M.TECH. THESIS ABSTRACT 2008

Power & Control

Signal processing, Communication & Networks

Microelectronics, VLSI & Display Technology

RF Engineering & photonics

Title **:** ***Artificial Intelligence Based Location And Classification Of Power Quality Events***

Author(s) **:** ***Shakya Deepti***

Roll No **:** ***Y6104025***

Supervisor(s) **:** ***SinghSri Niwas***

Abstract

Fault location is an important task for monitoring and protection of power system. This thesis presents an approach for fault location in the distribution system. The objective is achieved in two steps. In the first step, an algorithm for classification of fault section area in the system is proposed. Then in next step, the exact location of fault is identified in that area. Two algorithms have been proposed towards the first step i.e. for fault section estimation. Disturbance power concept together with Support Vector Machine (SVM) is used for fault section estimation. SVM locates the fault area based on the direction of first peak as well as the maximum magnitude of the disturbance power for each phase. Based on IEEE Std 1159, two stage fuzzy classifier is then used to identify the PQ disturbance generated in that area. Fisher Discriminant Ratio (FDR) is also proposed for identifying the fault section area. It uses the phase sequence of the positive sequence of three phase current as the feature vector to identify the fault type. The kernels for single line to ground fault, double line to ground fault, three-phase fault, capacitor switching and capacitor switching with SLG are designed in time-frequency plane. Once the fault section area as well as fault type is identified then the Feed Forward Neural Network (FFNN) is used to trace the exact fault location from the monitoring end. These FFNN are designed separately for each type of fault considered.

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Title	***:***	***Development Of A Search Capable Automatic Book Scanner Machine***
Author(s)	***:***	***Bhardwaj Jitendra***
Roll No	***:***	***Y3167141***
Supervisor(s)	***:***	***Potluri Ramprasad & Venkatesh K S***

Abstract

The thesis deals with the digitalization of hard bound books and making a searchableindex of chapter title, section title and gures from its scanned image. We proposea novel design and techniques of operation of automatic book scanner machine. Alaser line pattern is used for the image correction as well as feedback for the hardwarecontrols. Titles, section titles and gure are extracted from document image usingspace and frequency pattern analysis. It is an image based solution, and therefore itis language independent. We compare our results with some existing and availableprofessional softwares and show positive results. Application of the machine is indigitalization of libraries and archival of books. Digital libraries have a revolutionaryimpact on education systems.

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Title : ***A Kinetic Model For Multiplication In Superconducting Radio Frequency Cavities***

Author(s) : ***Ghatak Shreya***

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Supervisor(s) : ***Gupta Nandini***

Abstract

Nuclear power is an inevitable option for electricity generation in the near future. Inrecent years, there has been considerable upsurge of interest in the concept of acceleratordrivensub-critical reactor systems (ADS) in India, so as to design hybrid reactors systemfor production of nuclear power with the use of thorium as the main fuel. A high currentproton beam linear accelerator (LINAC) is an integral part of ADS. Bhaba AtomicResearch Centre (BARC), India is involved in the development of superconductingcavities for proton beam LINAC of ADS. The performance of superconducting cavity isgreatly affected due to multipacting. Multipacting is a phenomenon in which a largenumber of electrons can build up inside the system. Multipacting can cause electricbreakdown as well as thermal breakdown in RF components. Thus, it is essential toevaluate a cavity design for its propensity to multipact.A code has been developed in order to investigate multipaction occurrence in acceleratingcavities and other RF components. The simulations are carried out in three steps. At first,the cavity designs are optimized using SUPERFISH. Then the electromagnetic fieldwithin the cavity is re-computed with FEMLAB, which uses finite element method, inorder to obtain an accurate field-mapping, and to make the field values available to themultipacting simulation code. In the multipacting subroutine, electrons are assumed to bereleased into the system from various points on the cavity wall and with different initialparameters. The 'bright set' is characterized as the combination of those boundary pointsand launching phases that allow the electrons to be accelerated into the cavity. Thetrajectories of the electrons launched from the above-mentioned bright set are trackeduntil they hit the cavity surface. Leap-frog scheme is used to solve the Lorenz forceequation for primary electrons. By repeating this process for a very large number ofelectrons, the multipacting trajectories are identified. The position, velocity, phase andkinetic energy of each primary electron at each time step is calculated and stored. Aninterpolation function is used to calculate secondary emission yield (SEY) at differentimpact energies. Several counter functions are defined and calculated for identifyingmultipacting field levels.The developed code is verified by using it to simulate multipaction in a TESLA cavity,and comparing with published results. The code is then applied to the 700 MHzsuperconducting cavity designed by BARC. The cavity is found to be multipacting–prone. The regions of the cavity from which multipacting electrons are likely to initiate,and the operating field-levels at which multipacting is expected are identified. The natureof multipacting (order and point) is also obtained. Further, in an attempt to point outpossible means of making the same cavity multipacting-free, the effect of wall coating isstudied. Multipacting analysis is repeated for the same cavity but with variousalternatives to baked Niobium, and a possible material suitable for multipaction cure isidentified.

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Title : *Compensation Of Delay In Networked Control System In Deregulated Automatic Generation Control*

Author(s) : *Kantamala*
Roll No : *Y5104026*
Supervisor(s) : *Singh Sri Niwas & Potluri Ramprasad*

Abstract

Deregulation in the power sector has raised several issues. Traditional methods forproviding communication and control need to be revised. One service that involvessuch traditional methods is Automatic Generation Control (AGC), which underderegulated scenario needs to include bilateral contracts between generation companiesand loads. For effective AGC operation, Networked Control System (NCS) approachmay be used. An NCS uses an open, distributed communication network to exchangevarious signals. There are only a few works that include the effects of informationdelay in the communication channel. The effects of this communication network delaywere not of particular concern as, in the vertical utility structure, all the generation, transmission and distribution is owned by a single entity; thus, signal was transferredusing dedicated links which did not have the problems, like delay, associated withNCS.In this thesis, the effect of constant delays on the performance of AGC is simulated, anda simple delay compensation method is used to counter the adverse effect of networkdelay. Results show the effectiveness of the proposed method to counter the effect ofdelay in the performance of AGC.

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Title : *FPGA Based Maximum Power Piont Tracking From Photovoltaic Systems Using Interleaved DC-DC Convertors*

Author(s) : *Pulavarthi Viswa Madan*

Roll No : *Y6104091*

Supervisor(s) : *Sensarma Partha sarathi & Behera Laxmidhar*

Abstract

Due to increased power demand and environmental concerns associated with it, thereis a growing interest in efficient distributed generation systems based on renewable energysource(RES)s. Solar photovoltaic(SPV) energy is one of the most promising RES becauseof its availability, absence of moving parts and pollution free nature. Power outputfrom photovoltaic array (PV) depends on solar insolation, temperature and the voltageat which it is operating. The PV array voltage has to be controlled in order to extractmaximum power from the array. This process of extracting maximum power from the PVarray by adjusting its terminal voltage is called maximum power point tracking (MPPT).It is achieved by connecting a dc-dc converter across its terminals. Keeping the outputvoltage of the dc-dc converter constant, its input voltage (i.e. PV array voltage) iscontrolled to extract maximum power from the PV array. In this thesis, a modularconfiguration of parallel connected dc-dc converters is employed. This configurationoffers high level of redundancy, reliability and allows increase of power rating in steps.In the present thesis, a photovoltaic power generation system is considered having aPV array connected to load through solar interface module(SIM). The SIM module consistsof parallel connected boost converters. A digital control approach is used to controlthe PV array voltage ensuring equal current sharing among the paralleled converters.For extracting maximum power perturb and observe(PO) algorithm and adaptive POalgorithms have been used. Analytical investigation of each of these algorithms havebeen presented.Simulation of the complete PV system has been done with the developed mathematicalmodels of PV array and SIM module under normal and disturbance conditionsin MATLAB/Simulink. Real time implementation of the proposed system is done ona laboratory prototype. The control mechanism and MPPT algorithms have been programmedin field programmable gate arrays(FPGA). Experimental results obtained arein conformity with the analytical formulations, there by verifying the robustness of thecontrol system.

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Title	***:***	***DesignAnd Development Of Embedded DSP-Based Controller For AVR Applications***
Author(s)	***:***	***Meesala Srinivasa Rao***
Roll No	***:***	***Y6104076***
Supervisor(s)	***:***	***Potluri Ramprasad& Behera Laxmidhar***

Abstract

Modern synchronous generator excitation systems are beginning to utilize the power,flexibility, and the cost advantage of digital electronics. These digital excitation systemstypically use one or more embedded DSP or microprocessor to perform the control functionsof the excitation system. These control functions include voltage regulation, fieldcurrent regulation, var or power factor control, power system stabilizers, and limiters.To perform all these control functions, complex algorithms are required to improve theoverall system efficiency. More often reduced manufacturing cost takes precedence overbetter efficiency. DSPs with their high computational power can provide reduced costand higher efficiency. Though the cost of a standalone DSP chip has reduced, its integrationto form a complete embedded product is an area often overlooked.This thesis presents the design and development of an embedded DSP-based controllerboard using TI's TMS320F2812 DSP integrated circuit (here after abbreviated asF2812) and Input/Output cards required to interface with external digital inputs andoutputs of the Automatic Voltage Regulator (AVR) system.In this thesis, the application code was programmed into the flash memory ofF2812 using serial communication interface (SCI) of F2812. The flash programming canbe done through either "SDFlash serial utility" or "C2oooProg utility".To test the working of the developed custom DSP board, few basic tests such astoggle test, ADC-DAC loopback test and RS-232 communication interface are performed.After confirming the working of the DSP board, few basic modules such as Phase LockedLoop (PLL), PI controller are implemented. These modules will be used in furtherdevelopment of the board. And also, a basic AVR system is implemented in the DSP bymodeling the exciter and generator as first order transfer functions and the results arecompared with MATLAB/Simulink.

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Title : *Design And Implementation Of Parallel Operation Of Inverters With Instaneous Current Sharing Scheme Using Multiloop Control Stratrgy On FPGA Platform*

Author(s) : *Shah Shahil*
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Supervisor(s) : *Sensarma Partha Sarathi*

Abstract

In these days of acute shortage of conventional energy resources, the harness ofrenewable energy has received considerable attention. In general, power obtained fromRenewable Energy Sources(RES) is not of the form which is directly deliverable to theAC load or the utility grid. Voltage Controlled Voltage Source Inverters (VCVSI) formsthe interface link which conditions power to the form deliverable to grid or load. Tomodularize the system, instead of a single inverter, the use of number of parallel invertersof reduced rating is proposed. The parallel operation of inverters in RES system o ersadvantages like reliability and redundancy in addition to the low maintenance cost ofa low power unit compared to that of high power unit. However there is a need ofcontrol strategy to strictly hold the amplitude, phase and frequency of output voltagesof inverters at the same values in order to avoid circulating currents through invertermodules and make them share load currents equally even during transients.In this thesis work a control scheme is proposed and implemented for paralleling ofthree phase inverters which enables the inverters to share load currents equally evenduring transients (instantaneous current sharing), and also track the sinusoidal voltagereference. This voltage reference is either free running or is derived from grid voltage soas to feed AC load or to synchronize the module with any utility grid. The design issuesfor designing of multiloop control structure are analyzed at length with the discussionof active damping to increase the damping and relative stability of system. Design ofouter current sharing controller has been done and its design intricacies are included inthe work.FPGAs can be used to control power electronic systems. They have advantages likehigh speed, parallel processing capability, and rich digital I/O interface. In this thesis,basic modules required for development of controllers for power electronic systems aredeveloped and tested with standard signals. The proposed control scheme for paralleloperation is implemented for two 3-phase inverters using this FPGA platform.

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Title : Experments With LonWorks Mini EVK
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Supervisor(s) : Potluri Ramprasad

Abstract

LonWorks is a popular control network platform (by "platform", we mean that this includes theprotocol, and the hardware and software resources needed to implement the network protocol)that has been promoted by Echelon Corporation, USA.Mini EVK is an evaluation kit that ismanufactured and sold by Echelon Corporation to help potential LonWorks customers evaluatethe LonWorks platform. This kit is significantly limited in capabilities when compared with theLonWorks platform.We perform the following in this thesis:1. We describe the components needed to build a LonWorks-based network. We present thesteps that we need to go through in order to build this network.2. We present a simple control network comprising four nodes built using two mini EVK kits.This network models a real-life larger-in scale temperature control sytem.3. We perform the closed-loop control of a permanent magnet DC motor using the FT3150Neuron processor board that came as part of the mini EVK kit.From the point of view of a beginner to the LonWorks platform, LonWorks users' forums on theWorld Wide Web contain few examples of working designs, and only a limited information onthe broad issues addressed in this thesis. Thus, this thesis' contributions may be useful to fill thisgap to some extent.

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Title : *Sensorless Maximum Power Point Tracking Control InWind Energy Generation Using Permanent MagnetSynchronou Generator*

Author(s) : *Srighakollapu NVS Kumar*
Roll No : *Y6104075*
Supervisor(s) : *Sensarma Partha Sarathi & Behera Laxmidhar*

Abstract

Wind energy generation is becoming more popular with the advent of advanced power electronic interface. This interface enables the extraction of maximum power efficiently and effectively from the available wind power.The main focus of this thesis is on control of active rectifier for maximum power extraction from wind power using permanent magnet synchronous generator(PMSG). This thesis presents fours different control strategies for variable speed wind energy conversion system (WECS). The generator is operated in the speed control mode below the base speed by controlling active rectifier feeding power to the DC bus. The thesis begins with the simulation of conventional vector control approach whose control reference depends on priori information of wind turbine parameters and its characteristics. This dependance is avoided using a basic well defined maximum power point tracking (MPPT) algorithm, Perturbation and Observation method. In this method the control reference is dynamically varied based on the direction of active power change.To apply MPPT algorithm in wind turbine generator system, the control parameter is either rotor speed, modulation index, or terminal voltage of generator. MPPT algorithm on rotor speed is similar to vector control approach with speed control loop forming outer loop in the control hierarchy.In this thesis two different MPPT techniques are proposed by applying MPPT algorithm on modulation index and MPPT algorithm on generator terminal voltage, used in WECS. The MPPT algorithm on modulation index obviates the measurement of wind speed, while MPPT on generator terminal voltage obviates the position sensor along with wind speed measurement. Thus the resulting systems has low cost and higher reliability.The effect of PWM converters on AC machines is also discussed. The use of LCL filter is observed to be advantages to avoid the effect of switching voltages. The control difficulties in LCL filter control are highlighted. An efficient lossless active damping technique was discussed. PO algorithm along with above mentioned effective and efficient techniques is applied on WECS to harness maximum power. The performance of the proposed control methods is validated through simulation results with various changes in wind velocity.An FPGA implementation of voltage control is discussed. Experimental results have shown the effectiveness of control with different disturbances.

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Title : CAN- Based DC Motor Netwoked Control System
Author(s) : Chaudhury Awadhesh Kumar
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Supervisor(s) : Potluri Ramprasda

Abstract

This thesis describes a networked control system (NCS) test bed that we built using theController Area Network (CAN) protocol, and studies the performance of this NCS. This NCSconsists of a serial link that connects three nodes: a DC-to-DC converter, an optical speedencoder, and a controller. The DC-to-DC converter feeds the armature of a permanent magnetDC motor, the encoder helps measure the speed of the shaft of this motor, and the controllerhelps control the shaft's speed. The NCS is essentially a feedback loop comprising these threeelements, in which the communication between these three nodes happens over the serial link.

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Title : *FPGA Based Parallel OperationOf DC-DC Convertors For Renewable Energy Applications*

Author(s) : *Sabarish K*
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Supervisor(s) : *Sensarma Partha Sarathi*

Abstract

With the rapid growth of industries and accelerated depletion of fossil fuels, the focus hasshifted to naturally occurring and abundantly available renewable energy sources (RES).RES like wind energy, solar energy, biomass energy etc., are abundantly available butare highly intermittent. Power electronic converters play a pivotal role in harnessing thepower from these RES and processing it into an utility friendly form. DC-DC convertersare widely used in renewable energy systems like Distributed Generation (DG), in placeswhere it is required to harness and process power from DC sources like solar cells, fuelcells or battery banks. Energy storage media is inevitable in renewable energy systemslike distributed generation (DG), due to the highly intermittent nature of the RES.Battery banks are the most popular ones due to their low cost and simplicity.In this thesis, a bi-directional battery interface module (BIM) has been proposed.The proposed BIM is inherently modular, as it incorporates three parallel connectedDC-DC converters. The BIM is capable of charging the battery bank in buck mode anddischarging the same in the boost-mode. In the discharge mode the control objective isto regulate the output voltage to a fixed DC value irrespective of load changes. In thecharge mode the objective is to charge the battery bank in different regimes viz.,constantcurrent charging and constant voltage charging. A control scheme has been proposed forparalleling the three converters, enabling them to share the load current equally evenduring transients, in both modes of operation. However the scheme can be extendedto any 'N' number of parallel connected converters. A two loop control structure hasbeen adopted. Digital current programmed mode control technique has been used forreal-time implementation.FPGAs are widely being used in for the control of power electronic converters. Theyoffer a number of advantages like parallel processing, high speed and are rich in digitalI/O. In this thesis, basic modules required for development of controllers for powerelectronic systems are developed and tested with standard signals. The complete analysisof the system starting from plant modeling, choice of control strategy and design ofthe controllers have been presented. The validity of the proposed control strategy isconfirmed through both computer simulation and real-time implementation.

