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Seventh International Multi-Conference on Systems, Signals & Devices

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Preface

Following the success of SSD'01 held in Hammamet-Tunisia, SSD'03 and SSD'05 held in Sousse-Tunisia, SSD'07 held in Hammamet-Tunisia, SSD'08 held in Amman-Jordan, SSD'09 held in Djerba-Tunisia, the seventh International Multi-Conference on Systems, Signals and Devices - SSD'10 to be held at Philadelphia University-Jordan, 27^{th} to the 30^{th} of June 2010. The conference program consists of 4 plenary sessions and 23 oral sessions. SSD'10 multi-conference is organized to include 4 conferences covering different fundamental and applied aspects:

1 "Int. Conf. on Systems Analysis and Automatic Control" (SAC)

2 "Int. Conf. on Power Electrical Systems" (PES)

3 "Int. Conf. on Communication and Signal Processing" (CSP)

4 "Int. Conf. on Sensors, Circuits and Instrumentation Systems" (SCI)

SSD'10 secretariat has received 145 submissions from 22 countries: Algeria, Austria, Bahrain, Canada, Egypt, Finland, France, Germany, India, Iraq, Italy, Jordan, Lebanon, Libya, Oman, Romania, Saudi Arabia, South Africa, Spain, Tunisia, U.A.E., United Kingdom, U.S.A.

Each paper has been reviewed by at least two reviewers of the program committee which consisted of more than 100 scientists from more than 30 countries. Only 104 papers have been accepted.

We would like to express our deep gratitude to all chairs and members of the program committee for their substantial reviews. Special thanks are due to all members of the organizing committees for their determination to make this event a promising success.

Finally, we would like to extend our deep gratitude to all those who have contributed to the financial support of SSD'10 financially.

Amman, June, 2010

Munther N. Baker

International Multi-Conference on Systems, Signals & Devices

Volume I
Summaries of the Conference on
Systems, Analysis & Automatic Control

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Seventh International Multi-Conference on Systems, Signals & Devices

Conference on Systems, Analysis & Automatic Control

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Topics: Advances in linear control theory, System optimization, Multivariable control, Large scale and infinite dimension systems, Nonlinear control, Distributed control, Predictive control, Geometric control, Adaptive control, Optimal and stochastic control, Robust control, Hierarchical and man-machine systems, Intelligent control systems, Robotics and mechatronics, System identification, Biological and economical models & control, Neural networks and neural control, Fuzzy systems and fuzzy control.

Contents

International Multi-Conference
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paper reference
SSD10-PL-1569330946

Industrial linked mechatronics, an application in autotronics

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Summary

Mechatronics and Mechatronic applications are becoming standard in all modern industries. In automobiles; the electronics components and their networking have a considerable and increasing ratio with respect to construction, function and cost. The objective of this lecture is to highlight the author's experience in linking academia with industry in developing a sustainable program for Mechatronics education and research. As a specific example; the ever increasing market need in automotive industry and electronics (Autotronics) will be focused.

The topics of the lecture will include: Need of Mechatronics in automobile industry, Automotive modern sensor technologies, actuators and control units, and a proposal for an industry linked program in Autotronics. This proposal includes a dynamic program that considers industry need as a powerful potential for academic education, postgraduate, and research. At the same time, the academic innovations and advanced research will have the advantage to inspire new feasible industry applications.

The authors experience in a multinational European /Egyptian project: "Development Of An Industry Linked Mechatronics Program and Training of Trainers (DIMPToT)" is to be briefly introduced. A proposal for a new regional Mechatronics project in which experts from Egypt, Jordan, Germany, Poland, and The U.K. will be also highlighted.

Keywords: Mechatronics, autotronics, industrial applications.

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SSD10-PL-1569288097

Diversification of the eddy current technology

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Summary

In metrology eddy current non-contact transducer have been widely used for measurement of position, displacement, cracks, vibration, proximity and alignment, as well as parts sorting applications over the past years. By reason of further developments of front end sensor elements as well as electronics, new application areas of eddy current sensors are technically feasible. In this paper lately achieved results in eddy current sensor developments will be presented.

Keywords: Eddy current, process control, rolling mill, gradiometer, tissue diagnostics.

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SSD10-PL-1569330948

Autonomous aerial vehicles: guidance, control and signal processing platform

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Summary

The use of unmanned systems is gaining momentum in civil applications after successful use by the armed forces around the globe. Autonomous aerial vehicles are important for providing assistance in monitoring highways, power grid lines, borders, and surveillance of critical infrastructures. It is envisioned that cargo shipping will be completely handled by UAVs by the 2025. Civil use of unmanned autonomous systems brings serious challenges. The need for cost effectiveness, reliability, operation simplicity, safety, and cooperation with human and with other agents are among these challenges. Aerial vehicles operating in the civilian aerospace is the ultimate goal which requires these systems to achieve the reliability of manned aircraft while maintaining their cost effectiveness.

In this presentation the development of an autonomous aerial vehicle will be discussed. The architecture of the system from the mission requirements to low level autopilot control laws will be discussed. Trajectory tracking and path following guidance and control algorithms commonly used and their implementation using of the shelf low cost components will be presented. Autonomous takeoff landing is a key feature that was implemented onboard the vehicle to complete its degree of autonomy. This is implemented based on accurate air-data system designed and fused with sonar measurements, INS/GPS measurements, and vector field method guidance laws.

Flight test data were collected to develop a complete mathematical model for the aircraft, and identify the stability and control derivatives of the UAV. A hardware-in-the-loop (HIL) simulation was used to develop and test the UAV autopilot hardware and software development virtually. A user friendly ground station is to interface with HIL using

external stick commands, and 3-D visualization of the vehicle's motion using flight-gear open source flight simulator.

The outcomes of the proposed research is that the AUS-UAV platform named MAZARI is capable of autonomous takeoff and landing based on a prescheduled flight path using waypoint navigation and sensor fusion of the inertial navigation system (INS) and global positioning system (GPS).

Several technologies need to be mastered when developing a UAV. The navigation task and the need to fuse sensory information to estimate the location of the vehicle is critical to successful autonomous vehicle. Currently extended Kalman filtering is used as fusion algorithm for position and poses estimation. Then path planning, trajectory generation and trajectory guidance alternative strategies is presented.

One of the important UAV mission is target surveillance using an onboard vision system. AUS-UAV Mazari is using a gimbaled camera for target monitoring and target tracking using basic digital image processing and techniques. The payload is integrated with the autopilot to lock on the target while the aircraft is moving.

Future plan is to develop a cooperation strategy between several vehicles in the air and on the ground. Use of vision system to aid the vehicle in localization using ground features is also under consideration.

Keywords: Autonomous aerial vehicles, guidance, control, image processing.

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paper reference
SSD10-PL-1569329494

Electromagnetic Fields and Human Health

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Egypt.

Summary

It's hard to imagine a world without electricity. And yet, wherever electricity is used, EMFs re created around the equipment and wires. These EMFs are usually invisible and imperceptible, but they are quite real. The interaction of EM fields with matter has been studied by physicists for over a century.

Today, EMFs are much better understood and documented than they were a few years ago. Calculations based on the classical equations have long been used to estimate the strengths and characteristics of the EM interactions with condensed matter, molecules, atoms and particles. Experiments have shown that these equations successfully represent the interactions, thus allowing physicists to use these interactions to investigate the basic properties of matter.

In this presentation the following will be present and explain: the electric and magnetic field, the field intensities are we exposed to in our everyday lives, their effects on the human body and on our health and the opinion of public health authorities around the world.

Keywords: EMF, electromagnetic fields, health effects, human health, environmental.

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SSD10-SAC-1569287875

Composite control of a delayed singularly perturbed system by using lambert-W function

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Summary

The composite state feedback control designed for singularly perturbed system SPS with small time-delay by using Lambert-W function is proposed in this paper. Based on the delayed slow subsystem (SS) and fast subsystems (FS) decomposition, we design a composite sate-feedback control. So the gain of delayed SS will be designed by using Lambert-W function and the gain of FS will be designed on the basis of classical pole placement method, and the two gains will be regrouped in global gain to design the delayed SPS. To illustrate the effectiveness of the proposed design approach we will it applies on a model of hydraulic delayed system.

Keywords: Singularly perturbed systems, order reduction, composite control, Lambert-W functin, time-delay systems.

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SSD10-SAC-1569288049

An improved output feedback decentralized control approaches for interconnected large scale systems

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Summary

In this paper, new approaches are proposed for characterizing robust decentralized controllers for discrete time large scale interconnected systems. In fact, it consists on a new stabilization condition, formulated as an LMI optimization problem parameterized by a scalar, offering an additional degree of freedom. This approach is also extended to treat the dynamic output feedback .Numerical examples are given to illustrate the effectiveness of the proposed design methods.

Keywords: Interconnected systems, decentralized control, output feedback, Lyapunov theory, linear matrix inequalities (LMI).

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SSD10-SAC-1569288059

A delay decomposition approach for exponential stability of perturbed neutral systems with mixed delays

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Summary

This paper deals with the exponential stability analysis problem of neutral systems with mixed time delays and nonlinear perturbations. Using the Lyapunov theory and the free weighing matrices method, a delay decomposition approach is developed by introducing a new quadratic Lyapunov Krasovskii functional, which is constructed by uniformly dividing the delay interval into multiple equal length subintervals. Based on this, a new delay dependent robust exponential stability criterion is derived in terms of Linear Matrix Inequalities (LMIs) technique. Numerical examples are carried out to support the applicability of the proposed approach and to demonstrate the effectiveness of our results.

Keywords: Exponential stability, time delay systems, Lyapunov method, linear matrix inequalities (LMI).

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SSD10-SAC-1569293549

FieldBus Scheduling Using Boltzmann Machine

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Summary

A centralized access control in fieldbus systems is characterized by the presence of a processing unit acting as link active scheduler (LAS), whose task is to manage the bandwidth, distributing it among a1l the producing devices, and respecting their time constraints. The bandwidth is distributed on the basis of a scheduling table containing transmission instants for the information produced by different processes in the system such as to guarantee correct scheduling. This paper discusses the results of using Boltzmann machine neural networks (NNs) with reduced scheduling tables. The work is proposed to replace the existing systems in many remote control stations connecting intelligent field devices.

Keywords: Fieldbus, real time systems, real time decision algorithms, neural networks, machine learning and ai, factory communication.

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SSD10-SAC-1569297089

An adaptive fault tolerant control in interconnected systems

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Summary

Partial or total systems failures may drastically change system leading to performance deteriorate and instability. The reliability and fault-tolerance of a control system can be achieved through the design of either an active or passive fault tolerant control (FTC) scheme. This work aims at the adaptive fault tolerant control using output feedback. Fault tolerant adaptive control is developed for N-interconnected subsystems with unknown sensors failures. Such sensors failures are characterized by some unknown inputs stuck at some unknown fixed values at unknown time instants. An effective output feedback controller structure is proposed for sensors failures compensation. The FTC scheme has an additive control in the adaptive controller which has an intrinsic robustness in terms of the stability and performance of the estimation sensors failure. This work is an extension of the additive control method presented in [8] to the interconnected subsystems. Numerical and simulation results are provided to demonstrate the effectiveness of the proposed controller.

Keywords: Adaptive control, additive control, fault tolerant control, interconnected systems, sensor failure.

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SSD10-SAC-1569287871

Output feedback controller using the high gain observer and the immersion technique for an induction motor

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Summary

This work deals with the synthesis of an output feedback predictive controller for an induction motor. The theoretical study showed the possibility of solving the control law design problem by taking into account input constraints. Furthermore, the unavailable state variables of the system are recovered by the incorporation of an observer. Two important titles in the design feature are worth to be emphasized. The first one consists in identification of electrical parameters by the immersion technique. The second consists in using the high gain observer (HGO) to perform on-line an accurate estimation of the mechanical speed, load torque and the rotor fluxes. The global scheme involves a design of a sensorless output feedback predictive controller. Simulation results for an induction motor are addressed to show the effectiveness of the applied control design method.

Keywords: Predictive control, observers, immersion, high gain observer, induction motor.

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SSD10-SAC-1569288117

Sliding mode observer for nonlinear mechanical systems subject to non-smooth impacts

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Summary

In control mechanical systems design, the velocity signal is not always available and may be corrupted by noise. It is therefore necessary to estimate it in order to construct the control law. This paper proposes a new sliding mode observer for nonlinear mechanical systems subject to non-smooth impacts. The estimation of the velocity signal is derived from only position measurements. The proposed observer ensures an asymptotic velocity observation also in presence of non-smooth impacts. Excellent simulation results are included to show the effectiveness of the proposed approach.

Keywords: Nonlinear observer, sliding mode, mechanical systems, non-smooth impacts.

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SSD10-SAC-1569288533

Robust speed and position observer using HOSM for sensor-less SPMSM control

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Summary

This paper presents the synthesis of a simple and effective speed and position observer for a Surface Permanent Magnet Synchronous Motor (SPMSM). The proposed observer based on Higher Order Sliding Mode (HOSM) is designed in order to ensure the robustness against disturbances and to avoid the chattering phenomenon which is inherent in standard first order sliding mode. The stability and finite time convergence of the developed observer are studied. Simulations are carried out using Matlab/Simulink to illustrate the robustness and the stability of the proposed observer.

Keywords: Permanent magnet synchronous motor, higher order sliding mode, observer, stability analysis, finite time convergence.

