thesis. Recursive lagrange -euler equation of robot arm motion has been linearized around a reference trajectory and linear models have been obtained. The linearized model obtained at 3 kg load is considered as nominal one. The linearized robot model has been found to be unstable at the nominal load also at the two extreme load conditions of no load and 6 kg load. A controller has been designed based on pole placement using state feedback so as to stabilize the robot at all loads. For this systems, uncertainty bounds were evaluated for both structured and unstructured uncertainties. The unstructured uncertainty representations has been found unsuitable for uncertainty representation in robot models as it violated the stability tests at the above load conditions. In the structured uncertainty representation using a state transformation method it was possible to establish stability robustness of the nominal controller when used over the entire range of load variation. Therefore it is concluded that structured uncertainty representation is most suited for the representation of uncertainty in robot models

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Title : *A Simulator For A Systolic Array Signal Processor (SASP)
Based On Adsp-14xx And 32xx Chip Set*

Author(s) : *Wandhekar Sanjay A*

Roll No : *8810460*

Supervisor(s) : *JoshiAvinash*

Abstract

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Title : *Design Of Robust Controller For LTI Systems With Matching Uncertainties*
Author(s) : *Tripathi R K*
Roll No : *9410441*
Supervisor(s) : *Hole K E*

Abstract

One of the essential roles of feedback is to produce a satisfactory control of plants with parameters that are either not known exactly, due to modeling errors, or are varying in time during operation. The feedback law with the above mentioned property is commonly known as ROBUST CONTROL. In this thesis, design of a robust controller for multivariable uncertain dynamical system with matched uncertainty is considered. The design is based on the linear Quadratic regulator theory with prescribed degree of stability. The results developed earlier for fixed perturbations have been extended to perturbations satisfying matching conditions. The perturbation can also be time varying. The results developed lead to automatic selection of weighting matrices Q and R to guarantee stability robustness. The designed model is tested for three examples and the results show that the present method is easier to use than those available in the literature

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Title : *Optimization Of Spline Interpolated Robot Joint Trajectories By The Method Of Local Variations*
Author(s) : *Sinha Sushma*
Roll No : *8810454*
Supervisor(s) : *Prabhu S S*

Abstract

A combination of B-Spline representation and the method of local variations (MLV) has been used for off-line optimal planning of robot joint trajectories. B-Splines have several advantages for robot trajectory presentation, in terms of accuracy of the representation and its derivatives and in terms of the ease with computations can be done. Furthermore, because of their property of local support, B-Splines are well suited for use with MLV. Two types of optimal joint trajectories have been determined: (1) trajectories to obtain minimum energy loss in the joint motors, for fixed time of traversal of the end effector between two given points in Cartesian space and (2) trajectories which minimize the time of traversal of the end effector between two given points in Cartesian space. The trajectories obtained satisfy constraints on position, velocity, acceleration and jerk in the joint space. The algorithms developed have been used to solve the planning problems posed for PUMA – 580 robot manipulator. Through obstacle constraints have not been considered here, they can be incorporated without difficulty in the algorithms developed.

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Title : *Software Package For Designing H ∞ Optimal Control*
Author(s) : *Kulkarni A G*
Roll No : *8810401*
Supervisor(s) : *Hole K E*

Abstract

One of the techniques employed by designers to reduce the effect of disturbance on the controlled output is the H_{∞} optimization technique. The approach adopted by the designers in the early eighties was based on the frequency domain approach. The software required to solve the H_{∞} optimal control problem using this technique was formidable. The aim of this thesis was to develop a software based on the results published since 1987 to solve the H_{∞} optimal control problem using the state space approach. The object of the H_{∞} optimal control problem is to design a controller such that the effect of the disturbance on the output is below a prespecified level. The design of the controller is achieved by the solution of certain algebraic Riccati equations. The nature of the Riccati equations encountered in the design procedure are similar to those that arise in the linear quadratic differential game theory. Because of the nature of the Riccati equations it is not possible to solve the Riccati equations encountered in the linear differential game theory was adapted to develop the software. The software created here solves the H_{∞} optimal control problem by first designing a full state feedback controller followed by the design of an observer based gain matrix and lastly by checking whether the closed-loop system thus obtained is stable and meets the required objective of disturbance attenuation.

