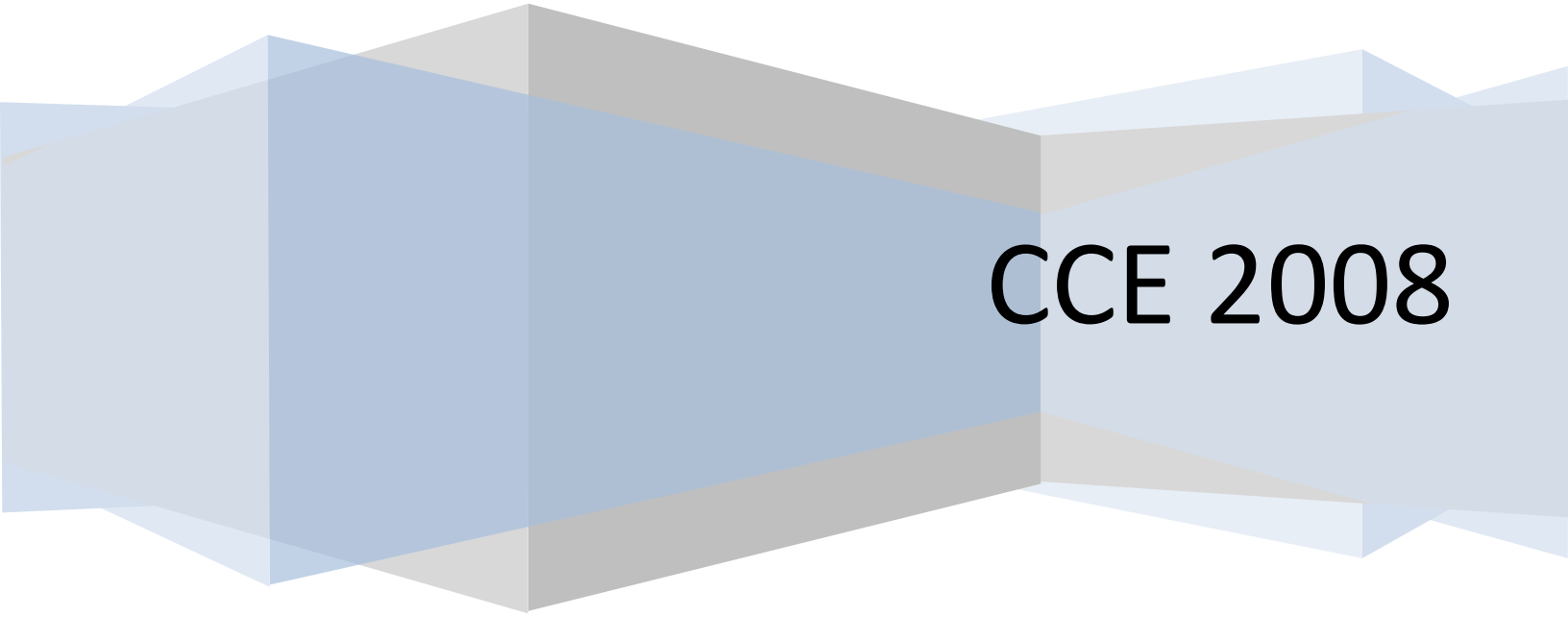
Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional

2008 5th International Conference on Electrical Engineering, Computing Science and Automatic Control

Final Program and Abstract Book

Mexico City, Mexico

November 12-14, 2008



November 2008

Contents

Message from the Podium

Editorial.

This year we are celebrating the 5th International Conference, which is highlighted by an important change in its organization that includes for the first time, the participation of three academic departments at CINVESTAV: Electrical Engineering, Computer Science and Automatic Control. This marks an important step for a Conference that was born in the last decade of the past century (1995) as an effort of the Department of Electrical Engineering to open a specialized forum where the local research groups could expose their investigation results and proposals, interact with each other, and to have the opportunity to become aware of the recent research and developments from leading institutions abroad, too. Also, the interaction with technological industry mangers and government officials, has had since then, a special place in the activities of the conference. Evidently, the conference has experienced a continuous evolution that is reflected in its enhancements throughout its existence. First, it was a national event; then, in 2004 it was projected as an international conference. This year, its organization has been extended to include the participation of two departments that emerged as specialities with their own personalities and structures within CINVESTAV, namely, the Computer Science Department and the Automatic Control Department, whose contributions have been very valuable. Such a new stage has arisen many expectations and opens endless possibilities for the future. We hope that our objective of spanning interest to a wider engineering audience can be fulfilled, keeping always in mind the goal of having an event of better quality each year.