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SSD10-SAC-1569268111

Fuzzy adaptive sliding-mode control for a class of nonlinear systems

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Summary

A direct and an indirect adaptive fuzzy state feedback approximation are considered for a class of nonlinear systems. In this work the control system consists of sliding mode control and an adaptive fuzzy logic control. An adaptive fuzzy approximation plays a dominant role to maintain the closed- loop stability. The sliding- mode control is inserted to handle the influence of external disturbance and fuzzy approximation error instead of upper bound of the plant. In this work a stable direct and an indirect fuzzy adaptive sliding-mode controller for a class of nonlinear system are developed. The developed algorithms guarantee the asymptotic stability of the closed-loop system. Two simulation examples are given to illustrate the performance of the proposed methods. Computer simulation results confirm that effect of both external disturbance and fuzzy approximation error can be compensated by the developed methods. A comparative study is also conducted for both algorithms.

Keywords: Adaptive fuzzy control, sliding-mode control (SMC), fuzzy control, nonlinear systems.

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paper reference
SSD10-SAC-1569287091

Fuzzy optimal control of nonlinear systems

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Summary

This work is aimed at looking into the fuzzy optimal control of nonlinear systems detailing adopted mechanisms and approaches in order to be able to control these systems. First of all, the nonlinear systems have been modeled by Sugeno fuzzy systems. Then, three approaches have been considered. In the first one, a local approach to obtain fuzzy models has been applied. The second one is a global fuzzy optimal control procedure. The third one consists in the use of genetic algorithms to optimize parameters of fuzzy controllers. At the end of this work, a comparative study between considered approaches has been presented. It has been found that (i) the global approach gives better results, (ii) the optimized fuzzy controller by genetic algorithms presents a slight sub-optimality, and (iii) the local approach gives also a slight sub-optimality.

Keywords: Optimal control, fuzzy modeling, nonlinear systems, genetic algorithms.

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paper reference
SSD10-SAC-1569290861

Fuzzy predictive control based on Takagi-Sugeno model for nonlinear systems

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Summary

In this paper, a method of designing a nonlinear predictive controller based on a fuzzy model of the system is presented. The Takagi-Sugeno fuzzy model is used as a powerful structure for representing nonlinear dynamic systems. So, the strategy of the fuzzy predictive control based on a fuzzy Takagi-Sugeno model is applied to the control of a chemical reactor. Indeed, the work is consists to develop, in a first step, a fuzzy model from a merger of a number of local models obtained by the principle of linearization around an operating point, or by learning through the gradient algorithm. In a second stage and basis on local models already developed, a fuzzy predictive control is synthesized with different approaches. The principal aim is to apply local generalized predictive control.

Keywords: Takagi-Sugeno fuzzy models, nonlinear systems, predictive control, fuzzy predictive control.

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SSD10-SAC-1569299988

Fuzzy control of a two-wheel balancing robot using DSPIC

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Department of Mechatronics Engineering, Philadelphia University, Jordan

Summary

This paper is concerned with the design and implementation of a two-wheel balancing robot. The angle and angle change are used as inputs to the robot system in order to calculate the appropriate motor force to balance the robot. ADXL330 accelerometer and two DC motors are used as the sensor and actuators, respectively. More importantly, the robot system uses fuzzy control that is implemented on DSPIC 30f2010. The robot under study represents a mechatronic system since it includes the integration design among mechanics, electronics, and embedded smart controllers. The system model is first tested under Matlab/Simulink. Then, the Printed Circuit Boards are designed, the C-program is written, and the mechanical structure is built. Finally, the robot is built and tested in the laboratory.

Keywords: Balancing robot, fuzzy control, DSP.

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paper reference
SSD10-SAC-1569283209

Comparison between neural network based PI and PID controllers

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Summary

The Pneumatic actuation systems are widely used in industrial automation, such as drilling, sawing, squeezing, gripping, and spraying. Also, they are used in motion control of materials and parts handling, packing machines, machine tools, and in robotics; e.g. two-legged robot. In this paper, a Neural Network based PI controller and Neural Network based PID controller are designed and simulated to increase the position accuracy in a pneumatic servo actuator. In these designs, a well-trained Neural Network provides these controllers with suitable gains depending on feedback representing changes in position error and changes in external load force. These gains should keep the positional response within minimum overshoot, minimum rise time and minimum steady state error. A comparison between Neural Network based PI controller and Neural Network based PID controller was made to find the best controller that can be generated with simple structure according to the number of hidden layers and the number of neurons per layer. It was concluded that the Neural Network based PID controller was trained and generated with simpler structure and minimum Mean Square Error compared with the trained and generated one used with PI controller.

Keywords: Neural networks, PID, PI, pneumatics.

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SSD10-SAC-1569287205

Neural emulation applied to chemical reactors

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Summary

In this paper, a real time recurrent learning-based emulator is presented for unknown dynamics of nonlinear plants. This emulator is based on fully connecte recurrent neural networks. Starting from zero values, updating rate, time parameter and weights of the instantaneous neural emulator adapt themselves in order to track continuously the plant dynamics. The contribution of this paper is to validate the emulator with experimental data from the batch reactor of ENIG, Tunisia.

Keywords: Neural emulation, fully connected recurrent neural networks, RTRL algorithm, chemical reactor.

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paper reference
SSD10-SAC-1569292047

Neural Approches for Modelling Nonlinear systems

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Summary

This paper deals with the problem of neural modelling of nonlinear systems. In a first place, we will discuss the neural modelling process. The approach adopted of neural modelling will be presented in a second place; this method is based on mono-network neural modelling and multi-network neural modelling. The results of simulation obtained will be illustrated by a nonlinear system of second order and by a chemical process.

Keywords: Neural modelling, nonlinear systems, mono-network neural modelling, multi-network neural modelling.

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Robust adaptive path following for a nonlinear third order Nomoto's ship model

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Summary

Scientific development in various areas of science and engineering techniques pushed automatic research to study more and more non-stationary systems including variable parameters. Because of using a command with fixed parameters can lead in some works to a failure and cannot maintain or achieve good performance indices that are increasingly required in several industrial applications. We focus on this paper on the control law with parameters that can be adjusted during the time (i.e. use an Adaptive command structure), and this is a well known technique of adaptive backstepping. The Adaptive version of the backstepping technique includes the ability to summarize the controllers for a large class of nonlinear systems with known structure and uncertain parameters. Although the robustness of the control law has been intensively studied in the case of linear systems, many other robust controllers were involved in the case of nonlinear systems. In this paper, we are studying the control problem of a third order Nomoto model. The study unfolds in two steps: First, an adaptive backstepping procedure is applied to an uncertain strict feedback form which presents the model of our ship, to track a given reference asymptotically and estimate the uncertain parameters which characterize the ship's model. Second, the reference signal supplied along with new position to be attained by the ship. To ensure this reference, a LOS algorithm is therefore presented. The main idea of the LOS algorithm is to give an intuitive understanding of the behavior of the ship: That consists on steering the actual ship's heading to a desired angle. The guidance by the LOS algorithm has been also treated by Healey, Lienard and Fossen and calculations have

been developed by Morten. This shows that it is an effective method for marine vehicle navigation and this is thanks to its simplicity, its low cost and flexibility to sudden changes in the desired specifications for the followed path. In this paper, an adaptive backstepping method is used for ship course tracking control. This has been done by applying a reference signal derived from a LOS algorithm. Simulation results show the effectiveness of the proposed work and the designed controller can be used to the ship course tracking with good performances.

Keywords: Adaptive backstepping control, nonlinear control, adaptative control, line of sight.

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SSD10-SAC-1569293323

Structured mixed-sensitivity H_∞ design using particle swarm optimization

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Summary

In this paper, a new structured mixed-sensitivity H_∞ design approach, based on the Particle Swarm Optimization (PSO) technique, is proposed. The optimization-based synthesis problem is formulated and solved by a constrained PSO algorithm. In the proposed approach, a PID controller's structure is adopted. The case study of an electrical DC drive benchmark is envisaged to illustrate the efficiency and viability of the given control strategy. A comparison to another similar evolutionary algorithm, such as Genetic Algorithm (GA), shows the superiority of the PSO-based method to solve the formulated optimization problem. Simulations and experimental results show the advantages of simple structure, lower order and robustness of the proposed controller.

Keywords: Structured H_∞ design, particle swarm optimization, genetic algorithms, electrical DC drive, real-time experimentation

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SSD10-SAC-1569296287

Sliding mode control for non linear water treatment system

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Summary

The ultraviolet irradiation presents a particular solution for the water disinfection, This paper presents a new state space model of a Ultraviolet (UV) lamp, used in a water disinfection pilot unit fed by a photovoltaic source. The non linear model relates the current and the conductivity of the low pressure discharge lamp used for water treatment was developed. The sliding mode control approach of a class of non linear systems subjected to control approach for the power UV lamp and power motor-driven pump is established. Reliable results are given to show the interest of the sliding mode control of complex physical systems.

Keywords: UV Lamp, state space modelling, sliding mode control.

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On the internal model control of uncertain systems

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Summary

The robust control of an uncertain continuous linear system is evoked in this paper. The stability study for this class of system is based on the application of the Hurwitz and Kharitonov theorems. An approach of internal model controller synthesis for uncertain linear continuous systems is proposed in this paper. This approach is based on the use of nominal model of the uncertain system. The case of an uncertain system is presented to show the effectiveness of this proposed control approach.

Keywords: Internal model control, uncertain systems, robust control, Kharitonov's theorem, Routh-Hurwitz criterion.

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paper reference
SSD10-SAC-1569314778

A hybrid evolutionary design of neuro-fuzzy systems

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Summary

In this paper, a hybrid evolutionary approach, combining the theory of learning automata (LA) and the steadystate genetic algorithm (SSGA), is proposed for design of TSK type fuzzy model (TFM). In the proposed mimetic approach, both the number of fuzzy rules and adjustable parameters in the TFM are designed concurrently. A learning automaton, which systematically updates a strategy to enhance the performance in response to the output results, is used to find the optimal number of rules, whereas the SSGA is used to perform the tuning of the TFM parameters. Computer simulations have demonstrated that the proposed hybrid method performs better than some existing methods.

Keywords: TSK-type fuzzy model, evolutionary learning, learning automata, SSGA.

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Strong simultaneous stabilization problem using linear matrix

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Summary

The problem of designing a stable controller to stabilize a given plant is known as strong stabilization problem (StSP). While stabilizing a set of plants by a single controller is known as simultaneous stabilization problem, (SSP). If the controller is stable in the SSP, the problem is known as strong simultaneous stabilization problem, (SSSP). It is known that the right half plane zeros of the closed loop transfer function, (the right half plane zeros of the plant plus the right half plane poles of the controller), affect its ability to track reference signals and/or to reject disturbances. Therefore, it is preferable to use a stable stabilizing compensator whenever possible, since in this case the closed loop right half plane zeros are those of the plant only. The StSP of linear time-invariant systems was first addressed and solved for SISO systems by Youla in (1974), who presented a tractable condition, called "parity interlacing property (PIP)", to check whether a given plant is strongly stabilizable or not. A plant G is said to satisfy the PIP if the number of poles of G between any pair of real right half-plane blocking zeros is even. The PIP was generalized to MIMO systems by Vidyasagar (1985). While the PIP is an elegant result, it does not provide a procedure to find a stable controller. A general procedure to construct a stable controller that stabilizes a given MIMO plant was not provided. The attempts to provide such a stable controller are classified into four categories, see for example Saif (2009) and the references therein. The SSP was first introduced by Saeks and Murray in (1982) and by Vidyasagarand Viswanadbam in (1982). This problem can be viewed as a reliable stabilization problem, where the set of plants to be stabilized may present a plant that operates in various modes of some failures (e.g., failure of sensor, severance of loops, software breakdown). If some failures occur, the dynamics of the system

will change. In such a case, it is hoped to find a controller that can stabilize the system despite any possible failures. Another application is the design of a fixed controller for linear plants characterized by different modes of operations or for the stabilization of nonlinear plants linearized at several equilibrium points. The complexity issue of simultaneous stabilization was discussed in Blondel and Gevers (1993). They proved that the simultaneous stabilization problem of three linear systems is rationally undecidable. Toker and Ozbay in (1995) and Syrmos, et al in (1997) concluded that this problem is very difficult due to its NP-hard nature. In this paper, first the strong stabilization problem of proper and non-minimum phase linear time-invariant systems is formulated. The formulation of the problem resulted in a sufficient condition in a form of linear matrix inequality (LMI) and necessary and sufficient condition is given in a form of quadratic matrix inequality, (QMI). Then this method will be extended to solve the strong simultaneous stabilization for a collection of continuous-time systems.

Keywords: Strong stabilization; simultaneous stabilization; stable controllers; linear matrix inequality.

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Adaptive tracking control of a mobile manipulator

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Summary

In this paper, we propose a computed torque controller for a dynamic model of non-holonomic mobile manipulator with bounded external disturbances in order to treat the adaptive tracking control. Firstly, a velocity controller is designed for the kinematic steering system. Secondly, a computed torque controller is designed such that the mobile manipulator velocity converges to the desired velocity controller deduced from the first step. In particular, the mobile manipulator can globally follow any path such as a straight line or a circle. Simulation results are given to demonstrate the effectiveness of the proposed controller.

Keywords: mobile manipulator, adaptive tracking control, computed torque controller.