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Title : ***DC Bus Voltage Build Up And Control InAStand Alone Wind EnergyGenerationSystemBySquirrel-Cage Induction Machine***

Author(s) : ***Hazra Sameer***

Roll No : ***Y6104068***

Supervisor(s) : ***Sensarma Partha Sarathi***

Abstract

In the present scenario, where the consumption of energy is increasing day by day, it has been extremely difficult to cater the energy demand only from fossil fuels such as coal, oil and gas. In this situation of energy crisis, renewable energy resources like wind, solar, hydro, biomass etc. are becoming very important. Energy conversion from wind is possible by squirrel-cage induction machine (SCIM), slip ring induction machine (SRIM) and permanent magnet synchronous machine (PMSM). SCIM is the cheapest, robust and low maintenance machine among all of these machines. Especially in isolated systems, low maintenance requirement and robustness make induction machine an obvious choice for energy conversion from wind. SCIM receives the reactive power for flux build up, from the same source with which it exchanges active power. In grid connected systems, the machine can start voltage build up and power generation by taking reactive power from the utility grid itself. In an isolated case, where the SCIM is the only energy source, starting of the machine becomes a major concern. Connecting three phase capacitor bank and utilizing the machine remnant magnetism is one way to start the voltage build up. External energy source like battery with an inverter also helps in starting the system.In the present work, an approach of voltage build up with minimum additional hardware usage has been presented. The voltage build up in the induction machine has been analyzed with a small initial voltage in DC bus of the power converter without using any capacitor bank at the machine terminals or any battery at the DC bus. The voltage build up has been analyzed with both scaler (V/f) and vector control of induction generator with a ramp voltage reference of defined slope. After build up, the DC bus voltage is controlled at a set reference value at different load and turbine speed.In vector control of SEIG, the reference flux linkage is kept constant, which allows the terminal voltage to increase with wind speed and hence increases the power extraction at higher wind speed. The overall system modeling and the controller design have been presented with relevant simulation results. The whole system has been implemented in a low power hardware system using a 16-bit Fixed-point DSP as a control implementation platform.

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Title : Obstacle Avoidance Strategies For Mobile Robot Navigation
Author(s) : GuptaMeenakshi
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Supervisor(s) : Potluri Ramprasad

Abstract

Obstacle avoidance is an essential ingredient of any motion planning algorithm employedfor mobile robot navigation in an unstructured environment. This thesis primarilydeals with obstacle avoidance schemes based on sonar and vision sensors. Thecontributions of this thesis may be enumerated as follows:• The performance of CAMShift algorithm is improved by using a moving-averagepredictor, thereby enabling it to detect fast moving targets. CAMShift algorithmis used extensively for detecting moving targets.• A vision based obstacle avoidance scheme is proposed where the obstacle is separatedfrom its background environment using image segmentation, and its distancefrom the mobile robot is obtained using a fuzzy module. The scheme is implementedon-line to avoid static obstacles.• A sonar based obstacle avoidance scheme is proposed where the nonlinear relationshipbetween sonar readings and the obstacle direction with respect to robotframe is learnt using a feedforward neural network. The network is trained off-lineusing approximate models and then implemented in real-time to avoid dynamicobstacles.• Finally a simplified sensor-integration strategy is suggested to overcome the limitationsof schemes using either sonar or vision sensors alone.

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Title : ***Visual Motor Coordination Of A Redundent Robotic Manipulator***

Author(s) : ***Patel Naman R***

Roll No : ***Y6104051***

Supervisor(s) : ***Behera Laxmidhar & Potluri Ramprasad***

Abstract

This thesis primarily deals with visual motor coordination of a 7DOF redundant robotmanipulator. Visual motor coordination is the act of guiding a robot manipulator using visualfeedback. This necessitates solving inverse kinematic relationship and extracting endeffectorposition information from a pair of fixed cameras mounted on the workspace.A 3-dimensional Kohonen Self-Organizing Map (KSOM) is used to discretize input andoutput spaces and linear inverse kinematic relationships are learnt locally between eachinput-output pair of cells. Real time implementation is shown on 7DOF Powercube robot.Finally we show that it is possible to carry out an image based visual servoing using theapproximated local inverse Jacobian matrices from KSOM learning. This is the first time ithas been shown that KSOM based technique can be used to solve inverse kinematic problemat velocity level.Simulation and experimental results are provided to establish the usefulness of proposedalgorithms.

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Title : *DSP Implementation Of Adaptive Active Noise Control Headset Using Neural Networks*

Author(s) : *Veeravasantarao D*
Roll No : *Y6104087*
Supervisor(s) : *Behera Laxmidhar & Potluri Ramprasad*

Abstract

This thesis is concerned with Active Noise Control (ANC) system on headset applications. ANCis a technique of acoustic noise reduction by producing “anti-noise”signal using secondary source.Anti-noise signal is equal in magnitude and opposite phase with noise signal. With superpositionprinciple, this signal destructively interfere with primary noise and thereby noise reduction occurs.ANC effectively attenuates noise signals at low frequencies less than 600Hz where passive controldevices like mufflers, silencers and absorbers bulky and ineffective. The designed ANC system issuitable for reducing low frequency periodic noise like that from an engine or pump.The secondary path effects due to the acoustic environment of the system are incorporated intoANC system. The secondary path modeling is done using Least Mean Squares (LMS) algorithm.Chirp signal is used for secondarypath modeling.Adaptive Narrowband Feedaback ANC system for headset applications is the main problem addressedin this thesis. This system contains a single error microphone and a single headphone with acontroller. The controller generates anti-noise signal by using adaptive algorithm. The adaptive algorithmused is Filtered-X Least Mean Square (FxLMS) algorithm. The algorithm verification is doneby simulating realtime data on C platform. Realtime implementation is done using TMS320C6713DSP Starter Kit (DSK). Single tone, two tone and three tone signals are used as noise signals. FIR,IIR filters and Adaptive Linear Neuron (ADALINE) based filter design have been carried out for noisefilter. The noise reduction levels for a two tone noise signal using FIR, IIR and ADALINE are 40.42dB, 34.52dB and 43.47dB respectively. The number of parameters are updated in case of FIR, IIRand ADALINE are 60, 36 and 32 respectively. The ADALINE based nonlinear filter perform goodnoise reduction with less parameters than the remaining two.Two models for spiking neural networks (SNN) are proposed. The first model has a structuresimilar to MLP but the information coding is done in terms of spikes. Steepest gradient descent algorithm is used for learning the weights. Function approximation, time series prediction problemsand XOR realization are done using this model. It is observed that this model is capable of performingvery effectively than MLP. The second model is a modification of first model in which probabilisticspiking is incorporated. Simulation results on various problems carried out using this network andare compared with MLP.A new algorithm Synaptic Weight Association Training (SWAT) is proposed for spiking neuralnetwork. This is combination of Bienenstock-Cooper-Munro (BCM) learning rule with Spike TimingDependent Plasticity (STDP). The BCM rule is used to update the height of the plasticity window,associated with STDP. The SNN topology uses a single training neuron in the training phase whereall classes are passed to this neuron and the weights are subsequently mapped to the classifyingoutput neurons. The training algorithm also includes both excitory and inhibitory facilitating dynamicsynapses that create a frequency passband filter. IRIS data classification problem is done by using

thislearning method and the results are compared with standard backpropogation algorithm. The conceptof probabilistic spiking is introduced in this network and the same problem is simulated using thismodel.Noise filter is designed by using single spike SNN model but due to computational overloadrealtime implementation is not realizable. Simulation results are given and compared with FIR filterdesign. The simulation results show that good noise reduction is occurred in SNN based filter thanFIR filter. Secondary path modeling also done by using SNN. The simulation results only producedand compared with FIR filter. The nonlinearities caused by actuator are reduced in case of SNN thanFIR filter.

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Title	***:***	***Some Investigations Of AUtility Friendly Three- Level Inverter Fed High Performance Induction Motor Drive System***
Author(s)	***:***	***Pamulaparti Siva Nagi Reddy***
Roll No	***:***	***Y6104074***
Supervisor(s)	***:***	***Das Shyam Prasad***

Abstract

‘Direct Torque and Flux Control’ (DTFC) is an advanced control strategy foradjustable speed induction motor (IM) drives. It has been developed on the space vectorapproach, where the torque and flux of an induction motor can be controlled directly andindependently, without any co-ordinate transformation. In the DTFC, the motor torque andthe flux are calculated from the primary variables and they are controlled by selectingoptimum switching modes of the inverter. This selection is made so as to restrict the errors offlux and torque within the desired hysteresis bands. This control results in quick torqueresponse in the transient operation and improvement in the steady state efficiency. AlthoughDTFC has been widely applied to IM drives in medium power applications with two levelinverters; the applications in high power drives employing multilevel inverters have beenlimited to industrial drives such as traction and electric locomotives. For variable speed IMdrives used in industrial and traction applications, the font-end ac-dc converters should beutility friendly drawing sinusoidal currents at unity power factor in addition to havingregeneration capability.In this thesis, some simulated and experimental investigation of the DTFC for a threephase induction motor fed from a three phase three level inverter are presented. A three phasethree level Synchronous Link Converter (SLC) is used as the front-end converter. An analoghysteresis controller is developed in hardware, which controls the SLC such that it drawssinusoidal current from the supply and maintains unity power factor in the input side. TheSLC has the capability of bidirectional power flow. Hence the drive is utility friendly and iscapable of four quadrant operation. The SLC is also simulated using an adaptive hysteresiscontroller in MATLAB® SIMULINK. Simulation results are compared with typicalexperimental results.

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Title : ***An Improved Communication Strategy Of Matrix Converter For Sychronous Motor Drive***

Author(s) : ***Kulkarni Prasad***
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Supervisor(s) : ***Das Shyama Prasad& Potluri Ramprasad***

Abstract

Matrix Converter is a direct ac-to-ac power converter, which changes a fixed ac tovariable ac (Voltage magnitude and frequency). This is achieved without any dc link, andhence, the converter design is compact. In this thesis, two modulating schemes for matrixconverter viz., Venturini algorithm, and Space Vector Modulation are simulated.The main problem in such a converter when being implemented in hardware is thecommutation. This is so because the switches are four quadrant, and there is no fixed dclink. Traditional commutation schemes like four step current based and voltage basedcommutation are studied. A simple commutation scheme based on input phase voltages isdeveloped. It is simulated in software, and, its feasibility is confirmed. Then, it isimplemented in hardware. As a test for the commutation scheme, an induction motor isdriven by the matrix converter with the proposed commutation scheme.Subsequently, a synchronous motor (SM) is fed from the matrix converter. Twocontrol schemes for matrix converter fed SM drive, namely, Self Synchronous controland Vector control (in rotor reference frame) are simulated.A modified constant V/f control for self controlled SM is proposed so as to obtainunity motor power factor at higher speeds. It is desired to maintain the flux constantbelow base speeds. A four quadrant chopper for field winding is operated in currentcontrol mode, which helps in operating the synchronous motor in closed loop.

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Title : ***Audio Based Conditioning Monitoring And Fault Diagnosis Of Internal Combustion Engines***

Author(s) : ***Shriram Lakshminarasimhan***
Roll No : ***Y6104041***
Supervisor(s) : ***Kalra Prem Kumar***

Abstract

Every object in this little world produces sound. The only question which we needto answer is whether we want to listen to it and whether it contains any relevantinformation. Audio based condition monitoring of systems precisely tries to handle thequestions and in the process extracts the relevant information from the audio data toidentify the health of the system.In one of the leading automobile industry condition monitoring of engines isdone by a group of skilled technicians who by merely listening to the sound produced bythe engine certify whether the engine is good or bad, primarily owing to their excellentsensory network and cognitive capabilities. It would indeed be a challenging task tomimic the capabilities of those individuals in a machine.In the condition monitoring set up developed, the sound emanated from theengine is first captured and recorded. Subsequently the audio data is transformed into adomain where distinct patterns corresponding to the faults being investigated are visible.Using the pattern information available a novel feature extraction and clustering processwas developed to group the data into various categories based on the severity of eachfault.In the final stage a pattern matching approach using Hidden Markovs Model(HMM) was implemented to classify the engines into good and defective categories. Theresult of clustering and operators opinion regarding the status of each engine recordingwas combined to pick exemplars for training models. The entire process of acquisition ofdata and analysis of data was integrated for real time application. Results obtained aresatisfactory.

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Title : ICA Based Fault Diagnosis Of Reciprocating Compressor
Author(s) : Bhukya Chimbar Rao
Roll No : Y6104021
Supervisor(s) : Kalra Prem Kumar

Abstract

Condition monitoring of a rotating machine is required in order toearly detect the incipient faults. Early detection of the faults will make thesystem not to incur permanent damage, to its wear and tear. The conditionmonitoring of the reciprocating compressor in this thesis has been taken asthe subject. The parameters such as vibrations and acoustic emissions weretaken in order to understand the dynamics of the faults from a reciprocatingcompressor.Traditionally, human perception were required in order to detect anyfault with the rotating machine. But, human's perception is limited in manyways in order to judge whether system is running under mal operation.In order to minimize or reduce the human labor and error, there needsan automated system which can be helpful in condition monitoring of themachines. This basic, need lead to find a solution with the help of existingANN techniques, in detecting the health condition of reciprocatingcompressor.The above said parameters from the compressor were read andunderstood that they contain uniqueness in their pattern pertaining to eachfault category. Those patterns were obtained by ICA statistical technique, and in order to train the ANN and maintain a standard database Backpropagation algorithm has been introduced to this concept of conditionmonitoring. The thesis has begun at first presuming that each fault maypossess different pattern, which at last has been confirmed in practical.

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Title **:** ***Conditioning Monitoring And Fault Diagnosis Of Mono-Block Pumps Using Acoustic Signatures***

Author(s) **:** ***Awasthy Prakash***
Roll No **:** ***Y6104058***
Supervisor(s) **:** ***Kalra Prem Kumar***

Abstract

Condition monitoring and fault diagnosis of monoblock pump is done usingacoustic signatures and the results are confirmed with vibration data results. As afirst step faults are seeded in the pumps forcefully and fault data is collected usingexperimental setup consisting of sensor network and data acquisition hardware andsoftware. The collected data is represented in different time, frequency and timefrequencydomains. FFT, Spectrograms and Cochleagram plots of the signal areanalyzed for labeling of faults. Based on the labeling information the features areselected from the data. The extracted features are passed to the clustering (FCM)and classification (RBF) algorithms. Final classification is done using fuzzy rulebased sytem. Results for different features and different microphone positions areevaluated and compared with results obtained through vibration data.

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Title	***:***	***Mean Shift Algorithm Based Approaches For Blackboard And Text Detection In Lecture Video And Superimposed-Text Recognition***
Author(s)	***:***	***Chippa Sunil Kumar***
Roll No	***:***	***Y6104081***
Supervisor(s)	***:***	***Kalra Prem Kumar***

Abstract

The work in this thesis concentrates on the detection of text in digital media images/ videos in different environments. The environments include the e-classroom learningvideo, subtitles in movies, real life images which contain scene text.The mean shift algorithm is used for basic processing i.e. segmenting the image /video frames. The challenges posed for the text detection in e-classroom such as the nonuniformdistribution of the chalk powder on the board regions even after its cleaning, theluminance effect on the board which is a result of the change in light have been effectivelydealt in the work and further a text detection module for blackboard and written text in eclassroomlearning environment is presented in this thesis.In various real life situations it is required to extract the text present in the image /video frame that can be categorized as superimposed text or embedded text. An applicationis also presented in this thesis for text extraction in this situation also. Another applicationfor OCR based text recognition system is also presented in the thesis.All the application presented in this thesis are tested for several diverse cases andfound giving satisfactory results.

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Title : *Application Of Couterpropagation Neural Networks ForFace Detection In Classroom Environment And Standard Face Database*

Author(s) : *Singamsetti Venkata Nagendra Sathiraj*
Roll No : *Y6104088*
Supervisor(s) : *Kalra Prem Kumar*

Abstract

In this thesis, a Face Detection Model is designed using Counterpropagationnetwork to recognize the faces in e-classroom applications. At first, theCounterpropagation network algorithm is tested for segmenting the color images. To usethis algorithm for Face Detection we introduced some variants in the Counterpropagationnetwork algorithm and tested them on standard face databases. An algorithm is developedbased on the segmentation in HSV domain using Counterpropagation network to achievethe objective of Face detection in the Face detection model. Two problems associated withthe CPN are weight initialization and neuron number initialization. The first problem,weight initialization effects the network training and second problem, neuron initializationrelates to the neuron underutilization or lack of required number of neurons. The firstproblem of weight initialization is addressed with the help of Entropy initializationalgorithm and the second problem is addressed with the help of splitting algorithms. Usingthe standard Face databases, the designed models with Counterpropagation networkvariants are tested.