As expected, the participation to the conference has increased. This year, we received 166 submissions from 14 countries (including Mexico), from which 94 were accepted for oral presentation. The 39 submissions from abroad came from countries such as the USA, India, Spain, China, Egypt, Argentina and Brazil, among others, reflecting the renewed efforts conjugated to broaden the participation beyond our borders, so that this conference can be considered in the near future, as an important and challenging forum.

As Presidents of CCE 2008, we wish to thank the Organizing Committee, the anonymous referees and the supporting personnel for their valuable time and efforts for they make possible to hold a successful 2008 5th International Conference on Electrical Engineering, Computing Science and Automatic Control (CCE).

To all our attendees, we give them a warm welcome wishing them a very fruitful and enriching conference, hoping that all their expectations are fulfilled.

Dr. José Antonio Moreno Cadenas

Dr. Carlos A. Coello Coello

Dr. Alexander Poznyak Gorbatch

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Yuriy Shkvarko	CINVESTAV-IPN, Unidad Guadalajara

Final Program

TUTORIAL COURSES AND WORKSHOP

NOVEMBER 10-11, 2008

Monday November 10, 2008
TUTORIAL COURSES

	Room1	Room4	Room5
10:00-11:30	TUT2	TUT1	---
11:30-12:00	*Break*		
12:00-13:30	TUT2	TUT1	---
13:30-15.30	*Lunch*		
15:30-17:00	---	TUT1	---
17:00-17:30	*Break*		
17:30-19:00	---	TUT1	---

Tuesday November 11, 2008
WORKSHOP CASI 2008 AND TUTORIAL COURSES

	Room1	Room4	Room5
9:00-9:20	Welcome Ceremony		
9:20-10:40	WS1	---	---
10:00-11:30	---	---	TUT2
10:40-11:20	*Break (Workshop)*		
11:30-12:00	*Break (Tutorial Courses)*		
11:20-12:40	WS2	---	---
12:00 -13:30	---	---	TUT2
	Lunch		

CONFERENCE CCE 2008

NOVEMBER 12-14, 2008

Wednesday November 12, 2008
CCE

	Room1	Room2	Room3	Room4
08:00 -09:00	Registration			
09:00-09:20	Opening Ceremony			
09:30-10:30	PLE1	---	---	---
10:30-11:00	*Break*			
11:00-12:00	PLE2	---	---	---
12:00-12:30	*Break*			
12:30-13:30	MEC1	CS1	BIO1	AC1
13:30-15:00	*Lunch*			
15:00-17:00	SSM1	CS2	BIO2	AC2
17:00-17:20	*Break*			
17:20-18:00	COM1	CS3	SSM2	AC3
18:30	Welcome Cocktail			

Thursday November 13, 2008
CCE

	Room1	Room2	Room3	Room4
09:00-10:00	CS4	BIO3	MEC2	AC4
10:00-11:00	PLE3	---	---	---
11:00-11:30	*Break*			
11:30-12:30	PLE4	---	---	---
12:30-13:00	*Break*			
13:00-15:00	*Lunch*			
15:00-17:00	BIO4	CS5	SSM3	AC5
17:00-17:20	*Break*			
17:20-18:00	COM2	BIO5	SSM4	AC6

Friday November 14, 2008
CCE

	Room1	Room2	Room3	Room4
09:00-10:00	MEC3		SSM5	AC7
10:00-11:00	PLE5	---	---	---
11:00-11:30	*Break*			
11:30-12:30	PLE6	---	---	---
12:30-13:00	*Break*			
13:00	Closing ceremony			

AC1:	Nonlinear systems
AC2:	Nonlinear control applications
AC3:	Sliding mode control
AC4:	Nonlinear control design
AC5:	Robotics and Synchronization
AC6:	Optimal Control
AC7:	Optimal Control
BIO:	Biomedical Engineering
COM:	Communications Systems
CS:	Computer Science and Computer Engineering
MEC:	Mechatronics
SSM1 (a):	Materials, Characterization
SSM1 (b):	Integrated Electronic Circuits
SSM2:	Solar Cells
SSM3 (a):	Digital Circuits, signal processing
SSM3 (b):	Materials, fabrication and characterization
SSM4:	Materials, characterization
SSM5:	Solar cells and related topics
TUT1:	"Sliding Mode Control with Applications"
TUT2:	"Propiedades Físico-Qúimicas de Nanoestructuras: Nanotubos y Nanopartículas Magnéticas"
WS1:	Workshop CASI 2008: Special Session 1 - Multi-Sensor Adaptive Data Fusion and Imaging
WS2:	Workshop CASI 2008: Special Session 2 - Features extraction, Signatures Field Mapping and RS Image Understanding