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Power wheelchair driver behavior modelling

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Summary

Assisting persons in their vehicle driving task is essential for drivers comfort and security. Vehicle Driver behavior modelling is of main interest in order to provide assistive control. Many research teams have addressed this question. This is even more important in the case of handicapped persons. However, work in this domain is very scarce. The diversity of handicap situations renders the assistive vehicle control essential and needs more accurate modelling. In spite of their difficulties wheelchair control is not adapted to the individual need of handicapped persons. In this paper a model is proposed to account for wheelchairs driver behavior. This model is then tested on a wheelchair dynamic model. This model is intended to help analyzing the driver's capacity as well as for the development of personalized wheelchair controllers that take into account the driver's handicap situation.

Keywords: Behavior modelling, wheelchair driver, assistive control.

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Mutual and external synchronization control of multi-robot systems

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Summary

In this paper, we investigate the synchronization of robot manipulators group under coordinated and cooperative scheme. In cooperative schemes all agents were fully interconnected, such that all robots have a weight on the overall dynamics. In the coordinated schemes the leader robot or the master robot establishes the synchronized action of all the slave systems. Based on emergent consensus algorithm, the proposed controller works to position synchronization of multiple robot manipulators. The control strategy is to synchronize the angular position and the velocity of each robot in the system with respect to the common desired trajectory and the angular positions and velocities of other robots. Modelled by an undirected graph, the cooperative robots network only requires local neighbor-to-neighbor information exchange between manipulators and does not assume the existence of an explicit leader in the team. However the objective in coordinated scheme is to design interconnections and feedback controllers for the slaves, such that their positions and velocities synchronize to those of the leader robot. It is assumed that network robots have the same number of joints and any configuration made possible by one in the group can be completed by each robot in the cooperative system.

Keywords: Synchronization, cooperative multi-robots, master-slave scheme, trajectory tracking.

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Vibration controllability and observability of a single-link flexible manipulator

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Summary

This work presents a comparative study of two different control strategies for a flexible single-link robotic manipulator. The dynamic model of the flexible manipulator involves modeling the rotational base and the flexible link as rigid bodies using Lagrange method. The resulting system has one rigid Degree-Of-Freedom (1 DOF). Two types of regulators are studied and discussed: the State-Feedback controller, and the Linear-Quadratic regulator (LQR). While the latter is obtained by resolving the Riccati equation, the state-feedback consists on poles placement. A simulation is performed on MATLAB (7.5.0)/SIMULINK (V7.0)®, and later on, experiments were achieved on the flexible beam Quanser module. Experimental results are presented and compared at the end of this paper.

Keywords: Single-link flexible manipulator, state-feedback controller, linear-quadratic regulator.

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Fuzzy control approach for optimization mobile robot navigation in a cluttered environment

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Summary

Obstacle avoidance and path planning are the most important problems in mobile robots. In this paper, a fuzzy logic controller has been constructed in order to train an intelligent robot. Gradient method is used to optimize consequences of a Sugeno fuzzy logic controller for the mobile robot navigation, in order to reach a target in a cluttered environment. Not only simulation results are shown in this paper, but also the real-time implementation has been realized onto the mini robot Khepera II. Simulation results verify successfully the application of the proposed method to real motion situations.

Keywords: Fuzzy logic, gradient method, robot navigation, obstacle avoidance.

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SSD10-SAC-1569327414

A real time vision feedback system for automation of a nano-assembly manipulator inside scanning electron microscope

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Summary

In this paper, a vision feedback mechanism is simulated and proposed to automate the assembly process of nano-devices. The bottom-up approach using heterogeneous assembly at the nanoscale is become recently a doable trail in nano-manufacturing. Nano-manipulators inside a scanning electron microscope (SEM) have been adopted as a nanofabrication method to build nano-devices from various nano-components in real-time. Most of the current nanomanipulators inside SEM are operated manually and take relatively long time to construct nano-devices. Obtaining a feedback signal for precise automated nano-manipulations poses a major technical challenge. This research proposes the use of a vision feedback control to automate the most well-known Zyvex® nano-manipulators inside SEM. A proof of concept is demonstrated using a macroscale stage with a vision feedback system, end-effector and computer integrated controller based on Labview package. The evaluation of this mechanism is conducted by observing the positioning of an $X-Y$ actuated end-effector accurately near a predefined target. This feedback system can be integrated with Zyvex® nano-manipulators inside a SEM to automate the nano-manufacturing process.

Keywords: Nano-manipulator, vision feedback, automation.

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A rule-based system for trajectory planning of an indoor mobile robot

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Summary

In this paper, a software simulation model is developed for a two wheels driven mobile robot motion controller that can navigate the robot safely through an unknown environment. The work involves the design of a controller, which has four functions: motion control; obstacle avoidance; self-location; and path planning both global and local. The proposed controller is responsible for the mobile robot navigation after it generates a trajectory between start and goal points. Also it enables the robot to operate successfully in the presence of various obstacles present in any user built maps. The mobile robot is able to locate its position on any given map. The dynamic of the mobile robot is examined and the time constant of the two motors, which affects the direction of the mobile robot motion, is controlled. Obstacle avoidance is implemented with Fuzzy Logic Controller. The numerical experiments demonstrated that the indoor robot navigated successfully in tight corridors, avoided obstacles and dealt with a variety of world maps with various irregular wall shapes that were presented to it.

Keywords: Mobile robot, fuzzy logic controller, path planning, robot navigation, obstacle avoidance.

Author Index

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Contents

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Industrial linked mechatronics, an application in autotronics

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Summary

Mechatronics and Mechatronic applications are becoming standard in all modern industries. In automobiles; the electronics components and their networking have a considerable and increasing ratio with respect to construction, function and cost. The objective of this lecture is to highlight the author's experience in linking academia with industry in developing a sustainable program for Mechatronics education and research. As a specific example; the ever increasing market need in automotive industry and electronics (Autotronics) will be focused.

The topics of the lecture will include: Need of Mechatronics in automobile industry, Automotive modern sensor technologies, actuators and control units, and a proposal for an industry linked program in Autotronics. This proposal includes a dynamic program that considers industry need as a powerful potential for academic education, postgraduate, and research. At the same time, the academic innovations and advanced research will have the advantage to inspire new feasible industry applications.

The authors experience in a multinational European /Egyptian project: "Development Of An Industry Linked Mechatronics Program and Training of Trainers (DIMPToT)" is to be briefly introduced. A proposal for a new regional Mechatronics project in which experts from Egypt, Jordan, Germany, Poland, and The U.K. will be also highlighted.

Keywords: Mechatronics, autotronics, industrial applications.

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Diversification of the eddy current technology

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Summary

In metrology eddy current non-contact transducer have been widely used for measurement of position, displacement, cracks, vibration, proximity and alignment, as well as parts sorting applications over the past years. By reason of further developments of front end sensor elements as well as electronics, new application areas of eddy current sensors are technically feasible. In this paper lately achieved results in eddy current sensor developments will be presented.

Keywords: Eddy current, process control, rolling mill, gradiometer, tissue diagnostics.

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paper reference
SSD10-SCI-1569330948

Autonomous aerial vehicles: guidance, control and signal processing platform

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Summary

The use of unmanned systems is gaining momentum in civil applications after successful use by the armed forces around the globe. Autonomous aerial vehicles are important for providing assistance in monitoring highways, power grid lines, borders, and surveillance of critical infrastructures. It is envisioned that cargo shipping will be completely handled by UAVs by the 2025. Civil use of unmanned autonomous systems brings serious challenges. The need for cost effectiveness, reliability, operation simplicity, safety, and cooperation with human and with other agents are among these challenges. Aerial vehicles operating in the civilian aerospace is the ultimate goal which requires these systems to achieve the reliability of manned aircraft while maintaining their cost effectiveness.

In this presentation the development of an autonomous aerial vehicle will be discussed. The architecture of the system from the mission requirements to low level autopilot control laws will be discussed. Trajectory tracking and path following guidance and control algorithms commonly used and their implementation using of the shelf low cost components will be presented. Autonomous takeoff landing is a key feature that was implemented onboard the vehicle to complete its degree of autonomy. This is implemented based on accurate air-data system designed and fused with sonar measurements, INS/GPS measurements, and vector field method guidance laws.

Flight test data were collected to develop a complete mathematical model for the aircraft, and identify the stability and control derivatives of the UAV. A hardware-in-the-loop (HIL) simulation was used to develop and test the UAV autopilot hardware and software development virtually. A user friendly ground station is to interface with HIL using

external stick commands, and 3-D visualization of the vehicle's motion using flight-gear open source flight simulator.

The outcomes of the proposed research is that the AUS-UAV platform named MAZARI is capable of autonomous takeoff and landing based on a prescheduled flight path using waypoint navigation and sensor fusion of the inertial navigation system (INS) and global positioning system (GPS).

Several technologies need to be mastered when developing a UAV. The navigation task and the need to fuse sensory information to estimate the location of the vehicle is critical to successful autonomous vehicle. Currently extended Kalman filtering is used as fusion algorithm for position and poses estimation. Then path planning, trajectory generation and trajectory guidance alternative strategies is presented.

One of the important UAV mission is target surveillance using an onboard vision system. AUS-UAV Mazari is using a gimbaled camera for target monitoring and target tracking using basic digital image processing and techniques. The payload is integrated with the autopilot to lock on the target while the aircraft is moving.

Future plan is to develop a cooperation strategy between several vehicles in the air and on the ground. Use of vision system to aid the vehicle in localization using ground features is also under consideration.

Keywords: Autonomous aerial vehicles, guidance, control, image processing.

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SSD10-PES-1569329494

Electromagnetic Fields and Human Health

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Summary

It's hard to imagine a world without electricity. And yet, wherever electricity is used, EMFs re created around the equipment and wires. These EMFs are usually invisible and imperceptible, but they are quite real. The interaction of EM fields with matter has been studied by physicists for over a century.

Today, EMFs are much better understood and documented than they were a few years ago. Calculations based on the classical equations have long been used to estimate the strengths and characteristics of the EM interactions with condensed matter, molecules, atoms and particles. Experiments have shown that these equations successfully represent the interactions, thus allowing physicists to use these interactions to investigate the basic properties of matter.

In this presentation the following will be present and explain: the electric and magnetic field, the field intensities are we exposed to in our everyday lives, their effects on the human body and on our health and the opinion of public health authorities around the world.

Keywords: EMF, electromagnetic fields, health effects, human health, environmental.

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Torque and speed estimators to be implemented in a control strategy dedicated to TSTPI-fed BDCM drives

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Summary

Major improvements of the cost-effectiveness and of the reliability of electric machine drives could be gained through the integration of reduced structure inverters. Within this approach, the three-switch three-phase delta- shaped inverter (TSTPI) turns to be an interesting candidate. In a previous work, we have found that high performance of the TSTPI fed brushless DC motor drive could be gained following the implementation of a dedicated control strategy including a torque loop in order to reduce torque ripple during sequence-to-sequence commutations. Therefore, beyond the speed, the electromagnetic torque estimation turns to be a necessity. The paper proposes BDCM speed and torque estimators which are developed taking into account the waveforms of the phase back-EMFs and the outputs of six-pulse encoder associated to the motor.

Keywords: Back-EMF, electromagnetic torque and speed estimators, three-switch three-phase inverter, commutation, brushless DC motor.

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paper reference
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Braking of induction motor with the technique of discrete frequency control

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Summary

Braking of induction motor has been the subject of many researches in order to improve its performances. Many braking induction motor's strategies have been developed. Conventional braking modes are electromechanical such as braking with servo motor and counter current braking; then electrical one as direct current braking (DC). These two techniques have major drawbacks which limit their use. The first one is characterized by high braking current which reaches 7 pu and for the second one, brake torque is important only low speeds. In this paper a new electrical braking mode based on discrete variable frequency control (DFC) is suggested. Its is leading to significant reduction of braking current and improve the braking torque. The proposed strategy has been verified experimentally on a laboratory machine using induction motor feed by three phase inverter, AC thyristors monitored by a microcontroller PIC 16F867.

Keywords: induction motor, braking, discrete frequency control.

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SSD10-PES-1569288275

Sensorless speed and flux control scheme for an induction motor with an adaptive backstepping observer

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Summary

This paper deals with the synthesis of an adaptive nonlinear backstepping-observer for sensorless speed and flux backstepping control of Induction Motor (IM) drive with on-line rotor resistance adaptation. The backstepping control purpose is based on stability analysis established from Lyapunov theory. This approach takes system nonlinearities into account in the control system design stage. Controlled rotor flux and speed are given from an adaptive backstepping-observer. The effectiveness of this strategy has been successfully verified through computer simulations in terms of the reference tracking ability and the robustness against parameters variation.

Keywords: Induction motor, backstepping control, Lyapunov stability, backstepping-observer, sensorless control.

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Analysis of stator short-circuit faults for induction machine using finite element modelling

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Summary

In this paper we present an analysis on the different types of short-circuit (sc) that may affect the stator windings by means of a finite element model. Three cases of short-circuit were simulated on the electrical circuit of stator. The simulation of short-circuit faults allowed to consider Miscellaneous cases which may occur. The machine is modelled in magneto-evolving.

Keywords: Analysis, induction machine, short-circuit, finite element model.

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Classification of induction machine faults

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Summary

This paper presents the theoretical foundation of a method for classifying current waveform events that are related to a variety of induction machine faults. The method is composed of three sequential processes: feature extraction, feature selection and classification. The proposed feature extraction tool, time-frequency ambiguity plane with kernel techniques, is new to the fault diagnosis field. The essence of the feature extraction is to project a faulty machine signal onto a low dimension time-frequency representation (TFR), which is deliberately designed for maximizing the separability between classes. A distinct TFR is designed for each class. The feature selection seeks for the optimal number of features taking correlation into account. The classifier uses a quadratic discriminant function and mahalanobis distance as distance measure. The flexibility of this method allows an accurate classification independent from the level of load. This method is validated on a 5.5-kW induction motor test bench.