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Title : *Recursive DFT And Kalman Filter Applications For Fast And Robust Detection And Estimation Of Harmonics And Voltage Variations*

Author(s) : *Varshney Chirag*
Roll No : *Y6104022*
Supervisor(s) : *Singh Sri Niwas*

Abstract

The widespread application of electronically controlled loads has increased the harmonicdistortion of voltage and current waveforms. Harmonic pollution is regarded as one of themajor problems that degrade electric power quality. Traditional harmonic analysisapproaches such as DFT (Discrete Fourier Transform) and FFT (Fast Fourier Transform)algorithms are steady-state concepts and usually have a slow response because of the timedelay caused by the computational complexity. However, the Recursive Discrete FourierTransform can renew the spectrum values immediately after input of a new datum. Thus therecursive DFT is more suitable for real-time implementation than DFT and FFT, whichrenew the spectrum only at every N sampling point. The accuracy of recursive DFT isaffected by the variation of supply frequency as compared to conventional instantaneousreactive power method. But new detection method is proposed to obtain accurate harmoniccontent by compensating error due to frequency deviations. This method has dead time inaccurate detection of fundamental which is reduced by applying recursive DFT on smallerwindow length. But proposed recursive method can be used for fundamental only. Kalmanfilter allows an optimal estimate of real-time signal parameters. Unlike harmonic detectionmethod using instantaneous reactive power method, Kalman filter can be used to detectspecific harmonic components. Moreover, its application is not limited to three phasesystems and its accuracy is not affected by the system unbalance. In this thesis fundamentalextraction is done by recursive DFT and harmonic estimation is done by Kalman filteringtechnique. Finally both techniques are used for detection and estimation of voltage variationand results are compared against most commonly used RMS method.

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Title	***:***	***An Efficient Cocentric- Circular Mapping Of CBCR Color Components (YCBCR Domain) For Data Compression***
Author(s)	***:***	***Annadanam Sameer Kumar Sarma***
Roll No	***:***	***Y6104001***
Supervisor(s)	***:***	***Kalar Prem Kumar***

Abstract

The use of images and video for online learning system has been one of the important applications and results in the development of E-class room learning environments. The main aim of the system is to transmit the data for which good quality and faithful reconstruction is possible but the same time the level of compression should be high enough to be used for different transmission bandwidths. The most important feature of multimedia is color information. There is a necessity for a batter representation of Color data so that this will reduce the data to be transmitted. For this purpose we have devised method termed as Concentric Circular Mapping which gives 1-D representation of 2-DCbCr data..The two ideas that are at the core of this work are 2-D representation of the data by Concentric Circular Mapping (CCM) and its application to image sequences resulting in reduction of data to be transmitted. The advantages of these methods are the high compression ratio and quality of reconstructed image data. The method gives compression ratio as high as 750 across Cb and Cr components only. A perceptual quality based measure called as Structural Similarity Index is demonstrated for the reference frame selection from among a group of frames in a video sequence. Since this measure accounts for the content in video frame, it gives satisfactory results for selection of reference frame intuitively, as to which frame should contain maximum visual information from among the group of frames. The work is tested for several diverse kind of video including standard video, classroom video and it is found that the work gives satisfactory results.

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Title : *Dynamic Performance Evalution Of Unified DFI Architecture For Wind Power Generation*

Author(s) : *Vundekari Emmoji*

Roll No : *Y6104028*

Supervisor(s) : *Singh Sri Niwas*

Abstract

Wind power is a popular form of the renewable energy sources and has beenproved as potential source for electricity generation with minimal environmental effects.Modern wind farms can produce a sustainable amount of power, which can supplementthe base power generated by thermal, nuclear, or hydro power plants, when they areintegrated into the grid. Any loss of wind generation leads to severe stability problemsand possibly cascade outage may take place. To integrate these large wind farms into thegrid, the performance of the grid connected wind farms is required, in both steady stateand transient conditions. Most of the modern large wind power plants utilize doubly fedinduction generators.The present work utilizes the sixth order mathematical model of grid connecteddoubly fed induction generator and conventional decoupled vector control techniqueshave been used for the controller designs. The response of the doubly fed inductiongenerator wind turbine system to grid disturbances is simulated. Small signal studies havebeen presented on the considered system, in order to identify and quantify the cause ofproblem. Simulation results show that, the conventional doubly fed induction generatorsuffers from poor regulating characteristics during abnormal conditions.Further, modifications to conventional architecture and controllers have beenproposed to improve the performance. Voltage sag ride-through capabilities and smallsignal studies of the proposed wind turbine architectures have been investigated throughsimulations. It is observed that the proposed modifications to the architecture andcontrollers, give better performance than the conventional architecture in terms ofdamping.

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Title : *Classifications Of Piwer Quality Events Using Support Vector Machine*

Author(s) : *Gupta Robin*
Roll No : *Y6104065*
Supervisor(s) : *Singh Sri Niwas*

Abstract

The classification of disturbances of power system is the important task in theautomatic power quality assessment system. The thesis work mainly deals withclassification of power quality disturbances based on wavelet multiresolution analysis(MRA) and support vector machines (SVMs). After multiresolution analysis, signaldecomposition of power quality disturbances, characteristic vectors can be obtained.Short time power transform (STPT) is also used to supplement the characteristic vectorsfrom MRA. Support vector machines are used to classify these characteristic vectors ofpower quality disturbances. The performance of three approaches of solving multiclassproblem using binary classifier, one against one, one against all and DSVM arecompared. The training of all SVMs is done on MATLAB tool box and testing ofapproach is done on TMS320C6713 DSK actual cycle simulator.

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Title : *Parallel Operation Of ASynchronous Generator And A Doubly Fed Induction Generator In Micro Grid*

Author(s) : *Shankar Balla N S S*
Roll No : *Y6104017*
Supervisor(s) : *Srivastava S C*

Abstract

Renewable energy sources are being increasingly used as distributedgenerators (DGs) for the electrification of rural and remote areas. These distributedgenerators form a micro grid and supply power to the local consumers. Micro/minihydro power and wind power plants are the two of the popular forms of the renewableenergy sources, being installed in several countries.Micro/mini hydro power plants utilize synchronous generators (SG), whereas,modern wind power plants utilize doubly fed induction generators (DFIG). To integratemicro hydro turbine driven SG in micro/mini hydro power plants and wind turbinedriven DFIG in wind power plants, the study of parallel operation of a synchronousgenerator and a doubly fed induction generator is required. Proper control scheme needsto be adopted for their satisfactory parallel operation.This thesis has utilized the conventional voltage and frequency controlmethods for the synchronous generator and a stator flux oriented vector controltechnique for the doubly fed induction generator. Conventional Proportional Integral(PI) controllers have been designed to study some of the key issues in the paralleloperation of the SG and the DFIG, these include voltage and frequency control, properload sharing between the generators and unity power factor operation of DFIG.Simulation results for different step load change and fault conditions show that, with thePI controllers, unity power factor operation of the DFIG is not ensured. However, itprovides satisfactory voltage and frequency control.Further, Adaptive Neuro Fuzzy Inference System (ANFIS) based controllershave been proposed to overcome the problems faced with the PI controllers. The relativeperformance of the PI and the ANFIS controllers have been studied on a small microgird under three different loading conditions and sudden switching of the loads. It isobserved that the ANFIS controllers ensure unity power factor operation of DFIG andresults into better transient response than the conventional PI controllers in terms of thesettling time and transient variations

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Title : ***Optimal Placement Of TCSC For Congestion Management And Congestion Cost Allocation***

Author(s) : ***Pudi Srinivasa Rao***
Roll No : ***Y6104077***
Supervisor(s) : ***Srivastava S C***

Abstract

Maintaining system security is one of the major challenges faced by the systemoperators (SO) in the emerging electricity markets. The competition in the market causesincrease in the volume of electricity trade, which leads to an unexpected amount of powerflow through some transmission corridors and, thus, causes congestion in thetransmission system. One of the popular approaches to manage the congestion by the SOis rescheduling of generations from their contracted values utilizing security constrainedoptimal power flow (OPF). Relieving congestion results in certain congestion cost, whichneeds to be paid to the generators and is required to be recovered from customers, thosecausing the congestion, in some fair manner.This thesis has mainly addressed the issue of congestion management utilizingThyristor Controlled Series Capacitor (TCSC), one of the series FACTS controllers, andthe congestion cost allocation. A sensitivity factor based approach has been proposed forthe optimal placement of the TCSC to minimize the congestion cost. The sensitivity ofthe congested line flow with respect to flow in other lines has been used for theplacement of TCSC. A security constrained OPF scheme has been used for thecongestion management.To apportion the cost incurred in mitigating the congestion, two methods havebeen proposed. In one method, complex topological load distribution factors have beenutilized to find the MVA contribution of loads in the congested line flow. In the othermethod, transmission congestion distribution factors (TCDFs) have been derived usingsensitivity property of the Newton Raphson Load Flow (NRLF) Jacobian. The TCDFshave been utilized to define Congestion Cost Allocation Factor (CCAF) for each of theloads, which have been utilized for congestion cost allocation.The proposed methods of congestion management and congestion cost allocationhave been implemented on IEEE 30-bus and Indian 75-bus systems. The study resultsshow that the optimal placement of TCSC, based on the proposed sensitivity basedmethod, results in significant reduction in the congestion cost. The congestion costallocation using TCDFs based method is fairer than the cost allocation based onMVA flow tracing approach

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Title : *Frequency Domain Analysis Using Antenna And Spectrum Analyzer For The Measurement Of Partial Breakdown Activity produced By AC And DC Voltages*

Author(s) : *Garg Sachin*
Roll No : *Y3167305*
Supervisor(s) : *Arora Ravindra*

Abstract

Stable Partial Breakdown (PB) also widely known as Partial Discharge (PD) occurs in gaseous and solid dielectrics in the power system under extremely non-uniform field conditions. Atmospheric air is the most important, freely available, cheapest and most widely used gaseous dielectric. The behaviour of air, when subjected to electric stress, is an important aspect for insulation system design in High Voltage Engineering. Stable Partial Breakdown occurring in atmospheric air (also known as corona) at high voltage lines and transformers leads to EMI, power loss, generation of harmful gases and degradation of insulation properties. Therefore, it is extremely important to detect and identify PB sources using detection processes. In this work, the detection and measurement of PB using the electromagnetic noise measurement (widely known as EMI detection technique) was investigated. With this objective, a wired bi-conical antenna was designed for the frequency range 30 to 300 MHz to receive electromagnetic spectrum on spectrum analyzer. To simulate various probable PB sources five different electrode configurations have been examined with ac, positive and negative dc voltages. The partial breakdown activity in these configurations constituted glow (needle-needle, needle-plane and plane-needle), streamer (rod-plane) and leader corona (needle-glass-plane) when different types of voltages were applied. PB gives rise to electric pulses in the system having magnitude (q). Calculations have been made to relate power spectrum levels in various frequency ranges to charge injection due to PB in dielectric.

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Title	***:***	***Experimental Investigations On Breakdown Voltage OfAirFor Different Electrode Configurations Under WeaklyAnd Extremely Nonuniform Electric Field ConditionsWith HighVoltage DC***
Author(s)	***:***	***Mehndiratta Vikram***
Roll No	***:***	***Y6104090***
Supervisor(s)	***:***	***Arora Ravindra***

Abstract

Atmospheric air is the most important, freely available, cheapest andmost widely used gaseous dielectric. The behaviour of air, when subjected toelectric stress, is an important aspect for insulation system design in HighVoltage Engineering. The knowledge of maximum field intensity in theelectrode system of an equipment and maximum permissible electric stresswhich air as a dielectric can withstand provides a reliable and durableinsulation system. Therefore, it is desirable to investigate the breakdownstrength of atmospheric air as a dielectric when subjected to electric stressunder different conditions.In this work, the variation of breakdown strength of air isinvestigated in weakly nonuniform and extremely nonuniform fieldconditions, when subjected to positive and negative polarity dc voltages.With this objective, various electrode configurations of different dimensionshave been examined with either polarity dc voltages, changing gap distancesbetween the electrodes. The electric field to which air was subjected varyiedfrom weakly nonuniform to extremely nonuniform in these experiments.Eleven different sets of electrodes of dissimilar dimensions/shapes werechosen for investigation. The effect of polarity on the breakdown strength ofair has been investigated. Calculations have been made to determine themaximum and average field intensities and the Schwaiger factor to whichthe air was subjected. FEMLAB 2.3 Software package has been used tosimulate different electrode configurations. It is a finite element modelingand solver software package for various physics and engineeringapplications. FEMLAB also offers a smooth interface to MATLAB and itstoolboxes for a large variety of preprocessing and post processingpossibilities.

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Title	***:***	***Partial Breakdown Recognition And Pattern Analtsis For Air Epoxy And Ceramic Dielectrics***
Author(s)	***:***	***GoyalManoj Kumar***
Roll No	***:***	***Y6104046***
Supervisor(s)	***:***	***Arora Ravindra***

Abstract

Partial Breakdown (PB) also widely known as Partial Discharge (PD) is a localelectric breakdown that does not completely bridge the insulation between theelectrodes. It gives rise to electric pulses having magnitude (q) and phase (Φ) withrespect to the applied voltage waveform. It has well known that the failure ofinsulation of electric equipments is often due to the occurrence of partialbreakdown within or on the surface of the insulation. Therefore, if partialbreakdown is found to occur in any insulation system, it is an important step in thedetection process is to get the exact finger prints which could identify the differentpartial breakdown sources successfully.Partial breakdown cause progressive deterioration of insulating materials workingunder the high voltage conditions and may lead to ultimately insulator failure.Experimental findings indicate that deterioration increases with the number ofbreakdowns and is consequently proportional to the magnitude and frequency ofthe applied voltage. In order to obtain the better understanding the mechanism ofdeterioration produced by partial breakdowns, instrumentation capable ofindividual pulse resolution is required. A new computer based partial breakdowndetection system was designed in this work. This system is capable of recordinglarge number of partial breakdown pulses without dead time and producingvaluable information related to amplitude, polarity and the current pulsesmagnitude due to PB. Different electrodes system, epoxy resin and ceramicinsulators were investigated at high voltage for long duration tests.

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Title	***:***	***Design Of Simulator To Improve The QOS Of Optical Burst Switching Network By New Contention Resolution Scheme***
Author(s)	***:***	***Verma Umesh***
Roll No	***:***	***Y6104084***
Supervisor(s)	***:***	***Singh Yatindra Nath***

Abstract

Optical burst switching (OBS) is a technology positioned between wavelength routing and optical packet switching that does not require optical buffering or packet-level switching, and it is more efficient than circuit switching when the present traffic volume does not consume a full bandwidth or resource. However, several critical issues still need to be solved such as contention resolution without optical buffering which is a key factor of burst loss with a significant impact on network performance.Deflection routing is an approach for resolving contention by routing a contending burst to an output port other than the intended output port. In OBS networks, when contention between two bursts cannot be resolved through deflection routing, one of the bursts will be dropped. However, this scheme doesn't take advantage of all the available resources in network to resolve contentions. Due to this, the performance of existing deflection routing scheme is not satisfactory.In this thesis, we propose and evaluate new strategy, which aim at resolving contention.We propose a new approach called Backtrack on Deflection Failure, which provides a second chance to blocked bursts when deflection failure occurs. The bursts in this scheme, when blocked, will get an opportunity to backtrack to the previous node and may get routed through any deflection route available at the previous node. To compensate the reduction in offset due to handling of backtrack we proposed Increase in Initial Offset as per network diameter.The performance of our schemes that proposed in this literature is studied through simulation. The parameters considered in evaluating these schemes are burst blocking probability, permitted backtracking, requirement of initial offset and overall link utilization. The results obtained show that our scheme perform significantly better than previous.