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Title : ***Rotor Flux Estimation In The Field Oriented Control Of Induction Motor***
Author(s) : ***Jasuja Ishwar Vishandas***
Roll No : ***8810419***
Supervisor(s) : ***Joshi Avinash***

Abstract

Present work deals with the rotor flux and the rotor time constant estimation and the field oriented control of the induction motor. To make the analysis simple the field oriented model of the induction motor is used. Using this model, the steady - state and the transient solution for the rotor flux and the rotor speed is obtained. In the next part of the thesis, various methods are discussed to determine the rotor flux from terminal conditions. An effort has been made to estimate the rotor time constant by least square method. Finally, various control schemes for the induction motor are applied. It is shown how these methods can use the estimate flux values, obtained by the methods described in the previous part of the thesis, to make the control of the machine robust. A method, based upon the integration approach has also been applied to estimate the rotor resistance and the mutual inductance independently for the induction motor driven by PWM inverter

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Title : *Robust Non Linear Filtering And Adaptive Manipulator Control*
Author(s) : *Konerdu Ravindrababu*
Roll No : *8810440*
Supervisor(s) : *Ghosh Arindam*

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Title : *A Two Dimensional Simulation Of Mosfets*
Author(s) : *Nandi Tapas*
Roll No : *8810456*
Supervisor(s) : *Hasan Mohammad Mozaffarul*

Abstract

The most effective way to design VLSI MOSFET structures is to use a sophisticated complex two - dimensional model. Such a model, using the basic semiconductor equations along with the accurate models for the physical parameters of the basic equations, has been described here. Numerical simulations of this MOSFET model using finite difference method has also been described. Low computation cost algorithms have been used to develop an easy - to -use software package for planar MOSFET simulation. Simulated results are presented for few types of short channel MOSFETs to show the power of the device simulation to predict the behaviour of the device. Finally, the modifications of this MOSFET simulation model and the possibility to integrate this device simulation with the process and the circuit simulations have been proposed.

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Title : *Analysis Of The Series Resonant Converter Using A Frequency Domain Model*
Author(s) : *Roy Partha Pratim*
Roll No : *8810426*
Supervisor(s) : *Doradla S R*

Abstract

The resonant converters are generally analyzed using a time domain approach. In this thesis the steady state analysis of a series loaded resonant converter is presented using a frequency domain model. For a series loaded resonant converter with a large capacitive filter at the output, the output voltage may be considered to be ripple free dc. With this assumption the series loaded resonant converter can be modeled as a high-Q series LC circuit fed by two square wave voltage sources, one taking into account the effect of the load and the other for the source. Generalized expressions for circuit currents and voltages have been determined using the model. Waveforms of the resonant circuit current and capacitor voltage have been obtained. A multiple continuous conduction mode in which each power switch conducts twice in each half cycle has been identified. The characteristics of the converter on the output plane have been drawn and have been compared with the published results obtained from the time domain approach. There has been a good agreement between both results. The variations of output voltage and peak capacitor voltage have been studied. Relationships among several important quantities have also been determined. The variations of output power, input power, and converter efficiency have been studied for two of the common control schemes, namely, the open-loop frequency control and the closed-loop phase control. Lastly an example of the design of series loaded resonant converter to meet a given set of specifications has been given making use of the relations derived in the earlier chapters

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Title : *Design Of Roboust Controller For VTOL Aircraft*
Author(s) : *DwivediG N*
Roll No : *8810414*
Supervisor(s) : *HoleK E*