Keywords: Classification, induction machine, diagnosis, time-frequency.

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SSD10-PES-1569295237

Disturbance performance improvement of distance relay with aid of wavelet

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Summary

The present work deals with design of three-phase distance relay using wavelet multi-details transform technique. This technique is used to the fragment signal to details signals. The frequencies of those fragmented signals depend on the sample frequency. The energy levels of these chosen details are calculated for the three phase currents. Those are used to detect and to distinguish fault cases from other disturbances. On spite of identify the nature of fault. The apparent impedance as a vector has been calculated and then compared with setting impedance using the same technique.400kv northern region network is taken as an example for application . Mat lab 7.2 is used for representation of the system.. The results show that the relay respond to the faults with high speed and accuracy and distinguished faults from other disturbances as well as identify the type of fault. A trip signal to the circuit breaker issued after 20 milliseconds from the moment of fault.

Keywords: Distance relay, wavelet, fault.

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The investigation of power distortion in a three-phase modified controlled converter circuit

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Summary

Power system and its installation utility suffer from harmonic pollution due to the nature of non-linear load applications. The most reliable and significant approach, in order to contribute to minimize the harmonic pollution, is to treat each type of load autonomously. Therefore, this paper is investigating all types of power components for a filter circuit which is designed and used to reduce the harmonic amplitudes of the ac supply currents of a three phase six pulse controlled converter. The simulation results show that the filter circuit is active and reliable in the rectification and inversion modes, where dc machine is used as a load or prime mover in order to fulfill both rectification and inversion modes. The suggested method compared with the conventional type shows that a considerable improvements in effective power factor, minimizing harmonics and power distortion. Also different approaches have been presented for all types of power components.

Keywords: Power quality, harmonics, AC/DC converters, DC drives.

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Application of SHE-PWM for seven-level inverter output voltage enhancement based on particle swarm optimization

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Summary

In the present work, the Selective Harmonic Elimination Pulse width Modulation SHE-PWM is used to improve the output voltage quality of the DC/AC multilevel inverters. To achieve the requirement of the SHE-PWM such as a desired fundamental magnitude and the elimination of the low order harmonics contained in the output voltage, a heuristic and evolutionary algorithm is used. The problem of the SHE-PWM is presented by a constrained nonlinear objective function which has to be minimized. The main aim is the calculation of the switching angles vector solution presenting the best minimal value for the objective function. Furthermore. The results obtained with the present application show the effectiveness of the use of the Particle Swarm Optimization, on the other side, the application of the PSO with SHE-PWM is a promising solution which can make a great improvement with different power electronics converters.

Keywords: Particle swarm optimisation, SHE-PWM, multilevel inverter.

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Fuel cell PWM DC/DC chopper interface based on particle swarm optimization

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Summary

The main aim of the present paper is the study of the DC/DC chopper interface for fuel Cell (FC) source to overcome the drawback of current ripple. This goal can be achieved by the reduction or elimination of the low harmonics frequency, to fulfill this requirement the particle swarm optimization (PSO) is used, where a new PWM method is used with an objective function to be minimized. Finding the global minimum of this function leads to elimination of the selected harmonics, whereas, keeping the average value of the output voltage equals to the desired value or the reference value.

Keywords: Fuel cell, PWM DC/DC chopper, particle swarm optimization.

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Comparison among electronic start up methods for induction motors

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Summary

This paper presents a useful comparison of performances during the start up of the induction machine by means of electronics starters. To feed the induction machine, two chosen circuits configurations utilize back-to-back connected series thyristor and 3-phase inverter. Some control strategies such as discrete frequency control, soft starter and field oriented control have been proposed to reduce current and improve torque. Simulation results, obtained from 4kw induction machine with these electronic methods, show an improvement of the performances in the starting period by reducing the current and increasing the torque first by using 3-phase inverter then by discrete frequency control (DFC) and finally with soft starter.

Keywords: Induction machine, soft starter, discrete frequency control, ac thyristors, 3-phase inverter.

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Stability analysis of a two-cell DC/DC converter using a dynamic time delayed feedback controller

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Summary

In this paper, we are interested in studying the stability of the two-cell DC/DC buck converter. First, this system is described by a discrete nonlinear model in the state space. Next, we design a dynamic time-delayed feedback controller to assure equal distribution of the potential difference between the cells and to achieve a reference current through the load. According to the controller parameters, two cases are treated in this paper. A stability analysis of the system is carried out for each case. These results are confirmed with numerical simulations.

Keywords: DC/DC buck converter, nonlinear model, dynamic time-delayed feedback controller, stability analysis.

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Design of new street lighting lamp

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Summary

The developments in the technology of high power Light Emitting Diodes (LED s) offer alternative replacement of the conventional street lighting lamps such as mercury vapor high pressure sodium types, with energy saving up to 90% and a considerable reduction in carbon emissions. LED s offer a number of advantages when compared with the conventional street lighting lamps such as high energy saving, long life, high color index, no dust absorption and instant starting. In this work a new street lighting lamp using a LED type is designed with its control circuit and implemented at the same street lighting pole and fixture. The model is tested to show its efficiency and power saving when compared with the high pressure mercury vapor street lighting lamp. Can be supplied this LED from Solar Cell and any renewable energy.

Keywords: Light-emitting diodes, street lighting lamp.

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SSD10-PES-1569287625

Finite element method analysis of three phase transformer core accounting for anisotropy and air gaps

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Summary

In this paper, a new transformer model taking into account magnetic intrinsic anisotropy and air gaps core joints has been proposed. Two special elements have been introduced into the model which are simple to implement in a software based on Finite Element Method FEM. Each transversal element (T-element) for air gaps model and each longitudinal element (L-element) for anisotropy is characterised by new B-H relationship. This study has analyzed the influence of these parameters on 2D flux distribution in grain-oriented silicon steel of three-phase transformer core. Based on previous model, an equivalent variable air-gap has been used as T-element and has been implemented on programs using FEM. The proposed model allows localized analysis by extending their capabilities to consider the anisotropy. To develop the nonlinear anisotropic permeability modeling, only the B-H curves in the principal directions (Rolling Direction RD and Transverse Direction TD), available directly from the manufacturers, are required. The results obtained are validated qualitatively by comparison to works using complex anisotropy models and quantitatively by the reproduction of no-load currents of a 10kVA three limbs three-phase transformer.

Keywords: Three-phase transformer, Finite Element Method, anisotropy, air gaps core joints, no-load currents.

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SSD10-PES-1569290589

Mitigation of magnetic field under Egyptian 500 kV overhead transmission line

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Summary

The paper presents an efficient way to mitigate the magnetic field resulting from the three-phase 500kV single circuit high voltage transmission line existing in Egypt, by using a passive loop conductor in order to reduce the right-of-way (ROW). The paper used an accurate method for the evaluation of 50Hz magnetic field produced by overhead transmission lines. This method is based on the matrix formalism of multi-conductor transmission lines (MTL). This method obtained a correct evaluation of all the currents flowing in the MTL structure, including the currents in the sub-conductors of each phase bundle, the currents in the ground wires, the currents in the mitigation loop, and also the earth return currents. Furthermore, the analysis also incorporates the effect of the conductor's sag between towers, and the effect of sag variation with the temperature on the calculated magnetic field. Good results have been obtained and passive loop conductor design parameters have been recommended for this system at ambient temperature (35oC).

Keywords: Magnetic field, mitigation loop, right-of-way, transmission lines.

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SSD10-PES-1569290617

Computation of Electric field and human body induced current under overhead transmission lines

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Summary

In this paper the Charge Simulation Method (CSM) is implemented to compute the electric field distribution around Egyptian three phase 500kV transmission line, with the presence and absence of the human model. The human body is simulated as a conducting cylinder object with a hemisphere for his head. Three positions of human body model are considered to compute the induced current in it. These positions are defined as under maximum, minimum and average conductor height. A method to estimate the human body model induced current from the electric field computed without the presence of the human body model is proposed and its results are in good agreement with those computed with the presence of human body model under the transmission line.

Keywords: Charge simulation method (CSM), electric field, human body model, induced current.

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SSD10-PES-1569290621

The effect of compensating conductors' parameters of 500 kV transmission line on right-of-way and corona

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Summary

The use of Extra-high voltages transmission lines causes many problems, that due to the high value of the electrostatic field on the ground level which has an effect on men, animals, and plants. This paper investigates the effects of the compensating conductors' parameters, namely, the number of the compensating conductors, their radii, their heights above the ground and the spacing between them, on the Right-of-Way (ROW), and Radio interference level (RI).

Keywords: Terms-OHTL, electric field, compensating conductors.

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The effect of the artificial backfill materials on the ampacity of the underground cables

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Summary

The backfill materials around under-ground power cables affect the maximum current carrying capacity of these cables. Usually backfill soils around under-ground power cables lose their moisture content, forming dry zones around the cables and leading to an increase in the thermal resistance and decreasing in maximum current carrying capacity. But according to the results of the experimental works which are carried out in this paper, it is noticed that some types of soil lost their moisture content faster than the other. This means that the dry zone around the cable in some soils form faster than the others. The aim of this paper is to determine the best type of artificial soil that can be used as backfill material to minimize the effect of dry zones that cause thermal failure to the cable insulation.

Keywords: Backfill materials, cable ampacity, dry zone, temperature distribution.

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SSD10-PES-1569296997

3D FEA based feature investigation of a claw pole alternator with DC excitation in the stator

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Summary

This paper deals with finite element analysis (FEA) modeling and features investigation of a claw pole alternator with its DC-excitation winding is located in the stator rather than in the rotor in conventional machines. The proposed model takes into account for the saturation of the magnetic circuit. A special attention is paid to the distribution of the air gap flux density and the back-EMF. A validation of the results yielded by FEA is achieved considering both measurements carried out on a prototype of the studied machine and analytical results obtained by a reluctance model developed in a previous work.

Keywords: Claw pole alternator, DC-excitation in the stator, 3D finite element analysis, flux path, air gap flux density, back-EMF, validation.

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paper reference
SSD10-PES-1569330212

Theoretical study on torque ripples generation in permanent magnet synchronous machine

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Summary

In this study a new method used to minimize the torque ripples generated in Permanent Magnet Synchronous Machines (PMSM). The Iterative Learning Control (ILC) method is adopted for the minimization of torque ripples for a vector controlled surface-mounted PMSM. The ILC is a new technique used to compensate torque and speed ripples for PMSM drives. The novelty of the research presented in this paper is that the PMSM is modeled by the time-stepping finite element method (FEM), which proved to provide high accuracy. The results of the new technique are found to be very promising.

Keywords: Permanent magnet synchronous machines, iterative learning control, torque ripples time-stepping FEM.

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Participation of direct drive wind turbine to the grid ancillary services using a flywheel energy storage system

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Summary

Renewable energy sources have achieved increasing levels of penetration in recent years. Therefore, the impact of those sources on the power system is becoming greater, due to their intermittent source. The current tendency is to remain the Wind Turbine (WT) connected to the grid during voltage dip or frequency variation according to the grid connection requirements (GCR). This paper proposes an application of a Flywheel Energy Storage System (FESS) associated to a direct drive WT and connected to the grid in order to evaluate its participation to the ancillary services. The main functions of the FESS is to smooth the variable power delivered by the wind source and to ensure the injection of the power needed for the grid in order to increase the rate of penetration of WT into the grid and to improve its contribution to the ancillary services.

Keywords: Direct drive wind turbine, FESS, DPC, FOC, voltage dips.

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FACTS placement multiobjective optimization for reactive power system compensation

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Summary

One of the problems responsible of power generation and transmission is the maintaining of an appropriate voltage profile by installation of reactive power supplies. In this paper, we propose a new technique for the optimal location and design of two kinds of Flexible AC Transmission System Devices (FACTS) namely: Satitic Var Compensator (SVC) and Thyristor Controlled Series Compensator (TCSC) handling the minimization of transmission losses in electrical network. Using the proposed scheme, the type, the location and the rating of FACTS devices are optimized simultaneously. The problem to solve is multi criteria under constraints related to the load flow equations, the voltages, the transformer turn ratios, the active and reactive productions and the compensation devices. Its resolution requires the employ of the advanced algorithms. Thus, we propose an approach based on the evolutionary algorithms (EA) to solve this problem multi criterion. It is about the NSGA-II method (Ellitist Non Dominated Sorting Genetic Algorithm). The Pareto front is obtained for continuous, discrete and multiple of five MVArs of compensator devices for the IEEE 57-bus test system.

Keywords: Reactive dispatch, multiobjective optimization, NSGA-II, SVC, TCSC, FACTS.

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SSD10-PES-1569296897

Optimal reactive power value in Mosul ring bus-bars using genetic algorithm

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Summary

Reactive power compensation is considered to be very essential to support and stabilize the voltage of buses within permissible limit. The problem of reactive power compensation can be divided in to three parts, planning, expansion and control. Planning means setting of the location and magnitude of reactive power compensation resources in the electrical systems. Expansion means pursuing the changes for the reactive power requirements along time. Control means the operation method to realize better standards. This paper explain the use of Genetic Algorithm (GA) Technique to solve the problem of optimal location and size of reactive compensation in Mosul ring buses. The results are compared with available studies solving the problem using conventional methods.

Keywords: Optimal reactive power, genetic algorithm.