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Title **:** ***New Families Of ISI – Free Nyquist Pulses Using Wavelets***
Author(s) **:** ***Kumar Babloo***
Roll No **:** ***Y6104015***
Supervisor(s) **:** ***Chaturvedi Ajit Kumar***

Abstract

In digital commutations, pulse shaping plays an important role in determining thebandwidth requirement and reducing intersymbol interference (ISI). In this thesis, weintroduce a few families of ISI-free Nyquist pulses using wavelets. A novel family ofISI free pulses is proposed using Meyer wavelet which yields an enhanced performancein terms of ISI error probability, in the presence of timing error, as compared to thecurrently known pulses, like Raised Cosine Pulse (RCP) and Better Than Raised Cosine(BTRC) pulse. A family of Nyquist pulses is designed using Battle-Lemarie waveletwhich exhibits better spectral properties than RCP and IS95 pulse. However, theyare not finitely supported in time domain. Truncated versions of these pulses canimprove upon IS95 pulse in terms of 40 dB bandwidth, but they have larger stopbandripples. The equivalence of Nyquist criterion for ISI free pulses and orthogonality ofwavelets is established and then, the rich literature on orthogonal and biorthogonalwavelets is used to design ISI free Nyquist pulses. Time limited ISI free pulses aredesigned using Daubechies wavelets and Spline biorthogonal wavelets. It is shown thatconstruction of biorthogonal wavelets can be used as a method of factorizing a Nyquistfilter into transmit and receive filters. Using well known algorithms FIR filters havebeen designed which have smaller 40dB bandwidth and/or higher sideband attenuationthan IS95 pulse. However, time support of the obtained filters is larger than that ofIS95 pulse.

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Title : ***Use Of Variance Normalization For Redusing Speaker Variability In ASR Systems***

Author(s) : ***Waldekar Shefali***
Roll No : ***Y6104072***
Supervisor(s) : ***Umesh Srinivasan***

Abstract

Inter-speaker variability is a major cause of degradation in performance of speaker-independent (SI) Automatic Speech Recognition (ASR) systems, as compared to thespeaker-dependent (SD) ASR systems. The acoustics of the speech signal vary con-siderably across (inter-)speakers even for the same spoken utterance. Inter-speakervariability is mainly attributed to the differences in speakers' anatomy and especiallydue to the variations in their Vocal Tract (VT) geometry. Compensating for this vari-ability by estimating the speaker invariant features is called Speaker Normalization (SN).Vocal Tract Length Normalization (VTLN) is a commonly used Speaker Normal-ization technique in many present day state-of-art Speech Recognition systems and iscomputationally efficient, as only a single parameter needs to be estimated.VTLN is based on the idea of warping the frequency spectrum in order to achievespeaker normalization. In this thesis, we are investigating Speaker Normalization usingVTLN along with Variance Normalization (VN), which tries to remove channel effects.It is also seen as a method for compensating for the Jacobian of the transformation,which is usually ignored in conventional VTLN approaches.Recognition experiments were performed on TIDIGITS and Resource Managementdatabases, using linear and non-linear warping functions, to evaluate the performanceof the variance normalization approach. Results showed that use of variance normal-ization along with conventional VTLN has performance better than the conventionalVTLN used alone, for most of the warping functions.

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Title : Study Of Various Linear Transformations To Reduce Speaker Variability In Automic Speech Recognition

Author(s) : Lakkam Naresh
Roll No : Y6104044
Supervisor(s) : Umesh Srinivasan

Abstract

Speaker variability is considered as a major source of performance degradation inspeaker independent speech recognition systems. One of the main source of variabilityis the difference in vocal tract length. To account for such variations, different methodshave been proposed, which are commonly called Speaker Normalization methods.Speaker Normalization methods are broadly of two types, viz., Vocal Tract LengthNormalization (VTLN) and Speaker Adaptation. In VTLN, the spectrum of speechsignal of one speaker is warped to match the spectrum of another speaker. Thisis a feature domain approach for speaker normalization. In Speaker Adaptation, theacoustic models of the SI models are changed to match the spectral characteristics ofthe test speaker. These methods modify the models leaving the features unchangedand adapted models are formed for every speaker. Although both the methods servesthe same purpose, they are different in their approach to solve the problem.Usually VTLN is implemented by warping the filter banks in the front-end signalprocessing in MFCC analysis. This is computationally expensive method and theJacobian, which naturally comes because of warping, is ignored. Recently we haveproposed linear transformation approach for warping in VTLN. This has the advantageof reducing the computational complexities involved in VTLN and Jacobian was alsoaccounted for. This methods multiplies a matrix to the unwarped features to producewarped features.In adaptation, there are methods like Maximum Likelihood Linear Regression(MLLR) and Constrained MLLR (CMLLR) which try to change the mean and/orcovariances of the mixture components of the HMM models to match the speakerscharacteristics. These methods when also used during model training are calledSpeaker Adaptive Training. CMLLR adaptation, which modifies both the means andco-varuiances with the same matrix, is also equivalent to warping the features with theinverse of the matrix.However, in building HMM models, it is common practice to assume diagonal covari ance structure for the Gaussian components. Although the DCT operation in MFCCanalysis reduces the correlations that exist between feature components, the matrixoperation on the feature vectors during warping in VTLN/SAT introduces correlation.Hence a further step is necessary to remove the correlations.In this thesis, we have studied and experimented with different VTLN, Adaptation, SAT methods, and a feature decorretation methods in ASR. In VTLN, we have usedthe Bandlimited Interpolation method as the linear transformation approach for VTLNwarping, and in speaker adaptation, we have used CMLLR and MLLR for our experiments.CMLLR was also used to build compact acoustic models during training, whichis called SAT. We used a form of Heteroscedasctic Discriminant Analysis (HLDA) asthe decorrelating transformation. We have also tried to cascade different methods (likeVTLN with HLDA, and SAT with HLDA) appropriately to see their effects on wordrecognition accuracies.

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Title : Peak To Average Power Ratio In OFDM Systems
Author(s) : Subramanyam N
Roll No : Y6104078
Supervisor(s) : Vasudevan Kasturi

Abstract

The data rate and reliability required to support the new information age has increasedthe demand for high speed communication systems. Orthogonal Frequency Division Mul-tiplexing (OFDM) has recently gained great popularity due to its robustness in mitigatingvarious impairments in such systems.A major drawback of multicarrier signals is their high Peak to Average Power Ratio(PAPR). Since most practical transmission systems are peak-power limited, the averagetransmit power must be reduced for linear operation over the full dynamic range, whichdegrades the received signal power.This thesis presents a metric-based symbol predistortion algorithm and describes threemethods for PAPR reduction in OFDM transmission and compares its performance withseperately optimized parameters for each OFDM block (frame). The algorithm consists of predistorting a set of input symbols per block using simple metrics, which measure how mucheach symbol contributes to the output signal samples of large magnitudes. The symbols tobe predistorted in each block are selected as those with the largest positive-valued metrics.Predistortion of input symbols is performed either by scaling only the amplitude or byscaling separately the real and/or the imaginary parts of the selected symbols. The simplemetric-based structure of the algorithm gives high flexibility which enables various tradeoffsbetween performance and complexity. Another important feature is that the algorithm doesnot require transmitting any side information to the receiver and it does not involve anyadditional complexity for symbol detection at the receiver side. It is shown by simulationsthat a considerable improvement can be achieved with these separately optimized values foreach frame, which can be implemented as one-shot or iterative procedures.

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Title	***:***	***Rate-Adaptation And Precoding For MIMO Systems With Delayed Channel State Information***
Author(s)	***:***	***Maurya Atul Kumar***
Roll No	***:***	***Y6104012***
Supervisor(s)	***:***	***Chaturvedi Ajit Kumar***

Abstract

Demand for wireless communications is growing rapidly with increase in need of higherdata rate. Due to limited bandwidth and fading phenomenon of wireless channels, high datarate transmission is difficult. Multiple input multiple output (MIMO) systems can be usedin wireless systems to achieve high data rate communication. Performance of system can beconsiderably improved by exploiting the channel sate information (CSI) at the transmitter.In practice, transmitter hardly receives perfect CSI due to processing delay and time varyingnature of the wireless channel, the CSI becomes delayed or outdated. A rate-adaptive schemefor MIMO system is analyzed under the consideration of delayed CSI. Next, we consider thedesign of transmit precoding which improves the bit error rate (BER) performance of MIMOsystems in spatially correlated fading channels. We consider the case when transmitter hasknowledge of delayed CSI and the knowledge of transmit correlation as well. The precoderis designed by minimizing the upper bound of symbol error rate (SER).

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Title : ***An Efficient Space Time Completion Algorithm For Removal Of Artifacts In Old Video Sequences***

Author(s) : ***Chintalapati Jyothsna***
Roll No : ***Y6104031***
Supervisor(s) : ***Gupta Sumana***

Abstract

The unique records of historic, artistic and cultural developments are deterioratingrapidly due to ageing e ects of the physical reels of lms and magnetic tapes that carrythe information. Re-using of these old lm and video material is however only feasibleif the visual quality meets the standards of today. Thus in this thesis an e cient Space-Time Completion algorithm is presented for the restoration of the old video archives.In this thesis we mainly emphasized on the removal of blotches and moving scratchessince they form the most common artifacts in old videos.In Space-Time Completion the missing portions are lled-in by sampling spatio-temporal patches from the available parts of the video, while enforcing global spatio-temporal consistency between all patches in and around the hole. This algorithm isvery e ective in restoring the artifacts but the Time Complexity is large.To reduce the time complexity, we propose a new and e cient Space-Time Com-pletion algorithm. In this method along with the existing technique, we incorporateBackground Subtraction in which background is modeled based on RGB values andonly the foreground is interpolated, then Multi Resolution Analysis is employed inwhich the foreground that contains the corrupted pixels is decomposed to a coarselevel and then a reduced search window approach is employed in which the search win-dow is chosen according to the motion vectors that are obtained by the Block MatchingAlgorithm.By the proposed method the time complexity has been reduced to almost half ofthe existing method while the videos are also restored satisfactorily.

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Title : ***Synchronization Of QPSK Signals In The Presence Of Frequency Offset And AWGN***

Author(s) : ***Deshmukh Nikhil Ashok***

Roll No : ***Y6104026***

Supervisor(s) : ***Vasudevan Kasturi***

Abstract

Burst mode of communication has found application in several areas such as satellitetime-division multiple-access (TDMA) systems and terrestrial mobile cellular radio. Coherentdemodulation is used with passband digital communications when optimum errorperformance is of paramount importance. This requires accurate carrier synchronization.Timing synchronization is necessary to alleviate intersymbol interference (ISI). Tofacilitate rapid synchronization, a preamble is attached to the beginning of a frame. Wedesign and simulate a robust burst acquisition system for geosynchronous satellite communicationchannel under the non-ideal conditions of a frequency offset, a phase offset,an unknown delay and an AWGN channel. The modulation scheme used is QPSK.The estimation algorithms for carrier and symbol timing recovery are described. Wefocus only on data-aided (DA) estimation algorithms. The performance of the frequencyoffset estimator is compared with the Cramer-Rao bound. The system is simulated fordifferent frame lengths, the preamble length being restricted to be at most 1/10th of thedata length. The bit-error rate performance of the overall system is compared with thetheoretical results.

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Title	***:***	***Modification Of Rate Adaptation Algorithm Of Explicit Rate Adjustment Congestion Control Protocol For Faster Convergence***
Author(s)	***:***	***Maurya Nagendra Nath***
Roll No	***:***	***Y6104048***
Supervisor(s)	***:***	***Singh Yatindra Nath***

Abstract

Multi-rate Multicast Congestion Control (MR-MCC) is the most suitable protocol to solve the multicast congestion control problem in huge and heterogeneous network. Therefore it has been accepted as a solution of the congestion control for multicast communication (e.g., IPTV) over the global Internet. The design of MR-MCC includes the responsiveness, efficiency of network utilisation, low packet loss, scalability and fairness in network. Multirate multicast congestion control (MR-MCC) protocols uses Layer Coding Transport (LCT) techniques and Receiver-driven Congestion Control mechanism. This thesis is concerned with the modification of the rate adjustment algorithm of a multi-rate multicast congestion control (MR-MCC) protocol. The previously proposed MR-MCC protocols are RLM, RLC, FLID-DL, PLM and ERA. Having learnt from our studies of previously proposed MR-MCC protocols, we propose the modification of the rate adaptation algorithm of the most common MR-MCC protocol, namely Explicit Rate Adjustment (ERA). This modified rate adjustment algorithm has the better convergence time than the conventional algorithm. Through simulation, we demonstrate the reduction in the convergence time of the rate adaptation algorithm of the modified ERA congestion control protocol.

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Title : Paths On Z2 Under Arbitrary Adjacencies
Author(s) : Majeti Nageswara Rao
Roll No : Y6104050
Supervisor(s) : Venkatesh K S

Abstract

Many of the theories and propositions pertaining to paths and their lengths that havebeen developed for the real plane under the Eulcidean metrics can not be applieddirectly to digital grids. This thesis is an attempt to model paths in digital grids soas to analyze and understand their properties. The approach is completely formal andaxiomatic, and begins with defining an adjacency set as the set of digital grid pointsabout a reference point that will be treated as its nearest neighbors. It is shown thatmost of the results that follow are relative to the initial choice of adjacency. The theoryitself develops at a general level and makes no specific preference in this regard. Someof the important problems that are dealt with are: finding the cardinality of the setof all possible paths between a pair of points; deriving the conditions under which apath can exist between a pair of points, so on. An attempt is made to find the setof minimal path families under the Euclidean metric. The theory developed is forarbitrary adjacencies and is metric independent, except for the parts concerned withissues of path length.

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Title : Multi Camera Pan-Tilt Surveillance Networks
Author(s) : Wate Amol
Roll No : Y6104007
Supervisor(s) : Venkatesh K S

Abstract

With the advent of cheaper cameras and faster computing facilities, multi camera surveillancesystems are becoming increasingly popular for wide area surveillance. In this thesis, thechallenges of multi-person, multicamera tracking on a network of collaborating cameras isaddressed. Each camera is modeled to be a smart entity, capable of performing certain basicsurveillance tasks independently. PTZ cameras have been chosen in order to reduce thecoverage cost. A novel auto-calibration strategy is proposed that forms the backbone forassimilating the multiple marginal elds of view of a PTZ camera into one global mosaic.This approach is further extended during the implementation of surveillance algorithms foronline adaptive background modeling on active cameras and target localization followedby tracking in a dynamic background. Later these smart entities are grouped together ina hierarchical manner, so as to form a plug and play system. A set theoretic approach to nding spatial correspondences between pairwise cameras in a supervised manner is proposedfor a practical 2D manifold and its implications in a 3D environment are studied. We alsostudy a novel hando strategy that would be best suited for a dynamic system.

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Title : *Restoration Of Old Videos And Scene Change Detection Using Temporal Regularity Flow*

Author(s) : *Tumma Pramida*
Roll No : *Y6104059*
Supervisor(s) : *Sumana Gupta*

Abstract

In many of the old videos like old movies or tapes with historic moments, theartifacts present in them like blotches, scratches, intensity flicker etc, cause severe hindranceto our pleasure in watching them. In this thesis we propose to remove theartifacts, blotches and non-persistent scratches from old videos. This is done using theTemporal Regularity Flow.Temporal Regularity Flow gives the direction along which intensity variation ofa pixel is minimum. This is achieved through the condition that sum of directionalgradients should be minimum along the flow directions. Translational box splines areused to approximate the flow curves. After modeling a video for temporal regularity, we get motion vectors of all the pixels. AS blotches are temporally discontinuous, theintensity at the blotched pixel will not match with the intensities of other pixels alongthe flow directions. Thus, the blotches are removed from the video. The same will alsowork for non-persistent scratches. Time complexity has been reduced by a large extentusing the proposed method to remove blotches from old videos.In order to apply this algorithm, we need to divide the entire video sequence in togroups of frames belonging to same scene. For this we propose a scene change detectionalgorithm that uses Temporal Regularity Flow. Scene change detection is also used indifferent multimedia applications. Motion compensated frames are formed using theregularity flow. These are subtracted from the original frames and a pixel is flaggedwhere there is a difference. If the count of number of pixels flagged in a frame is greaterthan the threshold a scene change is detected.

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Title : Effect Of Precoding On Turbo Equalization
Author(s) : Gajwel Venu Gopal
Roll No : Y6104089
Supervisor(s) : Vasudevan Kasturi

Abstract

Turbo codes are a class of powerful error correcting codes that achieve very lowbit error rates at signal to noise ratios that are close to 0 dB. A channel which suffersfrom intersymbol interference (ISI) requires equalization to combat the effects ofchannel distortion. The turbo equalization approach to coded data transmission isdiscussed. Turbo equalization is an iterative equalization and a decoding techniquethat can achieve equally impressive performance gains for digital communication systemsoperating over the channels that require equalization.In this thesis, effect of precoding on turbo equalization is discussed. The performanceof serially concatenated system which includes channel with memory precededby a precoder as a rate-1 inner coder is discussed. Binary precoding technique whichmakes non-recursive ISI channel appear recursive to outer code and hence provideexcellent bit error rate (BER) performance is described. The precoders whose memoryis less than the memory of the channel are considered. The effect of differentprecoders on BER performance for different channels is studied.A rate-1/2 convolutional code is considered and channel is modeled as a tappeddelay line. The optimum turbo receiver consists of channel maximum a posteriori (MAP) detector and a MAP decoder for convolutional encoder. Each MAP decoderis implemented as forward/backward algorithm operating on observations and softinputs from constituent MAP algorithms to produce a posteriori probabilities (APPs).