1. AC1: Automatic Control - Nonlinear Systems

Wednesday (12:30-13:30) Room 4
Session Chair: Valery R. Nosov

2. AC2: Automatic Control - Nonlinear Control Applications

Wednesday (15:00-17:00) Room 4
Session Chair: Rubén Alejandro Garrido Moctezuma

3. AC3: Automatic Control - Sliding Mode Control

Wednesday (17:20-18:00) Room 4
Session Chair: Leonid Fridman

6. AC6: Automatic Control - Optimal Control

Thursday (17:20-18:00) Room 4

Session Chair: Samuel Moya

7. AC7: Automatic Control - Optimal Control

Friday (9:00-10:00) Room 4

Session Chair: Vadim Azhmyakov

8. BIO1: Biomedical Engineering

Wednesday (12:30-13:30) Room 3

Session Chair: Roberto Muñoz

9. BIO2: Biomedical Engineering

Wednesday (15:00-17:00) Room 3

Session Chair: Abdelhalim Azbaid

10. BIO3: Biomedical Engineering

Thursday (9:00-10:00) Room 2

Session Chair: Arturo Vera

11. BIO4: Biomedical Engineering
Thursday (15:00-17:00) Room 1
Session Chair: Carlos Alvarado

12. BIO5: Biomedical Engineering
Thursday (17:20-18:00) Room 2
Session Chair: Alejandro Valentino

13. COM1 Communications Systems
Wednesday (17:20-18:00) Room 1
Session Chair: José Oscar Olmedo Aguirre

14. COM2 Communications Systems
Thursday (17:20-18:00) Room 1
Session Chair: José Oscar Olmedo Aguirre

15. CS1: Computer Science and Computer Engineering
Wednesday (12:30-13:30) Room 2
Session Chair: Debrup Chakraborty

16. CS2: Computer Science and Computer Engineering
Wednesday (15:00-17:00) Room 2
Session Chair: Francisco Rodríguez Henríquez

17. CS3: Computer Science and Computer Engineering

Wednesday (17:20-18:00) Room 1

Session Chair: José Guadalupe Rodriguez García

18. CS4: Computer Science and Computer Engineering

Thursday (9:00-10:00) Room 1

Session Chair: Xiaoou Li

19. CS5: Computer Science and Computer Engineering

Thursday (15:00-17:00) Room 2

Session Chair: Luis Gerardo de la Fraga

20. MEC1: Mechatronics

Wednesday (12:30-13:30) Room 1

Session Chair: Luis Govinda Garcia Valdovinos

21. MEC2: Mechatronics

Thursday (9:00-10:00) Room 3

Session Chair: Gerardo Silva Navarro

22. MEC3: Mechatronics

Friday (9:00-10:00) Room 1

Session Chair: Hebertt José Sira Ramírez

23. SSM1 (a): Materials, Characterization

Wednesday (15:00-16:00) Room 1

Session Chair: Alejandro Ávila García

24. SSM1 (b): Integrated Electronic Circuits

Wednesday (16:00-17:00) Room 1

Session Chair: Antonio Cerdeira Altuzarra

25. SSM2: Solar Cells
Wednesday (17:20-18:00) Room 3
Session Chair: Victor Sánchez Reséndiz

26. SSM3 (a): Digital Circuits, Signal Processing
Thursday (15:00-16:00) Room 3
Session Chair: Rodolfo Quintero Romo

27. SSM3 (b): Materials, Fabrication and Characterization
Thursday (16:00-17:00) Room 3
Session Chair: Mauricio Ortega López

28. SSM4 Materials, Characterization
Thursday (17:20-18:00) Room 1
Session Chair: María de la Luz Olvera Amador

29. SSM5 Solar Cells and Related Topics
Friday (9:00-10:00) Room 3
Session Chair: Lourdes Albor Aguilera

30. WS1: Workshop CASI 2008: Special Session 1 - Multi-Sensor Adaptive Data Fusion and Imaging
Tuesday (9:20-10:40) Room 1
Session Chair: Iván Esteban Villalón Turrubiates

31. WS2: Workshop CASI 2008: Special Session 2 - Features extraction, Signatures Field Mapping and RS Image Understanding

Tuesday (11:20-12:40) Room 1

Session Chair: Héctor Pérez Meana

Courses

Prof. Yuri B. Shtessel

Department of Electrical and Computer Engineering
The University of Alabama in Huntsville
Huntsville, Alabama

Title: “Sliding Mode Control with Applications”

Content

1. Basics of sliding mode control
2. Higher order sliding mode control
3. Sliding mode state and disturbance observers
4. Guidance and control of Missile Interceptor using second order sliding modes
5. Blood glucose regulation using higher order sliding mode control
6. DC-to-DC and AC-to-DC power converters control in sliding modes
7. UAV tight formation control via higher order sliding modes

Dr. Florentino Lopez Urias

Instituto Potosino de Investigación Científica y Tecnológica

Departamento de Materiales Avanzados

San Luis Potosí, S. L. P.