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Optimal Interaction between PSS and FACTS devices in damping power systems oscillations: part I

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Summary

Most power systems are interconnected through long distance tie lines in order to transfer or exchange a large amount of electric power. Due to limited availability of resources because of the strict environmental constraints and sometimes shortage of funds to build new transmission lines, this necessitates the operation of transmission lines near or for short term on their thermal limits. Also, the demand for electric power has rapidly increased and is expected to continue growing , while expansion in generation is restricted too due to the same reasons mentioned above, this necessitates the generators too to operate near their stability limits.

As a result of all these factors, power systems oscillations will occur; if not well damped, these oscillations may keep growing in magnitude until loss of synchronism results. The power system stabilizer (PSS) and flexible ac transmission system devices (FACTS) can help in damping of power systems oscillations.

The objective of this work is to study and design a controller capable of doing the task of damping in less economical control effort. This can be well done if a specific coordination between PSS and FACTS devices, is accomplished.

- Firstly, A genetic algorithm-based controller is used. Genetic Algorithm (GA) is utilized to search for optimum controller parameter settings that optimize a given eigenvalue based objective function.

- Secondly, an optimal pole shifting, based on modern control theory for multi-input and multi-output systems, is used. It requires solving first order or second order linear matrix Lyapunov equation for shifting dominant poles to much better location that guaranteed less overshoot and less settling time of system transient response following a disturbance.

Keywords: power system stability, PSS, FACTS, genetic algorithms, pole shifting.

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Modelling and simulation of a gird connected PV generation system with MPPT fuzzy logic control

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Summary

This paper presents a simulation model of the electric part of a grid connected photovoltaic generation system. The model contains a detailed representation of the main components of the system that are the solar array, and the grid side inverter multilevel inverter NPC VSI. In order to extract the maximum amount of from the photovoltaic generator, we propose an intelligent control method for the maximum power point tracking (MPPT) of a photovoltaic system under variable temperature and insulation conditions. This method uses a fuzzy logic controller. As part of our work, we will focus on voltage inverter at three levels to NPC structure. The latter can increase the voltage supplied to the load (network) through their topology. Thus, they can generate more voltage sinusoidal possible and improve the total harmonic distortion through the high voltage levels provided by the structure of this new converter. The grid interface inverter transfers the energy drawn from the PV module into the grid by keeping common dc voltage constant. The PQ control approach has been presented for the multilevel inverter. The simulation results under Matlab/Simulink show the control performance and dynamic behavior of grid connected photovoltaic system.

Keywords: PV, MPPT, fuzzy logic control, NPC inverter, clamping bridge, enslavement, gird.

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SSD10-PES-1569307899

Study the Iraqi national super grid power flow based optimum generation in case of multi-contingency

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Summary

In this paper optimum power flow for Iraqi National Super Grid was studied. Optimum power generation data and load & generation were obtained from previous works and from Iraqi Control Centre respectively. Mathematical model using Lagrange method programmed in Matlab language was used to study the effect of the types and numbers of contingencies(faults in line, two lines, line and generator, three lines, etc.) on the system power flow and total system losses.

Keywords: Optimum generation, transient stability, power system, Super Grid, Multi-Contingency.

Author Index

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Contents

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Industrial linked mechatronics, an application in autotronics

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Summary

Mechatronics and Mechatronic applications are becoming standard in all modern industries. In automobiles; the electronics components and their networking have a considerable and increasing ratio with respect to construction, function and cost. The objective of this lecture is to highlight the author's experience in linking academia with industry in developing a sustainable program for Mechatronics education and research. As a specific example; the ever increasing market need in automotive industry and electronics (Autotronics) will be focused.

The topics of the lecture will include: Need of Mechatronics in automobile industry, Automotive modern sensor technologies, actuators and control units, and a proposal for an industry linked program in Autotronics. This proposal includes a dynamic program that considers industry need as a powerful potential for academic education, postgraduate, and research. At the same time, the academic innovations and advanced research will have the advantage to inspire new feasible industry applications.

The authors experience in a multinational European /Egyptian project: "Development Of An Industry Linked Mechatronics Program and Training of Trainers (DIMPToT)" is to be briefly introduced. A proposal for a new regional Mechatronics project in which experts from Egypt, Jordan, Germany, Poland, and The U.K. will be also highlighted.

Keywords: Mechatronics, autotronics, industrial applications.

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Diversification of the eddy current technology

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Summary

In metrology eddy current non-contact transducer have been widely used for measurement of position, displacement, cracks, vibration, proximity and alignment, as well as parts sorting applications over the past years. By reason of further developments of front end sensor elements as well as electronics, new application areas of eddy current sensors are technically feasible. In this paper lately achieved results in eddy current sensor developments will be presented.

Keywords: Eddy current, process control, rolling mill, gradiometer, tissue diagnostics.

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Autonomous aerial vehicles: guidance, control and signal processing platform

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Summary

The use of unmanned systems is gaining momentum in civil applications after successful use by the armed forces around the globe. Autonomous aerial vehicles are important for providing assistance in monitoring highways, power grid lines, borders, and surveillance of critical infrastructures. It is envisioned that cargo shipping will be completely handled by UAVs by the 2025. Civil use of unmanned autonomous systems brings serious challenges. The need for cost effectiveness, reliability, operation simplicity, safety, and cooperation with human and with other agents are among these challenges. Aerial vehicles operating in the civilian aerospace is the ultimate goal which requires these systems to achieve the reliability of manned aircraft while maintaining their cost effectiveness.

In this presentation the development of an autonomous aerial vehicle will be discussed. The architecture of the system from the mission requirements to low level autopilot control laws will be discussed. Trajectory tracking and path following guidance and control algorithms commonly used and their implementation using of the shelf low cost components will be presented. Autonomous takeoff landing is a key feature that was implemented onboard the vehicle to complete its degree of autonomy. This is implemented based on accurate air-data system designed and fused with sonar measurements, INS/GPS measurements, and vector field method guidance laws.

Flight test data were collected to develop a complete mathematical model for the aircraft, and identify the stability and control derivatives of the UAV. A hardware-in-the-loop (HIL) simulation was used to develop and test the UAV autopilot hardware and software development virtually. A user friendly ground station is to interface with HIL using

external stick commands, and 3-D visualization of the vehicle's motion using flight-gear open source flight simulator.

The outcomes of the proposed research is that the AUS-UAV platform named MAZARI is capable of autonomous takeoff and landing based on a prescheduled flight path using waypoint navigation and sensor fusion of the inertial navigation system (INS) and global positioning system (GPS).

Several technologies need to be mastered when developing a UAV. The navigation task and the need to fuse sensory information to estimate the location of the vehicle is critical to successful autonomous vehicle. Currently extended Kalman filtering is used as fusion algorithm for position and poses estimation. Then path planning, trajectory generation and trajectory guidance alternative strategies is presented.

One of the important UAV mission is target surveillance using an onboard vision system. AUS-UAV Mazari is using a gimbaled camera for target monitoring and target tracking using basic digital image processing and techniques. The payload is integrated with the autopilot to lock on the target while the aircraft is moving.

Future plan is to develop a cooperation strategy between several vehicles in the air and on the ground. Use of vision system to aid the vehicle in localization using ground features is also under consideration.

Keywords: Autonomous aerial vehicles, guidance, control, image processing.

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Electromagnetic Fields and Human Health

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Summary

It's hard to imagine a world without electricity. And yet, wherever electricity is used, EMFs re created around the equipment and wires. These EMFs are usually invisible and imperceptible, but they are quite real. The interaction of EM fields with matter has been studied by physicists for over a century.

Today, EMFs are much better understood and documented than they were a few years ago. Calculations based on the classical equations have long been used to estimate the strengths and characteristics of the EM interactions with condensed matter, molecules, atoms and particles. Experiments have shown that these equations successfully represent the interactions, thus allowing physicists to use these interactions to investigate the basic properties of matter.

In this presentation the following will be present and explain: the electric and magnetic field, the field intensities are we exposed to in our everyday lives, their effects on the human body and on our health and the opinion of public health authorities around the world.

Keywords: EMF, electromagnetic fields, health effects, human health, environmental.

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Critical communication radius prediction with random distributed nodes in wireless sensor network

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Summary

For a structured WSN (Wireless Sensor Network) position of the nodes is as per pure mathematical architecture with almost fixed quantity of number of nodes, but for a practically large area (in kilometer range), the random distribution of nodes are appreciable than the structured sensor network from project requirement and node specification point of view. A research study and result has been shown that is more optimum than the existing algorithm to estimate the critical communication radius and number of nodes for random distributed wireless sensor network.

Keywords: Critical communication radius, radius prediction & estimation, wireless sensor network (WSN), wireless sensor nodes.

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Using empirical mode decomposition for subscriber behaviour analysis in cellular networks in South Africa

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Summary

This paper looks at the potential benefit of using empirical mode decomposition for the decomposition of time series data generated from a typical cellular network in South Africa. It is shown that a robust method for the extraction of features that correlate to subscriber behaviour can be conducted by decomposing time series tele-traffic data into finite set of components generated iteratively using the EMD approach. The extracted features are useful for the planning and estimation of future demand in wireless cellular networks especially in areas where subscriber socio-economic factors play a vital role in subscriber demand.

Keywords: Cellular networks, time series data, empirical mode decompositions.

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Specific absorption rate (SAR) induced in human heads of various sizes when using a mobile phone

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Summary

This paper analyzes the specific absorption rate (SAR) induced in human head model of various sizes by a mobile phone at 900 and 1800 MHz. Specifically the study is considering in SAR between adults and children. Moreover, these differences are assessed for compliance with international safety guidelines. Also the effects of these head models on the most important terms for a mobile terminal antenna designer, namely: radiation efficiency, total efficiency and directivity, are investigated.

Keywords: SAR, monopole, human head.

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Efficient encoding and decoding schemes for wireless underwater communication systems

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Summary

This work focuses on presenting a novel high efficiency channel encoding for transmitting acoustical signals in the hope of improving wireless underwater communication. Yet, water puts a damper on communication capacity, slowing down the signal propagation and creating background noise and echoes. For thus systems and methods for implementing a control channel, e.g., in underwater communication system, are presented below. Aspects of the channel structures used to implement the control channel described herein, can improve error detection capabilities, reduce decoding complexity, and increase transmission efficiency. In certain aspects, transmission efficiency can be increased through using CRC encoding. A circular trellis check and Viterbi decoding can also be used to increase efficiency and maintain error detection capabilities. Symbol Error Rate (SER) can be reduced in embodiments described herein over that of tail-biting convolutional coding with a CRC. Furthermore, error detection offered by Reed Solomon encoder can well compensate underwater noise. Additionally, the encoder packet size can be fixed in order to facilitate decoding and reducing receiver complexity.

Keywords: Underwater channel, wireless communication, channel encoding, digital modulation, symbol error rate.

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Performance enhancement of wireless communication systems using transmit and receive diversity

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Summary

In this paper, we describe the concatenation of Turbo/Convolutional codes with transmit and receive diversity schemes by using Space-Time Block Code. It is shown that, by using two transmit antennas and one/or two receive antenna, large coding gain for the bit error rate is achieved over the system without diversity. Simulation results show that, by using systems with transmit and receive diversity, high gain can be achieved with very low complexity. It turns out that at , the gain of 9 dB can be achieved for system using STTD transmit diversity only (without using any channel codes) and 2 dB gain can be achieved over channel coding systems using hard-decision decoding with much lower complexity. The most important conclusion is that, using soft-decision decoding systems enhanced with transmit diversity can provide very high coding gain; e.g., in convolutional coded system using soft-decision Viterbi decoder, the coding gain is 12 dB over uncoded system and 5 dB over hard-decision decoding in flat fading channel, while the coding gain is about 13 dB for turbo coded systems using soft-decision decoding based on SOVA algorithm with transmit diversity and the coding gain is 15 dB if the decoder is based on Log-MAP algorithm. In systems using transmit and receive diversity, the coding gain is much higher, e.g., for convolutional-coded systems, the coding gain is 20 dB, while for turbo-coded systems using SOVA and Log-MAP algorithms, the coding gain are a little more than 20 dB and 21 dB, respectively.

Keywords: Space-time block code, turbo codes, SOVA, transmit diversity, receive diversity.

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Performance enhancement of wireless communication systems using loading algorithm

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Summary

In this paper, we consider a simple loading algorithm for Orthogonal Frequency Division Multiplexing based wireless communication systems for signal spectrum optimization. The algorithm is based on the margin adaptive loading criterion and its performance over 5GHz indoor wireless channels. Simulation results show a 6 dB improvement for BER of 0.02 over fixed modulation.

Keywords: Loading algorithm, OFDM, WLAN

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Enhancing the MIMO-OFDM radar systems performance

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Summary

This paper proposes a new peak-to-average power ratio (PAPR) reduction method for a multiple-input multiple-output (MIMO)-orthogonal frequency division multiplexing (OFDM) systems based on a genetic algorithm (GA). It has been introduced to be compatible with Radar systems, where the GA was used to optimize the MIMO-OFDM symbols in such way that could improve the system's performance. During this work, there was a comparison that has been stated among three systems; original radar system, radar system-based MIMO-OFDM and radar system-based MIMO-OFDM uses GA. Finally, a range of simulation results are provided to demonstrate the superiority of the proposed scheme, since it is showed an enhancement in the coverage distance besides reducing the PAPR effects.

Keywords: MIMO-OFDM, Radar systems, and Genetic Algorithm.