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Title : *A Study On IPv6 Flow Label Field And Using It For TheProvision Of Quality Of Service In IPTV Networks*

Author(s) : *Tripathy Jagadi*
Roll No : *Y6104030*
Supervisor(s) : *SinghYatindra Nath*

Abstract

The traditional best effort (BE) service model doesn't provide any service guaranteesover the Internet. The factors such as delay, latency, bandwidth, packet loss and jitter on thenetwork are not considered to be of much importance in this. Due to the complexity ofpresent day applications and communication needs such as the "triple play service", theabove factors which influence the quality of communications bear a lot of significance.IPTV network consists of traffics such as Real-time multicast & unicast services,Real-time interactive services which require the high bit rate user applications that have morestringent loss/error requirements than those supported by applications such as email and filetransfer. For example packets belong to real-time applications such as television broadcastshould be transmitted before those that belong to non-real-time applications such as emailand file transfer. Hence, the traditional Internets' best-effort service model needs change tointroduce mechanisms to request, control and provide for the requested quality of serviceover the Internet.The present work proposes an efficient scheme to use the current unspecified 20 bitsof the IPv6 flow label field for the provision of Quality of Service in IPTV networks.

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Title : *Generation Of Speaker Invariant FeaturesFor Automatic Speech Recognition Using Spectral Center Of Gravity*

Author(s) : *Vodapally Balaji*
Roll No : *Y6104016*
Supervisor(s) : *Umesh Srinivasan*

Abstract

Inter-speaker variability is a major source of performance degradation in speaker-independent (SI) automatic speech recognition (ASR) systems. One major sourcefor this variability is the differences in vocal tract lengths (VTLs) among speakers.These differences in VTL lead to spectral variability for the same sound enunciated bydifferent speakers. Compensating this variability by estimating the speaker invariantfeatures is called Speaker Normalization (SN).In this thesis, we present the novel speaker invariant features using the idea ofCenter of Gravity. These features are generated by aligning the CG of speech spectrato an estimated reference CG by shifting the spectra in Mel domain. The idea is basedon the observation that if two signals are delayed versions of one another, then theirCG's also differ by the same amount. The shift required for normalization is estimatedin a single step making it computationally efficient compared to the conventional VocalTract Length Normalization (VTLN) methods. The proposed method has the potentialto be used in speech recognition applications where real-time performance is important.We perform normalization at the model level and explore the various methods toobtain normalized features. Normalized features are obtained by directly shifting thespectra in mel domain or by non-linear interpolation of the spectra to effect the shift.To be consistent with conventional approaches, normalization at utterance level is alsoinvestigated. Few issues related to implementation like the duration information, IDFTlength and spectral amplitude have been investigated.Recognition experiments were performed on TIMIT, TI-DIGIT and Resource Man-agement databases to evaluate the performance of the proposed approach. Resultsshowed that proposed CG based speaker normalization has performance comparableto the conventional VTLN and yet provides huge computational advantage.

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Title : *A Novel Neighborhood System And Optimal Patch Extraction Algorithm For MRF Based Texture Synthesis*

Author(s) : *KKV Kumar Ajay*
Roll No : *Y6104004*
Supervisor(s) : *Gupta Sumana*

Abstract

Texture synthesis plays an important role in computer graphics, vision and image pro-cessing. Many texture synthesis algorithms use Markov Random Field (MRF) to modeltextures . This is because of its capability to model broad spectrum of textures. Thequality and speed of these algorithms mainly depends on the order of neighborhoodsystem used in MRF model. Presently, MRF based texture synthesis algorithms usepredetermined order for the neighborhood system. A smaller order of neighborhood re-duces the quality of synthesized texture, where as higher order increases synthesis time.This limitation of present algorithms affect their practical applicability. In this thesis wepropose a new neighborhood system for MRF based texture synthesis algorithms wherethe size and shape of neighborhood changes with the structure of input sample texture.This new neighborhood system is derived from the extracted fundamental period vec-tors of input texture. The proposed neighborhood system overcomes the limitations ofexisting neighborhood system to a great extent. We have tested the proposed neighbor-hood system by applying it to two well known MRF based texture synthesis algorithmsand synthesized large number of textures taken from two standard texture databases.Observed gain in synthesis speed, without any compromise in the quality of the output,established the efficacy of the proposed neighborhood system.In the second part of the thesis, an inverse problem of texture synthesis is modeledi.e., given a large textured region how does one extract an optimal patch such that theoriginal textured region can be faithfully synthesized from this patch. A multi-objectiveframework is developed to solve this problem. The proposal of objective functions with aconstraint, and their analysis for a number of natural textures, pave a path for explorationin this domain. The application of this inverse problem can be found in image compres-sion, storage, and content-based image retrieval. The results obtained established thevalidity of the proposed multi-objective framework.

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Title **:** ***Colorization Of Grayscale Images And Videos Using ASemi-Automatic Approach***

Author(s) **:** ***Jacob Vivek George***
Roll No **:** ***Y6104092***
Supervisor(s) **:** ***Gupta Sumana***

Abstract

Colorization is a computer-aided process of adding color to a grayscale image or video.The task of colorizing a grayscale image involves assigning three dimensional (RGB)pixel values to an image which varies along only one dimension (luminance or intensity).Since different colors may have the same luminance value but vary in hue or saturation,mapping between intensity and color is not unique, and colorization is ambiguous innature, requiring some amount of human interaction or external information. In thisthesis we propose a semi-automatic process for colorization where the user indicateshow each region should be colored by putting the desired color marker in the interiorof the region. The algorithm based on the position and color of the markers, segmentsthe image and colors it. In order to colorize videos, few reference frames are chosenmanually from a set of automatically generated keyframes and colorized using the abovemarker approach and their chrominance information is then transferred to the otherframes in the video using a color transfer technique making use of motion estimation.The colorization results obtained are visually very good. In addition the amount ofmanual intervention is reduced since the user only has to apply color markers on fewselected reference frames and the proposed algorithm colors the entire video sequence.

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Title : *Unsupervized Object Categorization From Surveillance Videos*

Author(s) : *Nandi Sudipto*
Roll No : *Y6104079*
Supervisor(s) : *Venkatesh K S*

Abstract

Appearance descriptors computed over the complete animacy of an object forms a powerfultool for scene analysis with object discovery in mind. This thesis proposes the means ofobtaining such descriptors in an unsupervised manner from the tracking algorithm output.During its scene presence, an object presents itself in many poses with di ering frequencies,thus generating multiple modes in the appearance feature space. For each object, we focuson its unoccluded intervals and obtain time-indexed vectors from shape and Haar templateswhich are then clustered to obtain appearance classes. The object is modeled as a probabilitydistribution over the space of co-occurrent shape and Haar templates. These objectmodels are clustered in an unsupervised manner with Bhattacharya distance metric betweenobject models. Further an algorithm is proposed which gives an asynchronous feedback tothe database constructed in the discovery phase on the arrival of new unseen objects orapearances found in further frames. A novel detection scheme on the basis of incrementaljoint-distribution using the knowledge of discovery stage is presented, it is capable ofidentifying object categories in each single frames. Classi cation and detection results onsimple (PETS) and complex tra c scenes consisting of a wide variety of objects shows robustperformance on complex scenes.

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Title : *On Sensing And Interference Mitigation Of Multi User Cognitive Radio*

Author(s) : *Dey Arnabkanti*
Roll No : *Y6104010*
Supervisor(s) : *Banerjee Adrish*

Abstract

Cognitive radio is a new wireless paradigm that can reconfigure the analog RF outputof a conventional radio and incorporate self-awareness and knowledge of transmissionprotocols. These developments will yield a cognitive radio able to sense its RF environ-ment and location and then alter its power, frequency, modulation and other operatingparameters so as to dynamically reuse whatever spectrum is available.In this thesis, we have extended the two sender two receiver cognitive radio modelto multiuser cognitive radio model and derived the conditions for optimal values ofpower sharing of the cognitive user's power for relaying primary user's message as wellas self communication such that the primary user communication rate is una®ected bythe presence of cognitive radios. We have also evaluated the probability of detectionas well as probability of false alarm for the primary user using energy based spectrumsensing method. We have also calculated the probability of error in detecting theprimary users and observed the e®ect of di®erent sensing parameters on the quality ofsensing.

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Title : *An Efficient Hybrid Transform For Video Coding With Early Detection Of Zero Quantized DCT Coefficients*

Author(s) : *Kumar P N Naresh*
Roll No : *Y6104056*
Supervisor(s) : *Shrma Govind*

Abstract

The sequences of digital video images typically require vast amounts of electronic mem-ory for storage and occupy much bandwidth during transmission. Widely used imageand video compression standards such as, JPEG and MPEG uses, 2D DCT to achievenear optimal compression of individual frames. This is done by decomposing framesinto components of di®erent spatial frequencies. In this dissertation, we propose anextension of DCT called warped discrete cosine transform (WDCT) and a compressionalgorithm based on WDCT. The proposed WDCT is a cascade connection of conven-tional DCT and all-pass ¯lters whose parameters can be adjusted to provide frequencywarping. The ¯rst order all pass ¯lters considered here can be implemented by Laguerrenetwork connected with DCT. For e±cient software implementation, we propose trun-cated and approximated FIR ¯lter banks which can be used instead of the Laguerrenetwork. As a result, the input-output relationship of the WDCT can be representedby a single matrix multiplication, like the DCT.In the proposed compression scheme, the frequency response of all-pass ¯lter iscontrolled by a ¯xed set of parameters from which a speci¯ed warping parameter isused for a speci¯ed frequency range. Also, for each parameter, the correspondingWDCT matrices are computed a priori. For each image block the best parameteris chosen from the set and the index is sent to the decoder as side information alongwith the result of corresponding WDCT matrix computation. At the decoder, theinverse WDCT is performed to reconstruct the image/frame. The proposed algorithm isimplemented only for I-frames and an analytical model has been proposed to eliminatethe redundant DCT, quantization, inverse quantization, IDCT computations in P-frames. The dynamic range of quantized DCT coe±cients is analysed and a thresholdscheme is derived to determine whether DCT, Q computations can be skipped withoutloss in video quality. The proposed transform outperforms the conventional DCT interms of video quality and the proposed analytical model reduces the complexity ofvideo coding.

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Title **:** ***Sub - Pixel Accuracy Motion Estimation Via C-1BT Transform In Video Coding***

Author(s) **:** ***Kumar SVijay***
Roll No **:** ***Y6104067***
Supervisor(s) **:** ***Shrma Govind***

Abstract

In this study Sub-Pixel Motion Estimation by means of Constrained One-bit Transformis proposed. Low-bit resolution representations exist in literature for motion estimation.Sub-pixel motion estimation employing these kinds of transforms have not been yet tried.Constrained One-bit (C-1BT) transform based Mean Absolute Difference motion estimationis done at integer pixel level thus has less accuracy. So, to increase the accuracy we extendthe C-1BT to half and quarter sub-pixel level. Half and quarter pixel values can be calculatedusing interpolation filters and there motion vectors can be computed using constrained onebittransform. In this work higher performance is achieved by computing half and quarterpixel motion vectors utilizing constrained one-bit transform than pure constrained one-bitmotion estimation. Experimental results show that the accuracy has been improved byextending the C-1BT transform to sub-pixel level. Thus the PSNR values of the video aremuch improved.

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Title	***:***	***Novel Spatial And Hybrid Error Concealment Techniques For MPEG-2 Video Decoder***
Author(s)	***:***	***Sagar K Prem***
Roll No	***:***	***Y6104037***
Supervisor(s)	***:***	***Shrma Govind***

Abstract

Error concealment in video communications is becoming increasingly important becauseof the growing interest in video transmission over Wireless Networks and Internet.Since most of the pictures in MPEG-2 compressed videos are inter-dependent,the loss of a single packet can corrupt not only a part of one picture but also severalpictures. Though retransmission of lost packets is one way to avoid these errors, itis not practical in many applications which involve real-time video transmission. Toovercome this problem we have proposed novel Spatial and Hybrid error concealmenttechniques for robust transmission of MPEG-2 compressed videos. These algorithmsare useful in recovering the lost parts of the video without requiring retransmission oflost packets. The proposed Spatial Error Concealment algorithm is used for estimatingthe lost Macro Blocks of I-pictures. This method combines linear and DirectionalSpatial Interpolation techniques using Macro Block mixing. It makes sure that the uniformand edge features are properly incorporated into the estimated Macro Block. Wehave also proposed a Hybrid Error Concealment algorithm for P-picture concealment.In this method, we first try to estimate the Motion Vectors of the lost Macro Blockusing the Motion Information in the correctly received neighborhood Macro blocks.To perform this we employ first order plane estimation. Then the estimated MotionVectors are added to the corresponding Macro Block in the reference picture, which isgenerally the preceding picture, to generate an estimate of the lost Macro Block. Thenwe determine the accuracy of this estimation using Boundary Matching Error criterion.If the error is above a specified threshold, it means that there is fast/complex motionin the video and temporal estimation could not conceal the Macro Block properly. Inthat case we use the spatial correlation across the Macro Blocks to reconstruct the lostMacro Block. Experimental results show that the Peak Signal to Noise Ratio (PSNR)as well as the subjective quality of the video are much improved using our algorithms.

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Title : ***Probability Of Starvation Based Rate Control For Video Streaming Over IP Networks***

Author(s) : ***Misra Ankit***

Roll No : ***Y6104053***

Supervisor(s) : ***Chaturvedi Ajit Kumar***

Abstract

The thesis addresses the problem of live streaming of video over the internet for lowdelay applications (e.g. video chat). We propose a new rate control scheme for thetransmission of MPEG-4 video over the UDP layer across the internet. In additionto frame losses over the UDP layer, starvation/overflow of the playback buffer resultsin extra distortion introduced by error concealment algorithms used to maintain theplayback at the receiver. The proposed controller utilizes playback buffer information tominimize the probability of this starvation/overflow at the playback buffer by optimallychoosing the quantization step size of the encoder. Further a joint minimization of thedistortion of video and the probability of starvation/overflow is analyzed to achieveminimum end-to-end distortion of the transmitted MPEG-4 video.

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Title : Novel Techniques For D Reconsturuction
Author(s) : Vaidya Amey
Roll No : Y6104086
Supervisor(s) : Venkatesh K S

Abstract

The problem of reconstructing the exact shape and texture of any object using itsmultiple views is considered. We observe the object from multiple views and captureits silhouette and texture images. We propose a method to automatically reconstructthe shape of the object using these silhouette images. However the silhouette imagescan only give the convex hull of the object. In order to reconstruct the concavities, wepropose a laser light based approach which can reconstruct even the concave surfaces.Finally after reconstructing the exact shape, we map the texture on the object usingthe images captured at multiple angles.

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Title : ***Joint Data Aided Timing And Frequency Offset Estimation In MIMO Systems***

Author(s) : ***Tippireddy Ashok***
Roll No : ***Y6104011***
Supervisor(s) : ***Chaturvedi Ajit Kumar***

Abstract

Joint Data-Aided Maximum Likelihood (ML) estimation of timing and frequency offsetin MIMO flat fading channels is considered. The Mean Square Error (MSE) performanceof the joint ML estimator is compared with the MSE performance of theindividual timing and frequency offset estimators. Tighter Joint Conditional Cramer-Rao bounds (JCCRBs) are derived for the joint estimation. The mean square errorperformance of the joint ML estimator is also compared with JCCRBs. By minimizingJCCRBs individual optimal training sequences for timing and frequency offset estimationare determined. Numerical optimization techniques are used for minimizingJCCRBs. The optimal sequences for timing offset estimation are found to be differentfrom the optimal sequences for frequency offset estimation. Training sequences areproposed which give good tradeoff performance for both timing and frequency offsetestimation.

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Title : Minimum Error Virtual View Synthesis
Author(s) : Sudhanshu
Roll No : Y3167353
Supervisor(s) : Venkatesh K S

Abstract

The thesis deals with the view synthesis problem i.e. to generate snapshots of a scenetaken from a 'virtual' view point di erent from the available 'reference' points ofthe given views. We propose a novel method to synthesize the virtual view from twouncalibrated reference views. We also extend our proposal to a novel approach in gen-erating virtual views from multiple reference images through an optimum path. Ouraim is to automatically generate virtual views at high speeds on standard hardwarein an environment which is prone to illumination and noise e ects. No assumptionsare made about the foreground and the background objects. The prewarping is doneby a novel approach followed by dynamic correspondence algorithms to generate thevirtual views. Based on a large number of experiments with real-world images, acost function is devised to identify the optimum path, in terms of synthesis errors, togenerate a virtual view in case of more than two reference images.