Abstract

In this thesis the design of a fixed feedback controller for VTOL (vertical takeoff and landing) aircraft with time varying parameters is considered. The robustness of the controller is guaranteed in the entire air speed range of 60 to 170 knots. The design is based on the Linear Quadratic Regulator theory with prescribed degree of stability. A sufficient condition is stated, which when satisfied guarantees optimality of the nominal optimal control law for perturbed system over the entire range of operation. If the condition cannot be satisfied, then a modified condition is stated. This modified condition when satisfied guarantees stability robustness with reduced phase margin, reduced gain reduction tolerance and reduced sector of nonlinearity as compared to that of optimal controller. These reduced stability margins, however are adequate from practical point of view. A fixed controller for VTOL aircraft is designed which guarantees adequate stability robustness and satisfactory performance over the entire speed range. The responses of VTOL aircraft with this fixed feedback controller are compared with those of optimal controller, approximate optimal controller and existing fixed feedback controller at various air speeds. The comparison establishes adequacy and superiority of the fixed controller designed here over the other existing ones

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Title : *Development Of A Software Package For Switched Capacitor Filter Design*
Author(s) : *Mukherjee Subhashish*
Roll No : *8810451*
Supervisor(s) : *Hasan Mohammad Mozaffarul*

Abstract

In this work, SFDP, a software package for the design of switched capacitor filters, has been developed. SFDP can generate circuit schematics from frequency domain specifications. The design approach has been to first derive an s - domain elliptic filter function from specifications. This is then transformed to the z - domain using the bilinear s - to - z transformation. The z - domain transfer function is then matched with the transfer functions of standard switched capacitor biquad building blocks to obtain the circuit component values. A submodule to design the operational amplifiers, used in the filter circuits, has also been included in the package. Several designs have been performed using SFDP and some of the designed circuits have been simulated using SPICE.

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Title : *Walsh Transform Based Digital Protection Of Power Transformer*
Author(s) : *Barnwal Rajiv Kumar*
Roll No : *8810434*
Supervisor(s) : *KalraPrem Kumar & Singh L P*

Abstract

The problem of protection of power transformers against abnormal conditions has been of great concern to power system engineers, traditionally percentage differential relays has been used to protect transformers against internal faults. However, this relay fails in case of magnetizing and over voltage inrush currents, on account of high differential current. The fact that magnetizing inrush current has a large second harmonic components, can be exploited to restrain tripping during this abnormal condition. Overvoltage inrush phenomenon has also been taken into account by noting that it contains. Large, but progressively decreasing odd harmonic components. Since third harmonic gets trapped in Y - Δ connection, therefore fifth harmonic has been used to restrain tripping during this abnormal condition. Digital filters have been used by simulating their characteristics with software. Sixteen point Walsh transform, because of their advantage like immunity to slight frequency variations, accuracy have been used to implement these filters. To make the relay reliable and fast, it has been designed with minimum hardware on the Vinytics microprocessor's kit. The relaying scheme has been tested for various simulated inrush and internal faults and is found to give satisfactory results

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Title : *P. I. D. Controller For Load Frequency Control Of Single And Inter-Connected Power Systems*
Author(s) : *Chand Suresh*
Roll No : *8810452*
Supervisor(s) : *KalraPrem Kumar &Sarkar B*

Abstract

This report presents an approach for improving the stability of load - frequency for single area and multi -area interconnected power systems using P.I.D. controller i.e. proportional, integral and derivative controls. These three components of the P.I.D. controller have been used in various combination in forward and feedback paths. Only some of the combinations were found to give improved transient and steady state responses. The proposed technique is applied to single area power system as well as two -ar ea interconnected power systems like thermal - thermal and hydro - thermal systems. The P.I.D. controller can be applied to multi - area - interconnected power systems. A comparison of the load frequency control (LFC) response with conventional and variable - st ructure system (VSS) control and proposed P.I.D. control strategies shows that, with the applications of the proposed algorithm, the system performance is improved significantly