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Hybrid multi-agent architecture (HMAA) for meeting scheduling

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Summary

This paper presents a novel multi-agent architecture for meeting scheduling. The proposed architecture is a new Hybrid Multi-Agent Architecture (HMAA) that generates new heuristics for solving NP-hard problems. Moreover, the paper investigates the feasibility of running computationally intensive algorithms on multi-agent architectures while preserving the ability of small agents to run on small devices, including mobile devices. Three experimental groups are conducted in order to test the feasibility of the proposed architecture. The results show that the performance of the proposed architecture is better than those of many existing meeting scheduling frameworks. Moreover, it has been proved that HMAA preserves small agents' mobility (i.e. the ability to run on small devices) while implementing evolutionary algorithms.

Keywords: Multi-agent, meeting scheduling, heuristic, genetic programming.

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Ad Hoc networks security challenges

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Summary

Ad Hoc networks lack a fixed infrastructure or centralized administration and are characterized by a highly dynamic topology, though these characteristics are appealing for use in many application domains, they also expose serious vulnerabilities which might be exploited to compromise one or several nodes of the network and possibly affecting overall performance. This introduces the challenge of offering a complete security solution that is effective, scalable and resource friendly. Such a solution should encompass the three components of prevention, detection and reaction. This paper aims to examine the vulnerabilities of Ad Hoc networks, the types of attacks expected and to discuss proactive and reactive techniques which deter such attacks, detect infiltrations and react against them.

Keywords: Ad Hoc, security, mobile, network.

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Performance analysis of the effects of network density and network mobility on velocity-based scheme in mobile Ad hoc network

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Summary

Broadcasting is essential in Mobile Ad hoc Networks (MANETs) .It is used in the initial phase of route discovery process in many reactive protocols that find the route only on demand. Although broadcasting is simple, it causes a broadcast storm problem, which is a result of packets redundancy,contention and collision. A mobility scheme based on velocity of node called (VON) has been proposed to overcome this problem. However , VON uses a fixed threshold regardless of network status. This study aims to study the effects of network density and network mobility on VON scheme.The results could be useful for better prediction of velocity threshold values.

Keywords: MANETs, VON, broadcasting, Mobility.

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Coverage planning in 3G multimedia networks based on walsh coding

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Summary

Capacity in Wideband Code Multiple Access (WCDMA) systems is interference limited, it is also strongly linked with coverage. The greater the level of influx of users within the cell, the higher the interference and hence the lower the cell coverage becomes and vice versa. This is called Cell Breathing. In this paper a Walsh coding is used as a precoding stage to the Multiple-Input Multiple Output-Orthogonal Frequency Division Multiplexing (MIMO-OFDM) system. The results of this work are compared with a conventional work that is based on convolutional coding. This is in order to check its fitness to the current system structure and the enhancement of the Eb/No, which will directly result in a better cell coverage and continued reliable services for the area of the cell as the load increases. Based on the simulation results, Walsh coding shows a slight improvement of complementary cumulative distribution function (CCDF). As a consequence, the MIMO-OFDM systems performance is improved comparing with the covolutionally coded MIMO-OFDM system. Thus, not only the Peak-to-Average Power Ratio (PAPR) is saved, but also the frequency spectrum efficiency is improved.

Keywords: Coverage planning, MIMO OFDM, Walsh code.

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An improved OTSU based watershed algorithm and its implementation on virtex II pro platform

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Summary

The Watershed algorithm as was proposed by Jean Paul Serra is an elegant formalism for image segmentation. Watershed conventional algorithm finds out peaks in the gradient image and identifies them as contours. Although this technique has proven its efficiency in some previous works, it suffers from over-segmentation problems, due to the fact that it considers in a similar way lower and higher valued gradients. This paper overcomes watershed oversegmentation problems by introducing a pre-processing step based on OTSU thresholding method, in which a pre-selection of the higher gradients will keep only real contours in the image. Moreover, an anisotropic diffusion is applied for smoothing the gradient image, getting rid of noisy peaks. The whole design was implemented on a Virtex II pro platform. An optimization of the hardware/ Software resources was done based on a co-design methodology. On a V2pro ff672, the design was applied to a 128*128 pixel image, leading to a 116MHz frequency. Performance evaluation was done on some images taken from different classes of the Berkley database

Keywords: Watershed, anisotropic diffusion, Otsu method, hardware implementation, impulse C.

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An eigen value based watermarking scheme for tamper detection in gray level images

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Summary

Fragile watermarking is used to determine if a digital content has been tampered, and localize tampered regions without referring to the original content. In this paper, we present a novel fragile watermarking technique for tamper detection in gray level images. The proposed method is efficient for simple and intelligent attacks such as collage attack and Vector quantization attack. The embedding process of the watermark starts from computing the Eigen values of the chaotically mixed image and that stands for the watermark, followed by inserting it into the LSBs chosen using the logistic map. The chaotic map is used to improve the security of our algorithm and to contribute with the Eigen values computation by making the watermark as unique as possible in order to face off intelligent attacks. Simulation results show that the presented method is fast, secure and performant in detecting and localizing tamper.

Keywords: Fragile watermarking, tamper detection, Eigen value, VQ attack, chaos.

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A new algorithm for automatic extraction of GIS layers

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Summary

GIS layers became an essential part of any GIS model today, and therefore, there is a need for developing automatic approaches to extract GIS layers from different digital map images such as satellite images. This is due to the increasing number of digital maps and the advances in the functionality of modern geographic information systems (GIS), In this paper, we propose a new approach to automatically extracting GIS layers based on the HSI color model. The results are acceptable.

Keywords: GIS, GIS layers, satellite images, color models, HSI color mode.

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A comparative study to select an image deconvolution method

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Summary

Image deconvolution is an important subject in image processing. It is an ill-posed inverse problem, so regularization techniques are used to solve this problem by adding constraints to the objective function. Various popular algorithms have been developed to solve such problem. This paper studies various approaches to the nonlinear degraded images restoration problem which are useful in many images enhancement applications. Swarm intelligence is applied for total variation (TV) minimization, instead of the standard Tikhonov regularization method which is often used. In this work, we attempt to reconstruct or recover corrupted images that have been degraded during acquisition; using some a priori knowledge of the degradation phenomenon. The truncated singular value decomposition (TSVD) method is also considered for image deconvolution in this paper. A comparison between these methods made on examples is included

Keywords: Deconvolution, swarm, TV, Tikhonov, TSVD, regularization.

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Pixel-level similarity fusion for image classification

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Summary

Recent research shows that local similarity calculations play a significant role in improving the recognition performance of template matching systems. We present a new scheme for parametric similarity calculation and fusion for image classification. State-of-the-art recognition results are obtained using the proposed method for a difficult task involving face images.

Keywords: Classification, similarity, template matching.

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Preprocessing of the ECG signals using the His-Purkinje fractal system

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Summary

Depolarization of the myocardial cells of the left and the right ventricles via the irregular but self-similar pattern of branching of the His-Purkinje tree produces the QRS complex on the surface electrocardiogram. The analysis of the power spectrum of the QRS complex has shown that it has the inverse power law or fractal behavior. This fractal behavior has been modelled in the frequency domain by a fractional power pole (FPP) which we have called the His-Purkinje fractal system. This paper deals with the ECG signal preprocessing using new and simple processing strategies based on the His-Purkinje fractal system. The MIT/BIH arrhythmia database has been used to test the effectiveness of the proposed method. The results obtained are presented, discussed and compared to the one of the most efficient preprocessing technique.

Keywords: ECG signal, His-Purkinje fractal system, ECG preprocessing, IIR filter, FIR filter.

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Bacterial foraging algorithm for neutron radiography image quality improvement

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Summary

We want to implement a new optimal approach for image restoration problem, which is useful for neutron radiography images enhancement to assist the physician interpreter on his evaluation. Our approach is based on using swarm intelligence optimization algorithms to solve a least squares minimization ill-posed problem, using Bacterial Foraging Optimisation (BFO) Algorithm. To get smoothed images in presence of noise, a Laplacian constraint is introduced for regularization purpose.

Keywords: Restoration, radiography, bfo, total variation, regularization

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RSA Based encryption/decryption of medical images

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Summary

The use of computer networks to transmit medical information is faced to data security problems. Hence it is necessary to make these data unreadable and indecipherable during their transfer. The encryption and decryption of medical images are performed either by software or hardware. A software implementation has the advantage of being portable and low cost but its drawback is the slowness decryption of a huge volume of data, compared to the hardware implementation and its inability to protect private keys. This is the reason that incited us to software implement the RSA protocol to encrypt and decrypt medical images by combining MATLAB and Maple tools. This software implementation has served as a basis comparison to the hardware implementation of the same protocol on an FPGA circuit. Some strategies have been adopted to make this software implementation the fastest in order to permit to the user generating keys, encrypting and decrypting medical images of different sizes with different keys sizes in a reasonable time based on the influence of the RSA parameters on the delays of the encryption/decryption operations.

Keywords: Medical image processing, public key cryptography, software development

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Implementation of 8-point slantlet transform based polynomial cancellation coding-OFDM system using FPGA

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Summary

The objective of this paper is to present the implementation a base-band OFDM transceiver on FPGA hardware. The design uses 8-point SLT/ISLT (Slantlet/Inverse Slantlet) for the processing module with processing block of 8 inputs data wide. All modules are designed and implemented using VHDL programming language. The Software tools used in this work includes Altera Quartus II 7.2 and ModelSim Altera 6.1g, to assist the design process and downloading process into FPGA board while Cyclone III board EP3C120F780C7 is used to realize the designed module.

Keywords: OFDM, PCC, FPGA, slantlet transform.

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DES96 - Improved DES security

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Summary

The Data Encryption Standard (DES) has shown noticeable signs of aging during the last two decades. In this paper we develop a system that is a DES-variant with more resistance towards the possible attacks against DES. The developed system has a sub-key generation algorithm that is completely different from the original DES. The developed system uses 84-bit initial key instead of the 56-bit key originally used. It has substitution boxes inside the key generation algorithm and mod2 additions. The choice of arrangement of substitution boxes in the main algorithm for each round is sub-key dependent. The result of the design is a DES-variant cryptographic system that has higher resistance against brute-force attack, differential cryptanalysis, and linear cryptanalysis. The proposed system design also canceled the weak-keys and complement keys properties of the DES.

Keywords: DES, encryption, des-variant, s-boxes.

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Digital IIR filter approximation of the fractional delay operator

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Summary

In this paper a simple and an efficient approach for approximating the fractional delay operator $z^{-\alpha}$ $(0 < \alpha < 0.5)$ using digital infinite impulse response (IIR) filters is proposed. In this technique, the coefficients of the closed form digital IIR filter derived for the approximation of the fractional delay operator, in a given frequency band, are based on the approximation of fractional order systems. An example has been presented to illustrate the effectiveness of the proposed design technique.

Keywords: Fractional delay, fractional order systems, digital IIR filter.

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Effect of coefficient quantization on the frequency of response of an IIR digital filter by using software

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Summary

In the realization of IIR filters in hardware or in software on general purpose computer, the accuracy with which filter, coefficients can be specified is limited by the word length of the computer or the length of the register provided to store the coefficients. In this paper, we discussed the effects of Finite word length on the performance of digital filters and how minimizing these effects. IIR filter can be realized in a direct form, a cascade form and in a parallel form. To minimize the effect of coefficient quantization, a higher-order transfer function should never be realized as a single direct form structure, but realized as a cascade or parallel of second-order and first-order sections. Using MATLAB package software programs are developed for Analysis of coefficient Quantization effects in IIR digital filter and good results are obtained.

Keywords: IIR digital filter, low pass filter, high pass filter.

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Accuracy of the sine-wave normalized frequency estimation by interpolated DFT method with rectangular window

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Summary

In this paper analyzes the accuracy of the normalized frequency estimator of a sine-wave provided by the interpolated discrete Fourier transform (IpDFT) method based on the rectangular window. The expression for the maximum of the magnitude of the estimation error due to the spectral interference from the image component is derived. The obtained expression is validated by means of computer simulations. Moreover, it has been shown that the influence of the spectral interference on the normalized frequency estimator is much higher than that of the wide-band noise superimposed to the sine-wave. This conclusion is confirmed by means of both computer simulations and experimental results.

Keywords: Error analysis, frequency estimation, rectangular window, interpolated DFT method.

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A new rule pruning text categorization method

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Summary

In this paper, the problem of rule pruning in associative text categorization is investigated. We propose a new rule pruning method within an existing associative classification algorithm called MCAR. Experimental results against large text collection (Reuters-21578) using the developed pruning method as well as other known existing methods (Database coverage, lazy pruning) are conducted. The bases of the experiments are the classification accuracy and the number of generated rules. The results derived show that the proposed rule pruning method derives higher quality and more scalable classifiers than those produced by lazy and database coverage pruning approaches. In addition, the number of rules generated by the developed pruning procedure is usually less than those of lazy pruning and database coverage heuristics.

Keywords: Information retieval, data mining, text caegorization, artificial intelligence, pattern recognition.

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paper reference
SSD10-CSP-1569288269

High level estimation of implementation cost of using morphological filter in edge detection

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Summary

Edge detection is a critical element in image processing, since edges contain a major function of image information. The function of edge detection is to identify the boundaries of homogeneous regions in an image based on properties such as intensity and texture. The morphological filter is used as an initial process in edge detection for noisy images where "opening-closing" operations are used to filter noise thus enhancing edge detection performance. In this paper we study the additional cost in resources caused by implementing the morphological filter prior to edge detection, area, power and energy consumption are considered, the cost is a major factor in determining to use or not the morphological filter in a particular application. To achieve this estimation we used a high level estimation tool, high level design and estimation is gaining ground as it allow design decisions in an early stages of development therefore reducing costs, these tools are also gaining in accuracy. We used morphological filter as a preprocessing stage for the Shen-Castan edge detector. Starting C code the high level estimation tool produces RTL level circuits and using power and energy consumption models based on a hardware database (generic ASIC in our case) it produces reports about Area, Power and Energy consumption, an estimation of performance is also possible.