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Title : *Packet Loss Based Rate Control For Video Steaming Over IP Netmorks*

Author(s) : *Teltia Gaurav*
Roll No : *Y3167120*
Supervisor(s) : *Chaturvedi Ajit Kumar*

Abstract

The thesis proposes the design of a rate controller for MPEG-4 coded video streamsthat can achieve constant quality reconstruction of frames at the receiver end undera rate budget constraint. To achieve this, we derive an analytical end-to-end ratedistortion model for video streaming over IP networks. This model maps one of thequality of service (QoS) parameters, packet loss ratio, de ned at the connection levelto actual distortion at the receiver end. We also provide an analysis on the e ects ofdi erent network link models on end-to-end rate distortion modelling. We integrate theproposed end-to-end rate distortion model in the design of a rate controller for a videostreaming application. The encoder takes a feedback of packet loss ratio from the clientand uses the end-to-end rate distortion models for a block of GOPs to determine thebits that should be allocated to a GOP in that block so that jitter in video quality isminimized. Simulation results con rm the e ectiveness of the proposed rate controllerfor networks having di erent packet loss ratios.

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Title : *Turbo DecodingFor AWGN And Quasi-Static FadingChannels*

Author(s) : *Kalra Kanwaljeet Singh*
Roll No : *Y6104038*
Supervisor(s) : *Vasudevan Kasturi*

Abstract

In this thesis, the performance of turbo decoding in AWGN and Quasi-static Rayleighand Rician fading channels is studied. Two approaches have been developed for detection ofthe transmitted data stream. In the first approach, channel estimation is performed usingpilot symbols. Estimates of the complex channel gain and variance of the additive noise arederived from known pilot symbols. In the second approach, differential decoding is performedprior to turbo decoding.A rate-1/3 convolutional encoder is considered for turbo encoding of the input datastream. The optimum turbo receiver consists of a channel estimator/differential decoderalong with a MAP decoder for the convolutional code. Each MAP detector is implemented asa forward/backward algorithm operating on observations and soft inputs from the constituentMAP algorithm to produce extrinsic information.The calculation of extrinsic information is carried out in exponential domain. The performanceof the proposed receiver is studied using computer simulations. Influence of lengthof the pilot frame on channel estimation technique is also examined. The influence of framesize (and hence the interleaver size) on system performance is presented.

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Title **:** ***A Computationally Efficient Approach To Warp Factor Estimation***

Author(s) **:** ***Akhil P T***

Roll No **:** ***Y6104039***

Supervisor(s) **:** ***Umesh Srinivasan***

Abstract

Speaker variability is considered as a major source of performance degradation in speakerindependent speech recognition systems. One of the main source of variability is the difference in vocal tract length. It is tackled by normalizing the speaker differences in speechsignals and is commonly referred to as vocal tract length normalization (VTLN). These vari-ations are commonly modeled as a pure scaling relation between the spectra of two speakersenunciating the same sound.Current state-of-the-art automatic speech recognition systems overcome this problem ofspeaker variability by doing a maximum likelihood (ML) based grid search over all scalingcoefficients. This process is computationally expensive when speech is modeled using HiddenMarkov Models (HMM).In this thesis, we use the Expectation Maximization technique to simplify the ML basedoptimization of scaling coefficients. The method presented is computationally efficient andgives a recognition performance comparable to the conventional method

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Title	***:***	***Parametric Representation Of Speech Signal By Using AFMS Signal Model***
uthor(s)	***:***	***Reddy KVaruna Kumar***
Roll No	***:***	***Y5104027***
Supervisor(s)	***:***	***Sircar Pradip***

Abstract

In this thesis the components of the multi component speech signals are separated by us-ing Fourier Bessel expansion. Each of the seperated components of the multi componentspeech signals are inturn modelled by using the amplitude and Frquency Modulated Si-nusoidal(AFMS) signal model.The reconstructed components of the speech signals can beadded together to get back the multi component speech signal.

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Title : ***Network Connectivity For Embedded Systems Based On FPGA***

Author(s) : ***Agrawal Nitin***
Roll No : ***Y6104055***
Supervisor(s) : ***Qureshi Shafi***

Abstract

Establish network connectivity for small embedded stand alone devices has become a very necessary task for their controlling and monitoring when they are placed in remote locations. The workstation deployment is not possible at many places as well as it is not cost viable hence there is a need for a dedicated processor which can provide the network connectivity. The required functionalities can be implemented in an ASIC or a on the shelf processor with TCP/IP protocol libraries. Additionally with increasing speed of data transfer on the network to have a dedicated processor which acts as a co-processor to the main CPU and handles the entire network interface will greatly reduce the CPU burden. This work presents a first step towards this as the hardware implementation of network connectivity for embedded system on FPGA. Due to the development towards more dense programmable devices (FPGAs) it is today possible to fit a complete embedded system including microprocessor, bus architecture, memory, and custom peripherals onto one single reprogrammable chip, normally called a System-on-Chip (SoC). As a main application this device was required to transfer the data of a RFID reader to the central server and thus nullifying the requirement of a presently used workstation. The design is based on a soft processor core viz. Microblaze instantiated in a low cost Xilinx FPGA using open source TCP/IP network protocol libraries. The device once programmed is capable of acting as a HTTP webserver and an SMTP based email client so that an email can be send to the destined central server transferring the data or informing of some activity. The present hardware is Spartan 3E starter kit which contains XC3S500 Spartan device connected with required peripherals such as memories, ethernet transceiver, clock sources and debug ports. Apart from FPGA the design also uses an external SDRAM to contain the application code of the processor and a SPROM for holding the self configuration bitstream of FPGA.

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Title : *Design Of ISO 14443 Comlient Passive, Read- Only RFID Tag With Asynconous Digital Echnique*

Author(s) : *Saraf Amit Kumar*
Roll No : *Y6104006*
Supervisor(s) : *Qureshi Shafi*

Abstract

In recent years, low cost RFID is increasingly becoming popular. Tags ofsuch an RFID system consists of less complex architecture, therebyminimizing the power consumption and costing less than $1.The work incorporates ISO 14443 regulations for designing the tag. Itutilizes 13.56 MHz carrier frequency which is available worldwide as an ISM(Industrial-Scientific-Medical) frequency. To reduce complexity, the tag ismade passive with the only available power source as inductively coupledelectromagnetic field of the reader. For further simplicity, a read-only tag hasbeen designed which just reveals its identity to the reader. The tagarchitecture is divided into two parts: analog and digital blocks. Thecomponents of analog block have been designed to reduce the leakage power.Asynchronous logic has been used in digital block to minimize the clockactivity and hence cause a reduction in transient power.We have used Type A specifications of ISO 14443 for RFID tag. This givesthe Interrogation field strength Hmin of the reader as 7.5 A/m. From thevalues of tag dimensions (85.72mm 54.03 mm 0.76mm), carrierfrequency (13.56 MHz) and no. of antenna turns (N=4), we get the min. rmsvalue of voltage available to the tag U2 as 2.581V. The rectifier takes up thisvoltage and converts into DC voltage. The limiter limits any HF voltage to 7.5V. Supply independent reference sources have been generated to providebiasing signals to the transistors. A Low dropout regulator supplies thevoltages for the digital block. The digital block utilizes an asynchronouscounter to derive their timing and processing signals. A 128 bit ROM storesan EPC (Electronic Product Code) which is fetched, processed and sent backto the reader via decoder, multiplexer and modulator units. As specified inISO 14443 Type A, the modulation type is 10% ASK with the data rate as 106kbps. The entire deign has been simulated with an input power source of600µW. The digital circuitry is implemented on 1V rail to rail voltage toreduce the power consumption. The integrated analog and digital schematichas been simulated on 0.18µm CMOS technology Level 53 models fromTSMC and Mentor Graphics EDA tool suite.

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Title : *Design Of Low Power High Speed Robust 64bit Adder*
Author(s) : *Tulasi M*
Roll No : *Y6104043*
Supervisor(s) : *Qureshi Shafi*

Abstract

Design of fast and energy efficient, 64 bit adder is essential for today's high end microprocessors which have stringent constraints on performance and power consumption. The trade-off between performance, power consumption and noise immunity in the nanometer-scaled CMOS circuits, requires design optimization at every level. In this thesis, high speed 64 bit adder has been designed using Kogge-Stone (KS) carry lookahead logic which has highest speed due to its minimum logic depth. The KS tree structure is implemented in radix-2 which is considerably faster than radix-4 because of minimal fan-out. Its energy consumption is reduced by 50% by introducing a sparseness factor of 2. Circuit level optimization is done by implementing the critical path of the adder in skewed logic, which is robust and has high performance. This circuit operates in two modes, precharge and evaluation. The delay of the slow precharge mode is reduced by adding clock transistors selectively. This logic has enhanced the speed by 24% and made the adder robust. Low Vth devices are used in the high speed adder circuit which resulted in large leakage current. Embedded and Sleep switch MTCMOS techniques which use high Vth devices are applied to reduce leakage current. The leakage current in skewed logic gates is reduced by embedding high Vth transistors in the non-critical precharge paths, but it caused large energy overhead. It is overcome by using sleep transistors that are effective in leakage reduction. Local sleep transistors have been introduced in every skewed gate which reduced leakage current by 67 times. To further reduce it, application of hierarchical sleep transistor sizing methodology based on mutually exclusive discharge patterns of the gates is proposed in this thesis work. By this leakage current has been reduced by 570 times with optimal energy overhead. The sneaky leakage paths in the transmission gates which resulted in large leakage current in the adder are also detected and eliminated. The MTCMOS techniques reduced the leakage current in the adder by more than two orders of magnitude and the resulting adder has a critical delay of 310 ps. All the designs are simulated in 1 V, 90nm GPDK (Generic Process Design Kit) technology using Cadence Spectre Simulator.

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Title : Simulation Of Capacitance-Voltage Characteristics Of Organic Thin Film Transistors

Author(s) : Manukar Paritosh
Roll No : Y6104057
Supervisor(s) : Iyer S Sunder Kumar & MohapatraY N (PHY)

Abstract

With the growing importance of organic thin film transistors (OTFTs), developing reliable techniques to characterize them along the lines of inorganic semiconductors has become urgent. At present, current based measurements are mainly used for this purpose. Capacitance based techniques can greatly complement this effort. Hence we attempt, in this work, detailed simulations of capacitance basedcharacterization.We perform C-V characterization of OTFTs by a standard simulation tool ATLAS. Validation checks are performed to establish its applicability to organic semiconductors by incorporating appropriate models and material parameters. Simulation of OTFTs gives capacitance-voltage curves comprising three distinct regions. A qualitative model that can describe the simulated C-V characteristics in all the three regions is established and it is validated by varying critical parameters as gate to source/ drain overlap and thickness of the semiconductor. The effects of varying Drain to Source voltage and frequency are also observed. The effects of defects and trap states within the HOMO-LUMO gap are studied. Since an organic semiconductor is disordered in nature, they are dominated by intrinsic defect states. Model validation check is performed again by introducing fixed oxide charge and extracting back its density. Next, a Gaussian Disorder Model is incorporated into our simulation which mimics the behavior of an organic semiconductor. Finally, the most important issue of role of interface on OTFT performance is discussed. Gaussian distribution of interface defects is found to show numerical instability at some gate voltages. Hence, we use single level interface traps for all our analysis. These interface traps show up as distinctive features which carry signature of deep acceptor and shallow donor trap levels. The frequency dependence of the C-V curves, G/w, effect of temperature variation on C-V with inclusion of only these two traps is studied. Finally, simple methods involving the use of differential capacitance to extract the trapped charge density and the interface trap density are discussed. Some preliminary efforts are made to fabricate OTFT devices with polystyrene as dielectric and P3HTas the semiconductor using a self-designed mask. However, high levels of leakage gate currents prohibits from obtaining reliable characteristics adequate for comparison with simulation showing the urgent need for further optimization of device performance and standardization of fabrication process.

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Title : *Capacitance Based Characterization Of Organic Diode Structures: Simulations And Experiments*

Author(s) : *Mohata Dheeraj Kumar*
Roll No : *Y6104027*
Supervisor(s) : *Iyer S Sunder Kumar& Mohapatra YN(PHY)*

Abstract

Organic semiconductors are emerging as potential candidate for large variety of large and small scale displays and cheap printable electronic applications. Some applications such as RFID require one to understand the small signal characteristics of diodes and TFTs. In literature, many such studies have been carried out under the generic techniques of Impedance spectroscopy, which basically deals with capacitance-voltage-frequency (C-V-f) characteristics of organic devices. These small signal characteristics carry relevant information about transport, material properties, contact properties etc. However, such studies have not been that well complemented by approximate models or simulations, even at the basic level, as has already been done for in-organic devices. This work basically concentrates on simulation of the capacitance-Voltage-frequency (C-V-f) characteristics of organic diode structures and understanding and correlating them with experimental results. The structures include: Single layer organic diodes with cathodes of different work functions, Bi-layer diode with different material and majority carriers and Doped Bi-layer structure Metal-Intrinsic semiconductor-P-doped semiconductor (MIP). Through these small signal measurements, both in simulations and experiments, we propose to find the built-in voltage (Vbi) and mobility of the majority carriers for all the structures and reason the occurrence of widely observed negative capacitance under certain conditions. Capacitance voltage characteristics of single layer devices are compared for cathodes with varying work-functions. We also show that the Vbi corresponds to the point where the current starts entering SCL regime from the initial exponential or power law regime. Through C-f, we show that using the concept of frequency scaled differential capacitance (FSDC), one can extract mobility of holes (majority carriers) for any cathode combination. We also show that Negative capacitance occurs due to recombination, when the carrier concentration of injected holes and electrons are comparable and that traps mediate the recombination process. We also show the effect of NC on the Cole-Cole plot and the different conductivity regimes that are visible in it at low applied bias, below the built-in voltage. For the bi-layer devices also, we show that mobility can be extracted using FSDC. Different conductivity regimes are shown using the Cole-Cole plot both in simulation and experiments. The simulation tool used is the popular device simulator ATLAS of SILVACO in which parameters appropriate to organic materials has been used.

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Title : *Read Static Noise Margin Upgradation InA Low Leakage 7T SRAM Cell*

Author(s) : *Sheikh Kaship Nabi*
Roll No : *Y6104039*
Supervisor(s) : *Qureshi Shafi*

Abstract

The aim of the thesis is to obtain a low leakage 7T SRAM cell while keeping noise margin, speed up to good level and area penalty to minimum compared to 6T SRAM cell. The 7T SRAM cell uses the concept of stacking to reduce sub threshold leakage while the cell is in hold state. The 7T SRAM cell provides 30.88% reduction in leakage power during store of zero. The emphasis is to reduce leakage during store of zero because most of the bits in cache are zero for both data and instruction. In the 7T SRAM cell, the area penalty due to extra MOS can be reduced due to sharing of layout of two 7T SRAM cells. The 7T SRAM cell faces problem of reduced read SNM compared to 6T SRAM cell. For minimum cell area, the read SNM for 7T SRAM cell is only 157 mV. To enhance the read SNM, concept of LLR unit is given which can raise read SNM to 344 mV. This LLR unit gives better speed compared to previous technique of fixed reduced voltage to word line. The LLR unit also provides better write noise margin by providing full voltage to the word line during write operation. The performance of 7T SRAM cell along with LLR unit is measured for 4k memory using 8 to 256 dynamic decoder. The comparison is done with 4k memory using 6T SRAM cell with same read SNM characteristics as proposed 7T SRAM cell. The designs are simulated in Hospice using TSMC 0.18 µm technology and layout is done in Mentor graphics citation.

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Title : *Numerical Simulation Of The Electron And Hole Energy Levels In InAs/GaAs Self Assembled Quantum Dots: Strain Distribution By The Continuum Elasticity And Band Structure By The K.P. Method*

Author(s) : *Trivedi Amit Ranjan*
Roll No : *Roll No*
Supervisor(s) : *Dutta Alok*

Abstract

In this work, we have investigated the InAs/GaAs quantum dots made by the self assembly process, which are known as the Self Assembled Quantum Dots (SAQDs) in the literature. Because of the confinement in all the three dimensions, the electron and hole energy levels in the SAQD are quantized. We have devised a scheme to obtain the numerical solutions of this electron and hole energy levels. Because of the huge lattice mismatch between InAs and GaAs, the InAs/GaAs SAQDs are strained; moreover, this strain in the SAQD heterostructure is not uniform. Also, in the structure, it is large enough to affect the band energies significantly. Hence, first by using the ~k-^ method, we developed a model to obtain the strain induced band structure for InAs and GaAs. Later, using the continuum elasticity method, the spatial distribution of the various strain coefficients in the structure was obtained through simulations using ANSYS 9.0. The various strain coefficients along with the model to produce the strain induced band structure, were used to obtain the spatial distribution of the conduction, heavy-hole, light-hole, and split-off band energies in the SAQD heterostructure. Using these band energies, the Schrodinger equation was solved on MATLAB 7.2 to obtain the quantized electron and hole energy levels in the structure. A comparison of these energy levels for the various SAQD geometries is also presented. We also compared our results with those calculated by other authors, whence we could analyze the limitations of the continuum elasticity method. Towards the end, we have proposed a novel approach to analyze the effect of the magnetic field on the electron and hole energy levels. A close correspondence between the results obtained from our calculations and those obtained by the experiments was observed, which validates our approach. Similar calculations for the energy levels in the SAQD have been reported in various other works, however, the amount of required calculations in the other approaches is large enough, and thus, these approaches have severe limitations when used in rapid order of magnitude calculations. In this work, we have taken special case to develop a scheme using which the results can be obtained with adequate accuracy, and without much demand on computational resources.