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Title : *Plasma : A Cad Tool For State Machine Synthesis*
Author(s) : *Puri Ruchir*
Roll No : *8810441*
Supervisor(s) : *Hasan Mohammad Mozaffarul*

Abstract

Presented work proposes a new State Machine Synthesis System named PLASMA which can be used for implementing FSMs (both asynchronous and synchronous machines) in PLAs. It provides the facility of state minimization, state assignment and PLA generation from coded state table and also minimizes the area of the PLA by using the facilities of boolean minimizer ESPRESSO -MV. The algorithm used for state minimization effectively prunes the tree structure of compatible list to find the minimum form of a minimized S OC (single output change) machine. An approach of state assignment, which is particularly suited for PLA implementation of sequential machines (both single multiple output change), is used the assignment module has specially been oriented towards saving the silicon area of the chip implementing sequential PLA. PLASMA has been tested for a range of randomly generated sequential machines and has been found to work very effectively by saving around 40 – 75% chip area. The system is complete and works very efficiently for incompletely specified sequential machines to achieve area optimization in the PLA structure

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Title : *Development Of A Computer - Controlled Inverted Pendulum*
Author(s) : *Reddy N Kasi*
Roll No : *8810424*
Supervisor(s) : *Ghosh Arindam&Biswas R N*

Abstract

This thesis discusses the development of a computer - controlled inverted pendulum which automatically balances itself. The thesis is divided into two different parts. In the first part, the theoretical development of the inverted pendulum, its control and the simulation results are presented. Again the DC motor which is used for balancing the pendulum has its own friction which might be detrimental for the balancing system. It will be more desirable to compensate for this motor friction. In the first part itself, various friction compensation schemes are discussed which also include a proposed self - tuning friction compensator. The second part contains the hardware development and experimental results of a rail -mounted vehicle - pendulum system. The DC motor used for the balancing system is of separately excited type which has a voltage rating of 240 volts. For driving this high voltage motor, a power amplifier (Four - Quadrant Chopper) is designed and developed. The system is interfaced with an IBM compatible PC/ XT through which the performance of the proposed controllers are tested.

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Title : ***Application Of Charge Simulation Method For Estimation Of High Voltage Fields***
Author(s) : ***Arora Ajay***
Roll No : ***8710401***
Supervisor(s) : ***Arora Ravindra***

Abstract

The Subject for estimation of HV field gained importance ever since the beginning of Electrical Engineering by the advent of digital computers. The conventional method for the estimation like field sketching by hand and by electrolytic tanks gave up their way. Numerical methods like FDM & FEM found their breakthrough in this field, however, a revolutionary change was brought up by Steinbuegler in late 1960's when he introduced CSM, a most appropriate and suitable for the estimation of electric field between complicated unsymmetrical electrode configurations. Although this method is being used in practice in advanced countries it has just made a breakthrough in India. In this thesis computer programmes using CSM have been developed for simple electrode configuration having rotational symmetry and involving one two dielectrics. Also, basic mathematical background such as plotting of equipotential surfaces, for finding vertical and horizontal components of electric fields on arbitrarily include interfaces and arbitrary location of simulation charged etc. Has been developed for further work in this field. Certain missing links in the existing theory have been found out. Thus this work can provide a good starting for tackling complicated electrode configuration and involving multielectric cases

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Title : *Symmetric Optimization And Its Application To A GTO Chopper Fed Dc Drive*
Author(s) : *KumarAmarendra*
Roll No : *8810402*
Supervisor(s) : *Dubey G K*

Abstract

The project reviews and investigates the Magnitude and Symmetric optimization techniques for the design of closed loop speed control systems. These techniques have been employed for the design of controllers for GTO chopper fed dc separately excited motor speed control system, employing the outer speed control loop and inner current control loop. The drive has been simulated on a personal computer and its performance has been evaluated. The drive has been fabricated using personal computer based controllers and its performance has been obtained experimentally.

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