Keywords: ASIC, morphological filter; Shen-Castan edge detector; High Level energy estimation; PowerOpt Tool.

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SSD10-CSP-1569307479

A proposed digital modulated signal identification based on pattern recognition

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Summary

In some communication applications, such as in the surveillance of the radio spectrum there is a requirement for rapid and automatic identification of the modulation type of a received signal. A receiver scans continuously over the spectrum of interest and when it detects a transmission, the output of its intermediate frequency (IF) amplifier is passed on to an identifier. The task of the identifier is to determine the transmission's modulation type. In other words, a radio station transmits a signal, which is detected by a radio monitoring device. This device dose not perform the demodulation of the signal; it's task is to determine the modulation mode by which the corresponding transmitter is driven.

Several modulated signal identifier (classifiers) have been developed for various applications. Most of these identifier operate in the HF range or classify AM, DSB, SSB, FM ,BPSK or FSK signals. In general, the framework of a modulation classification algorithm can be categororized as either a decision theoretic or a pattern recognition approach.

Digital modulation identification algorithm based on statistical pattern recognition techniques, has been developed to automatically identify the modulation type of a fixed length signal segments, and intercepted by fixed bandwidth HF radio receiver.

The proposed algorithm is developed by generating and statistically analyzing a large set of numerically simulated signals. The resultant algorithm is successfully tested on another independent set of simulated signals.

The developed algorithm allows automatic identification for the following digital modulated signal types: FSK-2, PSK-2, FSK-4, and PSK-4.

The algorithm is developed to be robust under wide variations of operating conditions, including signal to noise ratio, message content, baud rate, tuning error, data acquisition system quantization noise, and signal interference.

Algorithm performance is tested and investigated with the presence of some expected perturbing factors such as noise, and mismatch of the center frequency.

The proposed identifier gives a good identification results against noise, and signal frequency deviation. The obtained overall correct percent is 89identifier could be greatly improved by using higher sampling frequency and larger signal segments time length.

The proposed identifier gives a good performance with 1024 signals samples separated by 24.73 used sampling intervals. This means that small signal duration of 25.3 msec. is enough for successful identification.

Keywords: Digital Modulation Identification, Pattern Recognition, FSK, PSK.

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paper reference
SSD10-CSP-1569296407

Switched split vector quantifier applied for encoding the LPC parameters of the 2.4 Kbits/s MELP speech coder

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Summary

In this paper, we present an optimized switched split vector quantization (SSVQ) scheme developed for low bit-rate encoding of the LPC parameters represented by the line spectral frequencies (LSF). It will be shown that the SSVQ provides better performance in terms of bit-rate, spectral distortion and computational complexity than the traditional split vector quantifier. We further applied our SSVQ encoding system, called LSF-SSVQ encoder, to quantize the LSF parameters of the 2.4 Kbits/s normalized speech coder MELP operating over an ideal noiseless channel.

Keywords: Split vector quantizer; Switched SVQ; LSF parameters; MELP speech coder.

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Evaluating The NGN performance based on duplicate transmission of voice packets

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Summary

This work aims to enhance the Quality of Service (QoS) of the third-generation (3G) cellular networks. The quality of voice traffic over IP networks (VoIP) is greatly reduced due to the fact that packets in IP networks suffer from packet loss which is inevitable due to the best-effort nature of these networks. Many techniques have been proposed to decrease the effect of packet loss on the speech quality. In this paper we study the effect of packet loss on speech quality; we propose sending a duplicate copy of the speech stream over the network and we study the effect on the speech quality due to this duplication. This is especially useful in networks with extra available bandwidth. The performance of the system is measured according to the E-Model as defined in the ITU-T's Recommendation G.107. The speech sources used during the experiments are artificial voices obtained from the ITU-T's Recommendation P.50/Appendix I. The results of the proposed scheme suggest improvement in the system performance in terms of speech quality which can then be translated into greater percentage of users satisfied with the service and greater potential revenue. The proposed technique proves to be more effective when situations of higher percentages of packet loss and burst losses arise.

Keywords: Next Generation Network, NGN, Voice over IP, Multimedia, E-Model, Packet Loss.

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Perceptual evaluation of speech enhancement

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Summary

Speech enhancement is the process of de-noising a speech to improve quality and to make better intelligibility. Several speech enhancement methods have been proposed including: DWFM filtering, Donoho, Massart, and Kalman. To measure the performance of these filters, a speech evaluation method is needed. SNR is one of the most common methods for speech evaluation. The problem of SNR as a wave-form speech evaluation is it is too general and can fit any type of signal, even non-speech signals. In this paper the performance of several speech enhancement methods is compared using both SNR and PESQ which is an evaluation method that has been proposed by the ITU-T for speech-specific quality evaluation. The speech sources used during the experiments are artificial voices produced in ITU-T recommendation P.50 Appendix I. These artificial voices have the same spectral and temporal characteristics as the human speech signals.

Keywords: Speech enhancement, speech evaluation, SNR, PESQ, artificial voices.

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Wavelet in conjunction with neural network method for speech enhancement quality evaluation

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Summary

Wavelet Neural Network Evaluation method WNNEM is proposed as a powerful tool for enhanced speech signal evaluation. This objective evaluation measure utilizes Feed forward back Propagation Neural Network FFBNN to train the free of noise signal, and then enhanced signal is simulated to the training output results taken for given target. The distance between simulation and the target, over different wavelet sub bands is studied. Four known speech enhancement method for studying the performance of WNNEM are utilized. The advantage of this method is the evaluation of different band passes of frequency based on wavelet transform by neural network, which is very influential tool for non stationary signals processing. Several objective measures are used to investigate the WNNEM compatibility. Results proved the validity of the proposed method.

Keywords: Wavelet, neural network, speech enhancement, quality evaluation.

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SSD10-CSP-1569277141

Wideband modified dipole antenna for passive UHF RFID tags

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Summary

In this paper, a new modified wideband dipole antenna for passive UHF RFID is designed, simulated, fabricated and tested. The modification is done by adding vertical and horizontal stubs to the structure of the ordinary dipole antenna to reduce its length and broaden its bandwidth. IE3D full-wave electromagnetic simulator is used to simulate the modified dipole and compare it with the ordinary dipole antennas. The results showed that the modified dipole is shorter by (14%) and has wider bandwidth by (274.55%) which makes it able to cover the entire frequency band dedicated for UHF RFID systems (860 MHz $\sim$ 960 MHz). The modified dipole antenna is fabricated using PCB technology and its parameters are measured in an anechoic chamber. The effect of different materials on antenna performance also studied in this paper.

Keywords: RFID, dipole antenna, UHF band, return loss, passiv tags.

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SSD10-CSP-1569284503

Amplitude-only beam scanning in linear antenna arrays

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Summary

In phased arrays the mainbeam is scanned by either varying the phase excitations of the elements or varying the frequency of operation. In spite of their extensive use, these methods need either variable phase shifters or frequency sweeping. It is shown here that beam scanning is also feasible by varying magnitudes of the element excitations thus alleviating the need for phase shifters or frequency variation. In this technique, the amplitude excitations of some side elements are reduced while those of the others are increased by proper power division or weighting in the feed network. Theoretical analysis and computer simulations are presented to verify the proposed idea. A 3-element array is studied first, then the idea is extended to a 7-element array. Simulation results show appreciable scan angles with minor variation in the mainbeam level. Some degradation in the array pattern is noticed at large scan angles.

Keywords: Scanned arrays, beam steering, amplitude scanning, phased arrays, smart arrays.

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A 2.45GHz Sierpinski carpet edge-fed microstrip patch fractal antenna for WPT rectenna

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Summary

A Sierpinski carpet edge-fed microstrip patch antenna is proposed for size reduction of rectenna of Wireless Power Transmission (WPT) System. The conventional patch antenna is designed based on transmission line model with the characteristics impedance of 50?. The fractal geometry for the conventional antenna is generated up to second iteration and simulated. The results shows that the maximum of 27.68 by the Sierpinski Carpet microstrip patch antenna of the second iteration order, without affecting the other performances such as return loss and radiation pattern.

Keywords: Fractal antenna, microstrip patch antenna, Sierpinski carpet, rectenna, wireless power transmission (WPT).

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SSD10-CSP-1569317375

Design of fractal quadratic koch antenna

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Summary

Miniaturization for antenna design based on fractal geometry is of great interest in wireless communication. To this end, NEC4WIN95VM code based on moment method has been used to simulate two proposed designs of quadratic Koch model. Results are compared to classical Bi-Quad loop antenna. From results it is shown that the gain of fractal model is improved and there is reduction in height of the antenna and the area occupied by this model. Other antenna parameters has been calculated like radiation pattern, VSWR, and current distribution over the antenna body.

Keywords: Fractal antenna, quadratic Koch, miniaturizing antenna, loop antenna, fractal design.

Author Index

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Seventh International Multi-Conference on Systems, Signals & Devices

Conference on Sensors, Circuits & Instrumentation Systems

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Contents

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Industrial linked mechatronics, an application in autotronics

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Summary

Mechatronics and Mechatronic applications are becoming standard in all modern industries. In automobiles; the electronics components and their networking have a considerable and increasing ratio with respect to construction, function and cost. The objective of this lecture is to highlight the author's experience in linking academia with industry in developing a sustainable program for Mechatronics education and research. As a specific example; the ever increasing market need in automotive industry and electronics (Autotronics) will be focused.

The topics of the lecture will include: Need of Mechatronics in automobile industry, Automotive modern sensor technologies, actuators and control units, and a proposal for an industry linked program in Autotronics. This proposal includes a dynamic program that considers industry need as a powerful potential for academic education, postgraduate, and research. At the same time, the academic innovations and advanced research will have the advantage to inspire new feasible industry applications.

The authors experience in a multinational European /Egyptian project: "Development Of An Industry Linked Mechatronics Program and Training of Trainers (DIMPToT)" is to be briefly introduced. A proposal for a new regional Mechatronics project in which experts from Egypt, Jordan, Germany, Poland, and The U.K. will be also highlighted.

Keywords: Mechatronics, autotronics, industrial applications.

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Diversification of the eddy current technology

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Summary

In metrology eddy current non-contact transducer have been widely used for measurement of position, displacement, cracks, vibration, proximity and alignment, as well as parts sorting applications over the past years. By reason of further developments of front end sensor elements as well as electronics, new application areas of eddy current sensors are technically feasible. In this paper lately achieved results in eddy current sensor developments will be presented.

Keywords: Eddy current, process control, rolling mill, gradiometer, tissue diagnostics.

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SSD10-SCI-1569330948

Autonomous aerial vehicles: guidance, control, and signal processing platform

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Summary

The use of unmanned systems is gaining momentum in civil applications after successful use by the armed forces around the globe. Autonomous aerial vehicles are important for providing assistance in monitoring highways, power grid lines, borders, and surveillance of critical infrastructures. It is envisioned that cargo shipping will be completely handled by UAVs by the 2025. Civil use of unmanned autonomous systems brings serious challenges. The need for cost effectiveness, reliability, operation simplicity, safety, and cooperation with human and with other agents are among these challenges. Aerial vehicles operating in the civilian aerospace is the ultimate goal which requires these systems to achieve the reliability of manned aircraft while maintaining their cost effectiveness.

In this presentation the development of an autonomous aerial vehicle will be discussed. The architecture of the system from the mission requirements to low level autopilot control laws will be discussed. Trajectory tracking and path following guidance and control algorithms commonly used and their implementation using of the shelf low cost components will be presented. Autonomous takeoff landing is a key feature that was implemented onboard the vehicle to complete its degree of autonomy. This is implemented based on accurate air-data system designed and fused with sonar measurements, INS/GPS measurements, and vector field method guidance laws.

Flight test data were collected to develop a complete mathematical model for the aircraft, and identify the stability and control derivatives of the UAV. A hardware-in-the-loop (HIL) simulation was used to develop and test the UAV autopilot hardware and software development virtually. A user friendly ground station is to interface with HIL using

external stick commands, and 3-D visualization of the vehicle's motion using flight-gear open source flight simulator.

The outcomes of the proposed research is that the AUS-UAV platform named MAZARI is capable of autonomous takeoff and landing based on a prescheduled flight path using waypoint navigation and sensor fusion of the inertial navigation system (INS) and global positioning system (GPS).

Several technologies need to be mastered when developing a UAV. The navigation task and the need to fuse sensory information to estimate the location of the vehicle is critical to successful autonomous vehicle. Currently extended Kalman filtering is used as fusion algorithm for position and poses estimation. Then path planning, trajectory generation and trajectory guidance alternative strategies is presented.

One of the important UAV mission is target surveillance using an onboard vision system. AUS-UAV Mazari is using a gimbaled camera for target monitoring and target tracking using basic digital image processing and techniques. The payload is integrated with the autopilot to lock on the target while the aircraft is moving.

Future plan is to develop a cooperation strategy between several vehicles in the air and on the ground. Use of vision system to aid the vehicle in localization using ground features is also under consideration.

Keywords: Autonomous aerial vehicles, guidance, control, image processing.

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paper reference
SSD10-PES-1569329494

Electromagnetic Fields and Human Health

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Egypt.