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Title : *Design Of Delta-Sigma WithModulator Emphasis On Role Of Non- Idealities*

Author(s) : *Jain Sumit Kumar*
Roll No : *Y6104080*
Supervisor(s) : *Qureshi shafi*

Abstract

Modern electronic systems extensively use digital signal processing but require analog-to-digital and digital-to-analog converters to interface to the real analog world. There is strong cost and performance advantage in designing ADC's that can be integrated on the same substrate as the digital signal processing circuitry. The scaling of VLSI technology to deep submicron regime has dramatically improved the performance of digital signal processors. However, the poor component matching and reduced dynamic range of these deep sub micron CMOS technologies severely degrade the performance of the analog blocks. Delta-sigma ADC's, which are based on the principle of noise shaping and oversampling are well suited for implementation in VLSI technology as they are especially tolerant to circuit non-idealities and component mismatch. Also delta-sigma ADC's use digital filters which benefit from the continued scaling of the CMOS technology. Delta-sigma ADC's allows to trade the intrinsically available speed of deep submicron CMOS process for an increase of the accuracy. In this work a systematic methodology is developed to design any delta-sigma modulator architecture which can be implemented using switched capacitor approach. A complete set of behavioral models are developed to include various circuit level on-idealities for each of the functional building blocks used in delta-sigma modulator. Also behavioral models are developed at system level which provides designer the flexibility to choose the best architecture to meet specifications of any given application. Two different cascaded MASH delta-sigma modulators architectures are designed. The first design uses a single bit cascaded MASH 2-1 topology to achieve high-resolution. The OSR used is 64 and input signal bandwidth allowed is 80 KHz. The achieved SNDR for the converter is 87.69 dB with a dynamic range of 89 dB. The second design uses a single bit cascaded MASH 2-1-1 topology to achieve high-resolution. The OSR used is 32 and input signal bandwidth allowed is 160 KHz. Theachieved SNDR for the converter is 85.75 dB with a dynamic range of 87 dB. The key analog blocks designed are gain boosted folded cascode OTA, telescopic cascode OTA, folded cascade OTA, two stage miller OTA, common mode feedback loops forfully differential OTA designs, clock generator, band gap voltage reference generator, current reference generator, dynamic comparator, switches (PMOS, NMOS, Command bootstrap switches) and latches. All the designs are done in 3.3 V, 0.35 μm CMOS technology from TSMC using Mentor Graphics EDA tool suite.

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Title : *A study On The Effects Of Spatial Distributions Of Emissive Layer, Electron Blocking Layer And Hole Blocking Layer On The Characteristics Of Phosphorescent Organic Light Emitting Diodes*

Author(s) : *ToppoSundeep Ceasor*

Roll No : *Y3167368*

Supervisor(s) : *Qureshi shafi& Anand Raghubir Singh*

Abstract

Organic Light Emitting Diodes (OLEDs) are the emerging trends in modern display technologies. The distinguished characteristics of OLEDs for displays include enhanced luminance, high efficiency, better color tuning, wide viewing angle and flexible substrate. Tremendous amount of work has been done during the last decade to achieve low fabrication cost and high efficiency. Different materials as well as device architectures are in continuous progression. Phosphorescent OLEDs are the recent approaches in achieving high electroluminescence and efficiency. The present thesis concerns about the physical phenomena occurring inside the phosphorescent OLEDs. Particular attention is paid on the simulation and experimental behaviors of the devices. Different models have been suggested previously to explain the device physics. These models have been implemented and their effects on the device are studied. Experimental analyses have been done to comprehend the nature of OLEDs. Different structures have been devised so that factors affecting the electroluminescence and the efficiency can be explained. Harvesting of carriers in the emissive layer by the spatial distribution of electron blocking layer, emissive layer, and hole blocking layer is the key part of the thesis.

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Title : *Design Of Passive UHF RFID Tag Chip Operating A 915MHz For Use In Port For Access Control*

Author(s) : *Jaiswal Om Prakash*
Roll No : *Y3167208*
Supervisor(s) : *Qureshi shafi*

Abstract

This work presents the design of a fully integrated passive RFID tag working at 915 MHz which can be used in port for access control. The transponder gathers 4 W EIRP transmitted power from the base station. The communication between reader and tag is driven by the reader itself. The tag has to receive ASK modulated RF signal command transmitted from the reader. If the command is valid, it has to send its stored identity back to the reader. The tag contains a supply voltage generator, ASK demodulator, current controlled ring oscillator, voltage limiter, voltage regulator and power-on-reset circuit on the analog front end. Apart from this, digital block contains a receiver circuit and a 32 bit read only memory circuit. The integrated circuit (IC) is implemented in a 0.18 μm CMOS technology.

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Title : *Characterization Of IMIDAZOLINE-5-ONE Molecules For Solar Cell Fabrication*

Author(s) : *Mani Pramod*
Roll No : *Y6104060*
Supervisor(s) : *Iyer S Sundar Kumar*

Abstract

The main objective of this work is to find out the best molecule for bilayer solar cell fabrication from some of the novel molecules from the imidazoline-5-one family synthesized atilt Kanpur. Imodazoline-5-ones are the analogues of the chromospheres responsible for high fluorescence property of green fluorescent proteins (GFPs) discovered in jellyfish. These molecules are derivative of a bimolecular chromospheres, they have biodegradable nature, and these are environment friendly and non-polluting in nature. The in-house synthesis of these molecules allow for future tuning of the optical and electrical properties of these molecules by attaching suitable functional groups to the imidazoline-5-one ring.In this work four molecules from the imidazoline-5-one family molecule 1((4Z)-4-(4-Methoxybenzylidene)-2-((E)-styryl)-1-phenyl-1,4-dihydro-5H-imidazolin-5-one),molecule 2 ((4Z)-4-(4-N,N-Dimethylaminobenzylidene)-1-methyl-2-phenyl-5H-imidazolin-5-one),molecule3 ((4Z)-4-(4-N,N-Diphenyllaminobenzylidene)-1-methyl-2-phenyl-5Himidazolin-5-one)andmolecule4((4Z)-(4N,NDiphenyllaminobenzylidene)-1,2-diphenyl-5H-imidazolin-5-one) were studied. The electrochemical properties of these molecules were studied by absorption spectrum analysis, cyclic voltammetry (CV) analysis and hole transport layer/electron transport layer experiments. Finally the bilayer devices were fabricated. These molecules absorb the light in blue (440 - 490 nm) region from the solar spectrum. Thecyclic voltammeter analysis gives the values of HOMO energy level for these molecules. Tocalculate the hole and electron mobility the hole transport layer/ electron transport layer experiment were performed on these molecules by fabricating single layer device. Two combinations of bilayer devices proposed here. The bilayer device made by molecule 2 ((4Z)-4-(4-N,N-Dimethylaminobenzylidene)-1-methyl-2-phenyl-5H-imidazolin-5-one) and molecule 3((4Z)-4-(4-N,N-Diphenyllaminobenzylidene)-1-methyl-2-phenyl-5H-imidazolin-5-one) gives thebest solar cell effects. These showed a maximum short circuit current density of 61.84 nA cm-2,open circuit voltage of 1.5 V, fill factor 0.17 and efficiency 1.5E-5 % at an incident lightintensity of 100 mW cm-2. Effects of intensity variation on these fabricated bilayer devices were investigated. As we increase the intensity of the light the short circuit current density isincreasing, open circuit voltage is decreasing and the efficiency of the devices were decreasing.

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Title : ***A Study Of Encapsulation Methods And its Effect On OLED Degradation***

Author(s) : ***Rajoriya Anukool***

Roll No : ***Y6104009***

Supervisor(s) : ***Iyer S Sundar Kumar& Gupta Deepak(CSE)***

Abstract

Information displays always have been a topic of interest for consumer, scientist and engineers from all over the world. The display based on Organic Light emitting diode(OLED) is also not an exception. Early from its invention in 1987, OLEDs have gone through many changes and prototyping and due to combined efforts from all over the world, display based on OLED are finding themselves in the market. The superior qualities of OLED make it a potential candidate for future information display applicationlike e-paper, display on cloth etc, which one can only imagine in dreams. However, thedegradation of OLED is a key hurdle in realization of such application. This also makes itdifficult to replace existing flat panel displays with OLED based displays Work in this thesis concerns about the various aspect of encapsulation on OLEDdegradation. Particular attention is made to reduce the number of dark spots and its growth. The former is controlled by inclusion of new methods in conventional encapsulation. Dark spots growth is controlled by the use of an epoxy with low water vapor permeation and by reducing the cross section between the cover glass andsubstrate.Comparisons between different available epoxies have been made and by observing dark spots growth, the best epoxy has been selected. Application of pressure during encapsulation has successfully reduced the distance between cover glass and substrate. Heat treatment of device prior to encapsulation has reduced successfully the number of darks spots and some improvement in the current, voltage and luminescence has also been found out. Deposition of NPD on top of the cathode has also reduced number of dark spots; however, in this case heat treatment has not played any role in reduction of dark spots.

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Title : *Two-Dimensional Analysis And Modeling Of Undoped Cylindrical Gate-All-Around (GAA) MOSFETs*

Author(s) : *Agarwal Nidhi*
Roll No : *Y6104054*
Supervisor(s) : *Dutta Aloke*

Abstract

In this work, we present an analytical model of the 2-D potential distribution function inundated cylindrical Gate-All-Around (GAA) MOSFETs, based on the model developed by amid et al. The potential distribution function was obtained as a solution to the 2-D Poisson's equation in cylindrical coordinates, and allows one to obtain the extent to which the source/drain fields penetrate into the channel region. From this, analytical model of the minimum potential position in the channel as a function of the applied drain-to-source voltage and the device parameters is derived. This is then used further to develop expressions for the threshold voltage, the threshold voltage roll-off, the Drain Induced Barrier Lowering (DIBL)effect, and the sub threshold swing. The importance of these models lies in their ability to assess the magnitude of the various short channel effects that are becoming increasingly important as the device dimensions are being scaled down. Additionally, the sub threshold swing parameter is used to study the turn-off characteristics of the GAA-MOSFETs. It was found that these devices can reach the ideal value of the sub threshold swing, i.e., 60mV/decade, which allows them to be used with low values of the supply voltages, corresponding to the need arising with the downscaling of device dimensions. However, during the development of these analytical models, we came across several anomalies in the existing model of Humid et al. additionally, the results of the analytical model of Humid et al.did not have an exact match with the numerical simulation results reported by them, when we ourselves performed the simulations using MATLAB. Therefore, in this work, we made due modifications for all inconsistencies in the existing model. All the assumptions in the existing model of Hamid et al. were physically verified, and improved upon with rigorous quantitative justification, wherever necessary. An important contribution of this work wasto include the effect of the potential drop across the oxide in threshold voltage calculations, which to the best of our knowledge, have not been considered in earlier works. Additionally, a modified model of the potential distribution in radial direction is used, which exhibits quick convergence property. However, an exact match with the numerical simulation results of Humid et al. could still not be obtained, and therefore, correction factors were introduced in the models wherever necessary. This improved the matching to a great extent.

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Title : Modeling Of Double Gate FinFET For Analysis Of Dynamic
Author(s) : Patle Renu
Roll No : Y6104064
Supervisor(s) : Qureshi Shafi

Abstract

Double Gate (DG) nonclassical devices are becoming the most promising device structures for scaling in nanometer range. These devices have a promising future for low power and high speed circuit design by their unique feature of dynamic threshold operation through charge coupling between front and back gates. In this work the model and analysis is presented for this feature. The analysis is carried out for both long and short channel DGFinFETdevices. For long channel device the effective charge coupling factor is derived byusing the inversion charge centroid definition for undoped device. This analytical expression is used for extracting the impact of oxide thickness and channel (body) thickness on the dynamic threshold voltage range achievable. The sub threshold slope behavior is also modeled for both independent gate operation and DG mode operation ofFinFET device. For short channel device, first a model for effective channel length is presented in terms of source drain underlap, source drain doping gradient and gate bias.This model is then used to derive the effective charge coupling factor for short channel device. This factor is then used to gain the physical insight of dynamic threshold range and its dependence on bias and structural parameters.

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Title : *Transparent And White Organic Light Emitting Devices: Design, Fabrication And Characterization*

Author(s) : *Jain Mayank*
Roll No : *Y3167178*
Supervisor(s) : *Qureshi Shafi & Anand Raghubhir Singh*

Abstract

Organic light-emitting devices (OLEDs) have emerged from a stage of being research interest to a stage where they are finding themselves a part of many commercial applications. Initially organic semiconductors found applications in electroluminescence devices, but today they are also present in electronic applications like transistors etc. Transparent OLEDs, a dimension of organic industry, has proved itspotential for high-contrast, full color, flat panel, and head-up displays. In the similar manner, White OLEDs, another potential branch of OLEDs industry is useful for backlight applications, full color applications, interior illumination application, automotive dome lights and solid-state lighting.This thesis concerns the optimization of various factors for transparent OLEDsfabrication. Particular attention is paid to optimization of sputtering power for ITOdeposition, target-substrate distance, ITO thickness, metal cathode layer (Al) thickness. Comparative study which includes, light emission ratio from back and front sides, current-voltage characteristics, transparency and degradation mechanism, has been done for transparent devices formed with ITO capping layer and without ITO cappinglayer.Another topic addressed in the thesis is fabrication of White OLEDs, using single layer double doped architecture. Four different structures, with their affect on current density, luminescence characteristics and white light output are studied. Effect of change in red does pant concentration of presented. Apart from the above described topics, in beginning of the thesis, some fundamental aspects, basic working principles, device architectures, thin film deposition mechanism and principles device fabrication are presented.

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Title : *An Analytical Model Of The Eigen Energy Level For MOSFETs Having Ultra-Thin Gate Dielectrics*

Author(s) : *Yadav B Pavan Kumar*
Roll No : *Y6104018*
Supervisor(s) : *Dutta Aloke*

Abstract

With rapid and aggressive scaling of device dimensions of MOSFETs over the last decadeor so, in order to keep the various short-channel effects under check, the substrate dopingconcentration is increased continually along with a reduction in the oxide thickness.The immediate consequence of these two steps is that the vertical field increases manifold,which makes the quantum effects to set in, and creates carrier confinement within a narrowpotential well close to the semiconductor-insulator interface. A crucial parameter ofthis quantization process is the energy level of the first Eigen state (E0), which has to beobtained by a simultaneous solution of Schr¨odinger and Poisson equations. This methodis mathematically very tedious and computationally expensive due to numerical iterationsinvolved. Several attempts have been made by various researchers on the analytical modelingof this parameter, notable among them is the work by Stern. However, it used twoassumptions: the first one is an infinite barrier height (b) at the insulator-semiconductorinterface, and the second one is the triangular potential well approximation in the semiconductor.Recently, a semi-empirical model of E0 has been reported by Li et al., the resultsof which match the results obtained from numerical simulations very well. In this work,we have attempted to derive an analytical model of E0, without invoking either of the twoassumptions mentioned above. In order to take into account the effect of finite b at thesemiconductor-insulator interface, we used the approach invoking the asymptotic approximationsof the Airy function integrals to find the wavefunctions at the oxide and the semiconductor.Then, by the application of the boundary conditions at the oxide-semiconductorinterface, we developed the model for E0. The results were found to be quite encouraging,since over the practical range of the applied gate voltage, the error in E0 decreasedsubstantially as compared to that produced by Stern's model, taking the results of Li etal. As the reference. An important contribution of this method is the inclusion of b in the expression for E0, which, to the best of our knowledge, is hitherto not reported in anyanalytical E0 model available in the literature. Next, instead of assuming that the electricfield in the semiconductor is constant and equal to that at the surface (a consequence of thetriangular potential well approximation), we proposed a model for the actual electric fieldprofile, and extracted a constant effective electric field, by introducing a weight function.Better accuracy in the results was observed. Finally, the electric field profile model was improvedfurther to match the actual profile more closely, and an effective constant value ofthe electric field was extracted from this model. The usage of this expression for the effectiveelectric field in the model for E0 reduced the error to only about 2.8% (maximum), ascompared to about 23.5% (maximum) produced by Stern's model, over a range of [(0 − 2)V] applied gate-to-body voltage. Then, we equated, at Fox = 3 MV/cm, the results fromour final E0 model with that of Stern's with a modified exponent 0, and observed the variationof 0 as a function of b. As expected, it was seen that 0 is less than the value of2/3 reported by Stern. The model for E0 developed in this work is physics based, does notuse any of the assumptions stated above, and is analytical. Moreover, since b is explicitlyincluded in the model, it can be used for dielectrics other than SiO2 as well.