Summary

It's hard to imagine a world without electricity. And yet, wherever electricity is used, EMFs re created around the equipment and wires. These EMFs are usually invisible and imperceptible, but they are quite real. The interaction of EM fields with matter has been studied by physicists for over a century.

Today, EMFs are much better understood and documented than they were a few years ago. Calculations based on the classical equations have long been used to estimate the strengths and characteristics of the EM interactions with condensed matter, molecules, atoms and particles. Experiments have shown that these equations successfully represent the interactions, thus allowing physicists to use these interactions to investigate the basic properties of matter.

In this presentation the following will be present and explain: the electric and magnetic field, the field intensities are we exposed to in our everyday lives, their effects on the human body and on our health and the opinion of public health authorities around the world.

Keywords: EMF, electromagnetic fields, health effects, human health, environmental.

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SSD10-SCI-1569281653

Design-kit development based upon ISIT'S CMOS 1μM process technolgy

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Summary

This paper summarizes the necessary steps we went through to develop a design-kit for full-custom design based upon ISiT's CMOS 1μm technology process. All basic information dealing with technology setup, rule decks and analog simulation environment is provided and commented. The design-kit is fully compliant with Cadence Generic Process Design-Kit (GPDK) methodology guide, revision 1.8, September 2002. It has been developed using Cadence IC-Package IC5.1.41 tool-chain version, running under Solaris 10 OS. To validate our design-kit, an inverter cell has been designed according to the full-custom design flow.

Keywords: Process Design-Kit (PDK), CMOS process technology, cleanroom, cadence CAD tools.

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Design and simulation of a single stage single switch input current shaping circuit for AC/DC converter based on PWM technique

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Summary

In this paper a simple single-stage single-switch input-current shaping (S4ICS) circuit was designed, simulated and tested for AC/DC converter which generates input current harmonics due to its non-linear characteristics. A sinusoidal input current with nearly unity distortion factor was achieved through current harmonics mitigation by using PWM boost regulator. The circuit utilizes the charging and discarching increments of boost inductor current to shape a sinusoidal input current. Inductor current was controlled by means of PWM controller. The controller accepts two feed back signals, the first is the inductor current and the other is the output voltage of the AC/DC converter. The simulation results of fast fourier transform (FFT) show the great reduction in current harmonic which in turns tends to a great improvement in power factor and the sinusoidal shape of input current.

Keywords: Boost regulator, continuous conduction mode, current harmonics, current shaping, power factor, pulse width modulation.

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Memorization behaviors of different MIOS structures

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Summary

In this paper various kinds of charge storage cells are discussed as by examining many samples of MIOS with different structures. C-V, I-V and R-V measurements of the structures confirm the memorization capability of MIOS devices. The examined structures reveal three kinds of memory actions. The first one is the charge storage capability which can be shown through (C-V) curve shifting as the device was exposed to certain stress for a certain time. The second is the electronic switching that is demonstrated by the fact that the switching between ON and OFF states and back to original state can only be obtained by inverting the polarity of the applied bias voltage. The third kind of memorization action is that the device can be switched into a variety of stable intermediate resistance states. The new resistance state is determined by the height of the programming pulse applied to the device. This memory action is noticed from R-V characteristic and known as a nonvolatile analogue memory behavior.

Keywords: Memory devices, MOIS structures, Digital and analogue memorization.

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SSD10-SCI-1569315883

Influence of processing parameters on properties of strain sensors based on carbon nanotube films

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Summary

Carbon nanotube (CNT) films made from sing-wall and multi-wall nanotubes (SWCNTs and MWCNTs) were investigated recently as strain gauge for strain sensing. The quality of CNT films is important thereby as well as for many related applications. In this paper relevant processing factors such as the sonication time and concentration of sodium dodecyl sulfate (SDS) are investigated to characterize their influences on electrical properties of the produced CNT films. The results show that sonication time plays an important role for the quality of CNT films. A longer sonication time realizes better homogeneity of the CNT films, lower resistance values and higher reproducibility of the specimens. SWCNT and MWCNT specimens were manufactured and measured for strain sensing. MWCNT specimens show a better sensing property than SWCNT specimens with an applied strain up to 1%. Two strain sensing regions for MWCNT films can be clearly recognized possibly due to the different response characteristics of contact resistance and tube resistance to external loading. As the strain is smaller than 0.1% the sensitivity of the MWCNT films is low, about 2.5. For the strain from 0.1% to 1% the sensitivity is about 5 and the sensing property is reproducibility. Results of SWCNT films are much complex compared to MWCNT films. For the strain smaller than 0.2% the resistance variation curves and the sensitivities of SWCNT films are similar to those of MWCNT films. The sensitivities decrease however for the strain from 0.2% to 0.3% and change dramatically and irreproducibility for the strain from 0.5% to 1%.

Keywords: CNT film, strain sensor, sonication time, SDS concentration, reproducibility.

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Algorithmic construction of optimal and load balanced clusters in wireless sensor networks

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Summary

This paper proposes a clustering algorithm - Balanced Minimum Radius Clustering (BMRC) - for use in large scale, distributed Wireless Sensor Networks (WSN). Cluster balancing is an intractable problem to solve in a distributed manner, and distribution is important, by reason of both avoiding specialized node vulnerability and minimizing message overhead. The BMRC algorithm described here distributes several of the cluster balancing functions to the cluster-heads. In proposing this algorithm, several tentative claims have been made for it, namely that it is suitable for arbitrary number of cluster heads; that it specifies a way to elect cluster heads and use them to create the local models; that it accomplishes optimal balanced clusters in distributed manner; that it is scalable and it uses the number-of hops as a clustering parameter; that it is energy efficient. These claims were studied and verified by simulation.

Keywords: Wireless sensor networks, clustering, load-balancing.

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SSD10-SCI-1569323146

Detection and localization of cable faults by time and frequency domain measurements

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Summary

The localization of cable faults is very important for communication systems, power distribution systems and vehicles. Reflectometry methods are often used to detect and locate cable faults. A high-frequency signal is send down the cable. The reflected signal includes information about changes of cable impedance. With measurement of the time or phase delay the faults can be detected and located. These methods are used to detect open and short circuits. There are also techniques available for detecting frays, joints and other small anomalies. This paper describes and simulates different wire test methods that suitable for portable or in-situ test equipment and compares their advantages and disadvantages. The methods compared are the time domain reflectometry (TDR), time frequency domain reflectometry (TFDR) and frequency domain reflectometry (FDR).

Keywords: Cable faults detection and location, Frequency domain reflectometry (FDR), digital signal processing (DSP), time domain reflectometry (TDR), time frequency domain reflectometry (TFDR) and cable fault location.

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Design and test of general-purpose SPI master/slave IPs on OPB bus

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Summary

SPI is one of the most commonly used serial protocols for both inter-chip and intra-chip low/medium speed data-stream transfers. In conformity with design-reuse methodology, this paper introduces high-quality SPI Master/Slave IPs that incorporate all necessary features required by modern ASIC/SoC applications. Based upon Motorola's SPI-bus specifications, version V03.06, release February 2003, the designs are general purpose solutions offering viable ways to controlling SPI-bus, and highly flexible to suit any particular needs. The purpose of this paper is to provide a full description of an up-to-date SPI Master/Slave FPGA implementations. All related issues, starting from the elaboration of initial specifications, till the final system verification, are comprehensively discussed and justified. The whole design code, either for synthesis or verification, is implemented in Verilog 2001 (IEEE 1365). The RTL code is technology independent, achieving a transfer rate of 71 and 75 MBPS for the Master and the Slave, respectively, when mapped onto Xilinx's Virtex 5 FPGA devices.

Keywords: Serial peripheral interface (SPI), intellectual property (IP), system-on-chip (SoC), on-chip peripheral Bus (OPB).

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A neural network based algorithm for assessing risk priority of medical equipments

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Summary

This paper presents a robust algorithm for the assessment of risk priority for medical equipments based on the calculation of static and dynamic risk factors and Neural Networks (NNs). Four risk parameters have been calculated for a total of 345 different medical devices in two general hospitals in Baghdad. Static risk factor components (equipment function and physical risk) and dynamics risk components (maintenance requirements and risk points) were determined for the medical equipments under consideration. These risk components were used as an input to the feed forward NN trained with Back Propagation algorithm (BPNN). The accuracy of the network was found to be equal to 96risk factor assessment for the service departments in large hospitals in Iraq.

Keywords: Risk factors, neural networks, back propagation algorithm, risk priority.

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Hardware implementation and experiment validation of the VDDRHF color image filter

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Summary

This paper proposes a novel FPGA implementation of Vector Directional Distance Rational Hybrid Filter) (VDDRHF) for mixed noise suppression and fine-details preservation in color images. The Implementation was done, based on FPGA HW/SW validation using efficient hardware optimizations and non linear function approximations. The validation using FPGA board confirms the color image quality preservation. Our proposed architecture proves that HW/SW co-design present a high timing performance compared to software based solutions.

Keywords: VDDRHF filter, color image, architecture, FPGA implementation, Nios-II, validation.

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Impact of varying processor number for H264 In FPGA platform

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Summary

Multiprocessor architecture can be a solution for the increasing computational requirements for multimedia treatment algorithms such as video encoding. In this paper we study the effect of core numbers increase for the FPGA resources use and performances. We use the Altera core NIOS II processor and the Avalon bus as interconnection mean. We vary core number from one to four and noted its effect for FPGA logic elements, memory bits and DSP blocks use on one side and for treatment time on the other side. We used the H.264/AVC intra 16x16 chain as validation algorithm and the ALTERA Stratix 1S40 as implementation platform.

Keywords: FPGA, multiprocessor architecture, multimedia, DSP.

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An efficient pipeline execution of H.264/AVC intra 4x4 frame design

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Summary

In this paper, we present an implementation of the optimized H.264 INTRA 4X4 algorithm in order to reduce the time required to complete the INTRA 4X4 process. However the source of waste time in conventional architecture of INTRA 4X4 is the serialization of intra predictions and reconstructions of sixteen 4x4 blocks in one macro-block which can be replaced by a pipelined architecture while maintaining consistency with the standard. in this work, we have studied ten alternative scanning orders based on rearranging order of INTRA 4X4 to choose the best one in order to reduce dependencies between consecutively executed blocks without performance degradation. The best order is implemented by a pipelined architecture using VHDL language. The VHDL code is verified to work at 100 MHz in an ALTERA Stratix II EP2S60F1020C3 FPGA. As a result, the processing time is reduced by 31.25realtime video application. The H.264 INTRA 4X4 hardware and software are demonstrated to work together on ALTERA NIOS-II development board with Stratix II EP2S60F1020C3 FPGA.

Keywords: H.264, FPGA, Intra 4x4, scanning order, pipeline, embedded Linux, NIOS II.

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Hardware implementation of pulse mode RBFNN based edge detection system on virtex V platform

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Summary

In this paper, we have proposed a new architecture of RBFNN. Neural network efficiency in embedded systems offers the possibility of reconfiguration and the genericity of the solution. Indeed, the same integrated system can approximate any input-output function thanks to the parameters update on the chip. RBF neural networks constitute a subset of the neuronal networks, which has a great potential in reducing the size of the network. Pulse mode neural networks reduce significantly hardware resources by replacing the conventional huge multiplier by a simple frequency multiplier. As application, we approximate with the proposed RBF network, a Canny operator based edge detection, which is an important step in image processing. Acceptable edge detection approximation was done, with a mean generalization error of (4.604 %) on the Wang image database. Moreover, a design synthesis on FPGA virtex V platform was done, the results of implementation lead to an operating frequency of 445,295 MHz, which offers real time application performances.

Keywords: Neural network, RBF, FPGA, pulse mod, Training, Canny, edge detector.

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Fractional spline wavelet for numerical analysis in electromagnetic

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Summary

In this paper special focus is given to the application of fractional spline wavelet functions to solve electromagnetic scattering problem via numerical techniques. In this work the numerical technique used is the well known Moment method and the wavelets are used as basis function, and the electromagnetic scattering problem chosen here is a rectangular horn, considered to be perfect conductor. In previous work different type of wavelet are used but it was noticed that for special geometrical cases entire spline wavelet cannot full fill the requirement of the problem and special need is to use fractional spline wavelet. The results obtained with fractional spline use show that both the accuracy and the time processing are improved.

Keywords: Fractional Spline, wavelet, electromagnetic, moment method.

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Linearization of power amplifier class AB using cartesian feedback

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Summary

In this paper we present detailed simulations based on demonstrate the applicability of the Cartesian feedback technique to linearize the behavior of a class AB power amplifier which is widely used in wireless communication systems . The linearized amplifier is a parametric Model that takes into account actual operating characteristics of commercial unit used for multi-carrier transmission. This will contribute in improving the linearity of power amplifier and causes a considerable reduction in harmonics of output waveform.

Keywords: Power Amplifier, Mobile Power Amplifier, cartesian feedback.

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Tunable - compact bandstop defected ground structure (DGS) with lumped element

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Summary

This paper introduces new compact DGS Resonators and an approach in which lumped and tunable element are add within the DGS Resonating structure in certain places to obtain compact high performance and tunable filters. A comparison study of the combined resonators is presented to identify their relative advantages, disadvantages and their suitability for specific applications like cygnus system for seismic waves. A good agreement between the results of measurements and those produced from both the finite difference time domain method (FDTD) MATLAB code and the EM Simulation program are achieved.

Keywords: DGS, lumped element, resonators, FDTD, measurements.

Author Index