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Title : *A Study Of Materials, Processing And Operating Conditions On Fill Factor Of Bulk Heterojunction Organic Solar Cells*

Author(s) : *Verma Jai Kishan*
Roll No : *Y3167136*
Supervisor(s) : *Qureshi Shafi & Anand Raghubhir Singh*

Abstract

The energy demands of the world are ever increasing due to growth ofpopulation, infrastructure and amenities. There is need to find alternate ecofriendlyaffordable energy sources. The Photovoltaic (PV) technology gives clean, green and renewable energy. At present inorganic solar cells based on silicondominate the market. But organic solar cells are cheap, flexible and easy toprocess. This provides us with an alternative for inorganic solar cells.In this work we study the different factors affecting the performanceparameters of P3HT: PCBM based bulk heterojunction organic solar cells. Theeffect of buffer layer (PEDOT: PSS) on the fill factor and short circuit currentdensity is studied by using different dispersions of PEDOT:PSS which vary intheir conductivity. The fill factor improved from 0.11 to 0.52 on changing thegrade of PEDOT:PSS being used. It is found that more conductive PEDOT: PSSdispersion lead to better fill factor and current density. Illumination intensityalso plays significant role in working of the organic solar cell. With decreasinglight intensity the fill factor and efficiency of the device increase. At 20mW/cm2we have fill factor of 0.58 whereas at 89mW/cm2 we get only 0.48 as fill factor.Also annealing leads to improvement in fill factor from 0.43 to 0.52.

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Title : *Fill Factor In P3HT: PCBM Bulk Heterojunction Organic Solar Cells*

Author(s) : *SinghChetan Raj*
Roll No : *Y6104020*
Supervisor(s) : *Iyer S Sundar Kumar*

Abstract

The main goal of this work is to understand the causes and consequences of criticalsteps of fabrication process on efficiency determining parameters like Jsc and FF ofpolymer/fullerene bulk heterojunction organic solar cells. Basic device structure of bulkorganic solar cells is implemented to identify the attributes of material and interface onJsc and FF of devices.A study has been done on contemporary circuit models and on their limitations inexplaining behavior of low FF organic solar cells. It was found that high exponentiallyvarying series resistance in electrical circuit model has the potential to make curvatureconcave in fourth quadrant of I-V characteristics of solar cells under light. A new modelbased on physical properties of organic materials is proposed and the model worked toexpectations in explaining and in matching I-V characteristics of low FF organic solarcells.A unified troubleshooting technique is introduced for establishing a link between thematerial/interface properties with critical steps of fabrication. Different structures areproposed to trace out the critical factors and some characteristic signs are suggested toidentify them.Experiments are performed on developed guidelines to prove the validity of arguments.On varying the anode resistance while keeping its interface same, it is observed that theanode resistance can also be the critical FF determining parameter.In last, results from annealing experiments are reported and it is found that the thermalannealing conditions can be detrimental to the cathode interface if they are not performedin optimized way.

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Title : *Circuit Modeling ForP3HT: PCBM Based Solar Cells And Expermental Study Of Effect of PEDOT: PSS Layer On These Solar Cells*

Author(s) : *Srivastava Naveen*
Roll No : *Y6104052*
Supervisor(s) : *Iyer S Sundar Kumar*

Abstract

Solar cells based on organic materials like polymers and carbon based small molecules, owing to their usage of low cost materials and simpler manufacturing techniques like spin coating, should be able to overcome limitations in inorganic solar cells. In addition, the organic solar cells have the advantages of large area processing and compatibility with flexible substrates like plastics. Efforts continue to further increase the efficiencies of these solar cells to greater than 10% to make them commercially viable.This work describes the fabrication, characterization and modelling of P3HT: PCBM (poly 3.hexylthiopene-2, 5-diyl / [6, 6]-phenyl-C61-buytric acid methyl ester) based organic solar cell. P3HT: PCBM is used as organic active material, which generates electricity on illumination. ITO/PEDOT: PSS (Indium Tin Oxide/ Polyethylene dioxythiphene: Polystyrene sulphonic acid) is used as anode and Ca/Al is used as cathode material. This work concentrates upon the effect of PEDOT: PSS layer on performance of solar cell. The effect of varying the parameters related to the PEDOT: PSS film, such like thickness, dilution, and spin speed on the efficiency of organic solar cells is discussed in this work. It is observed that PEDOT: PSS layer has significant effect on solar cell parameters. The interface properties between PEDOT: PSS and P3HT: PCBM are discussed. A circuit model based on parasitic component is also developed in order to understand the device physics. The carrier mobility calculations are performed by impedance spectroscopy method and inductive effect in the devices is discussed.

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Title : *Study Of Effects Of Tio2 Nano Particles In P3HT: PCBM Bulk Heterojunction Organic Solar Cells*

Author(s) : *Singh Jyoti*
Roll No : *Y6104032*
Supervisor(s) : *IyerS Sundar Kumar*

Abstract

The use of inorganic solar cells remains limited due to the high costs imposed byfabrication procedures involving elevated temperature (400 °C to 1400 °C), high vacuum,and numerous lithographic steps. Organic solar cells that use polymers which can beprocessed from solution have been investigated as a low-cost alternative with solar powerefficiencies of up to 5%. Nonetheless, conventional inorganic solar cells routinely exhibitsolar power conversion efficiencies of 10%, and the most advanced, but also the mostexpensive models, can reach up to 40% efficiency.Solar cells employing the conjugated polymer films that are either spin-coated orprinted on plastic substrates offer an alternative to the conventional inorganic solar cellswith such potential advantages as low-cost, ease of manufacturing, non-toxicity, andlightness. During the last decade, the power conversion efficiency (PCE or η) of polymerbased solar cells has been steadily improved by the development of sophisticated devicearchitectures. However, the short exciton diffusion length and the insufficient utilizationof the incident light remain the most serious limitations on the effective and reliableoperation of organic solar cells. Herein, the former problem is solved by designing socalled bulk heterojunction (BHJs) or by optimizing the thickness of the active-layer. Theineffective conversion of input solar energy may be associated with the reflection ofincident light at substrate/active layer and electrode/active layer interfaces, which in turncauses the diminution of power conversion efficiency in the organic solar cells.In this work, the effect of TiO2 has been seen on power conversion efficiency in theBHJ polymeric solar cell by incorporating titanium dioxide nanoparticles into thecomposite active (photovoltaic) layer, comprised of P3HT, and PCBM. Nano-structuredTiO2 exhibits high processability, good electron transport characteristics, and excellentphysical and chemical stability, which are important requirements in the fabrication ofplastic solar cells. The influence of blending TiO2 nanoparticles in active layers iselucidated on both the optical properties and the electrical performance of P3HT-PCBMbased organic solar cells. With increasing concentration of TiO2 nanoparticles, deviceshowed reduced series resistance and increased open circuit voltage. Furthermore, the highly refractive TiO2 nanoparticles has increased the probability of internal lighttrapping by scattering the reflected from metal electrode, causing more photo-inducedcarrier to be generated in device. The transport of charge carriers through the active layeris also improved due to the formation of TiO2 nanoparticles/Ca/Al interfaces.

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Title : ***Design And Analysis Of AMESFET Wideband Amplifier For Fibre Optic Receivers***

Author(s) : ***Kumar V Lokeswara***

Roll No : ***Y6104042***

Supervisor(s) : ***JohnJoseph***

Abstract

Optical fiber communication systems are today employed as high-speed backbonelinks for both voice and data applications. There is a need for high performance and highspeedoptical receivers in the above applications. Low cost, high performance opticallinks can be designed with monolithic integration of photodetector and receiver circuitry.Such a complete integration is relatively easy for GaAs based receivers, and thetechnology behind GaAs-based Opto Electronic Integrated Circuits (OEICs) is quiteadvanced. Optoelectronic integrated circuits make use of the advantages of both light andelectrons. They exploit the advantage of low insertion loss and fast transmission of lightthrough the fiber and relatively easy controllability of electrons on the semiconductordevice. The metal-semiconductor-metal (MSM) photodiodes have proven very usefulwith the MESFET technology.Various configurations of optical receiver are discussed and transimpedanceamplifier has been selected for the final design. A detailed receiver noise analysis carriedfor the FET front end. The receiver consists of MSM detector, transimpedance preamplifier, main amplifier and a 50 Ω output buffer for matching. The design has beencarried with 0.6 μm gate length D-mode MESFET technology. The preamplifier has beendesigned with low noise matching technique with FET front end using cascode topology.The main amplifier consists of two stages of differential amplifier followed by an outputbuffer. The simulations were carried using Eldo analog simulator and results arepresented. The overall amplifier bandwidth is found to be roughly 5 GHz, making it anideal choice for typical high speed applications.

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Title : *Study Of The Effects Of Varying The Cathode In P3HT: PCBM Bulk Heterojunction Organic Solar Cells*

Author(s) : *Sahai Nitin*
Roll No : *Y2157252*
Supervisor(s) : *Iyer S Sundar Kumar*

Abstract

Solar energy remains the most abundant natural renewable source of energy thatis yet to be harnessed to its potential. Growing needs of energy consumption with hugeupsurge in development of our civilization has brought about ecological disaster due toemission of greenhouse gases on a large scale from oil and gas consumption. Solar cellstherefore, seem to be a viable option to answer all our energy needs maintaining theecological balance.However, the solar dream is yet to be fulfilled due to large prices of solar cellswhich might be countered by organic devices.In this study we fabricate organic solar cells and try to optimize their performancewith respect to cathode properties. Bulk heterojunction organic solar cells based onconjugated polymer poly 3-hexylthiophene (P3HT) as a donor, and derivatives of C60 [6,6]-phenyl C61-butyric acid methyl ester (PCBM) as acceptor have been fabricated. It hasbeen empirically established that Ca cathode devices demonstrate better photovoltaicperformance in terms of open circuit voltage and short circuit current density whencompared against Al cathode device.Also we have been successful in fabrication of large photovoltage organic solarcells by incorporating a thin interlayer of oxide barrier at the polymer cathode interface.Further Ca cathode deposition was optimized with respect to cathode thickness and anoptimum thickness of Ca was found which gave best results.

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Title : ***Realization Of Dual Bandpass Filter Using Multiport Finline And Metamaterials***

Author(s) : ***Rao V Madhusudana***

Roll No : ***Y6104044***

Supervisor(s) : ***Biswas Animesh***

Abstract

A three coupled fin-line wide bandpass filter of order 3 with fractional Bandwidth of 20% at Center frequency 10GHz for X-Band frequency (8-12 GHz) has been designed and simulated in commercial software Ansoft High Frequency Structure Simulator (HFSS). The same has been fabricated and measured with Network Analyzer, achieved reasonably good results. The same wide Bandpass filter has been converted into Symmetrical and asymmetrical band pass filters by using Meta-materials. This is a new concept for creating dual passband filters in fin-line technology. Asymmetrical dual pass band has been fabricated and measured with Network Analyzer and achieved satisfactory results.

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Title : SiC Quantum Dots By Spin On Technique
Author(s) : Dattu Jadgav Nilesh
Roll No : Y6104029
Supervisor(s) : Das Utpal

Abstract

In the ever changing world of today older materials and fabrication techniques posebottleneck in the growth of opto electronics. Thus new materials and techniques whichcan withstand challenging requirements such as high temperatures, high frequency, andhigh radiation environments are the need of the hour. There is an urgent need of opticalintra and inter connects on the commercial workhorse of silicon microelectronics, as onchip transmission delays are now a major bottleneck. However silicon is not a suitablelight emitting material. Hence there is a need to develop light emitters on silicon, whichare compatible with silicon microelectronics processing. For visible light emittingdevices on silicon, one needs to investigate wide bandgap materials of which GaN andSiC are the most commonly used. However, as the commercial viability is based on lowprocessing cost, any addition of light emitting device on silicon should also be obtainableat low cost.The work investigates low cost growth of SiC nanostructures on silicon, suitable forthe fabrication of the LEDs. The technique here uses spin coating of fullerene asprecursor on the surface of Si followed by high temperature annealing under argon flowenvironment. The fabricated nanostructures were studied before and after anneal usingSEM, AFM, STM, and room temperature photoluminescence. Spatial and sizedistribution of fullerenes over the surface has been optimized for spin rates (1350 rpm-4500 rpm) and fullerene concentrations (0.0681mg/mL-1 mg/mL) in the carbon disulfidesolvent. Three substrates of Si(100) ±0.5o misoriented, Si(100) 3o misoriented andSi(111) 3o misoriented towards the nearest (110) has been measured for this work.Image analysis of SEM images have shown C60 clusters before anneal with range of30-60 nm. The average separation of clusters was in the range of 120-160 nm. Si (100) 3osubstrate STM showed that the clusters are formed along the steps on the surface of Sisubstrate. It has been observed that lower C60 concentration in carbon disulfide produceslower cluster size and also smaller separation between the clusters.Anneal of the C 60 clusters have been done at 800oC and 1000oC for duration of 100minutes and 20 minutes respectively in argon atmosphere. The PL of SiC nanostructuresshows two peaks i.e. ~409 nm and second at ~434 nm for an excitation wavelength of350 nm. The combined FWHM linewidth is ~68 nm. None of the unannealed clustersshowed any luminescence. It is found that SiC/Si(100) luminescence is always poorerthan that of SiC/Si(111) by half an order of magnitude. 800oC anneal produced 1.2 timesbetter luminescence compared to 1000oC anneal, as obtained from the photoluminescenceintegrated intensity.It appears that 6H SiC phase exists for the 434 nm peak, as verified from the literature.The 409 nm peak matches with 4H SiC phase. The existence of quantum dots needs to beverified using a low temperature photoluminescence.In conclusion, a low cost spin on technique has to be established for the formation ofthe SiC nanostructures on Si, which show luminescence. However their quantum dotcharacter needs further investigation.

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Title : Monopole Antennain Double Negative Material Environments
uthor(s) : Khanna Pulkit
Roll No : Y3167246
Supervisor(s) : Sachidananda M

Abstract

The thesis explores the effect of double negative materials i.e. materialswith negative permittivity and permeability on monopole antennas. For thesame goal, several environments of double negative materials have beenconsidered. Environments considered consist of double negative shellsenclosing the radiating monopole antenna. The radiated power of theseantenna-shell structures is then analyzed theoretically to quantifyimprovements. The same structures are then simulated in the FEMLABplatform for numerical analysis. The results are then compared to establishconsensus between the theoretical formulations and numericalsimulations. The issue of practical implementation of these structures withartificial constructs for double negative materials is also discussed.

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Title : *Design And Development Of Resistive Strain-Gauge Based Automated Trackside BOGIE Monitoring System*

Author(s) : *Maroli Shailesh Kumar*
Roll No : *Y6104066*
Supervisor(s) : *John Joseph*

Abstract

Indian Railways (IR) is in a phase where it is investing a sizeable part of its resources in technology to monitor the health and performance of its rolling stock. In the days to come there will be tremendous pressure on the existing rail infrastructure to deliver in view of the rapid development and industrialization of the hinterland of the nation. The ever increasing need for economically viable, rapid and prompt transportation of people and goods will be the need of the hour. The task for IR is clearly and definitely cutout for rapid development of the nation.It is for the very first time in India that an exercise is being carried out to study the performance and parameters of a rail vehicle by the track side. The endeavor of this project is to develop an automated trackside bogie monitoring system using a set of strain gauges mounted on the tracks to measure the various forces exerted when a rail vehicle passes over it. From the force values recorded, information regarding the condition of wheelset/bogie is ascertained. Thresholds are defined for various parameters, which when exceeded, generates a fault report. The coach or wagon comprises a number of moving and stationary components. The measurement of forces will not directly result in identification of a faulty component. But the fault indication will definitely hint at an abnormal condition which may require immediate attention.The present set up is able to measure the average speed, as well as identify the type of locomotive and number of coaches and axles. A method for calculating the wheelset angle of attack has also been incorporated in the analysis. A set of strain-gauges were mounted on a 6 degree curve to obtain the precise timing signal for calculation of the angle of attack. Correlating a high derailment (L/V) ratio with a large angle of attack for a wheelset determines the wheelset/bogie to be faulty. It is observed that higher the speed of train, generally larger is the value of angle of attack. It is also noted that the angle of attack value obtained by this method has an accuracy of 3-4 milliradians compared to that obtained by a laser range finder, where it is of the order of 1 milliradian. Other factors like temperature, track condition, track curvature, precision and accuracy of strain-gauge mounting, soil condition and humidity also play an important role in the measurement of the parameters.

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