Laboratory for Nanoscience and Nanotechnology Research (LINAN) & Advanced Materials Department, IPICYT, San Luis Potosí S.L.P., México.

Title: "Physical-Chemical Properties of Carbon Nanostructures and Magnetic Nanoparticles"

Magnetic properties of carbon nanostructures are shown using a electron tight binding model in conjunction with the London approximation. We consider fullerenes, corrugated and noncorrugated carbon nanotori, carbon nanoribbons, nanocones, closed ends nanotubes, and finite graphene sheets. For corrugated carbon nanotori, we have constructed the structures in two different ways: (1) by joining the ends of carbon nanotubes containing pentagonal, hexagonal and heptagonal carbon rings, and (2) by coalescing C60 molecules along of the three different axes of symmetry. The noncorrugated carbon nanototori have been constructed by joining the ends of standard carbon nanotubes containing hexagonal rings only. Electronic ring currents, density of states, wave function spatial distribution are shown as a function of the system´s size and symmetry. Also, results on metallic nanoparticles inside carbon carbon nanotubes will be shown.

In addition, itinerant and localized ferromagnetism and antiferromagnetism in clusters at finite temperature will be presented using the canonical partition function over electronic and isomerization degrees of freedom. All energy levels of clusters have been determined exactly by diagonalization of the Hubbard model. The average total spin $\langle S \rangle$, magnetic susceptibility, specific heat, and the spin-spin correlation functions of clusters with 3-9 atoms will be shown as a function of the temperature and the on-site Coulomb repulsion. It has found an unexpected increment of $\langle S \rangle$ as the temperature was increased similar to the experimental results obtained for cobalt clusters. This behavior is explained using the spin-resolved spectral density. A characteristic temperature $T_c \approx 500\text{-}1000K$ has been identified where a precursor operates the orderdisorder magnetic transition in the clusters.

Keynote Speakers

Magnus Egerstedt
Associate Professor
Electrical and Computer Engineering
Georgia Institute of Technology
Atlanta, GA, USA
***Plenary**: "Hybrid Control of Networked, Dynamical Systems"*

Georgios B. Giannakis
University of Minnesota
USA
***Plenary**: "Distributed Estimation Using Wireless Sensor Networks"*

Marcelo Antonio Pavanello
Centro Universitario da FEI
Sao Paulo, Brasil
***Plenary**: "Los Temperature Improvements on the Performance of Planar and Multiple Gate SOI MOSFETs*"

Aleksandar M. Stankovic
Northeastern University
Boston, MA, USA
***Plenary**: "Energy Processing and Control Systems - Joint Past, Common Future"*

Piero Bonissone
General Electric Global Research
USA
***Plenary**: "Computational Intelligence Applications to Prognostics and Health Management (PHM)"*

François Guillemin
Directeur du Centre Régional de Lutte Contre le Cancer,
Nancy, France
***Plenary**: "SURGETICS"*

1. “Hybrid Control of Networked, Dynamical Systems”

Prof. Magnus Egerstedt
Associate Professor
Electrical and Computer Engineering
Georgia Institute of Technology
Atlanta, GA, USA

Arguably, the overarching scientific challenge facing the area of networked robot systems is that of going from local rules to global behaviors in a predefined and stable manner. In particular, issues stemming from the network topology imply that not only must the individual agents satisfy some performance constraints in terms of their geometry, but also in terms of the combinatorial description of the switching network, implying that hybrid systems theory must be employed. Moreover, a multi-agent robotic network is only useful inasmuch as the agents can be redeployed and reprogrammed with relative ease, and we address these two issues (local interactions and programmability) from a controllability point-of-view. In particular, the problem of driving a collection of mobile robots to a given target destination is studied, and sufficient conditions are given for this to be possible, based on novel tools from algebraic graph theory.

2. “Distributed Estimation Using Wireless Sensor Networks”

Prof. Georgios B. Giannakis
University of Minnesota
USA

Envisioned applications of wireless sensor networks (WSNs) include surveillance, monitoring and tracking tasks. These motivate well decentralized estimation and smoothing of deterministic and (non)stationary random signals using (possibly correlated) observations collected across distributed sensors. In this talk we present state-of-the-art algorithms for consensus-based distributed estimation using ad hoc WSNs where sensors communicate over single-hop noisy links. The novel framework reformulates basic estimation criteria such as least-squares, maximum-likelihood, maximum a posteriori, and linear mean-square error, as decomposable, constrained, convex optimization problems that are amenable to distributed solutions. The resultant distributed estimators are provably convergent to their centralized counterparts and robust to communication noise. Besides stationary, the framework encompasses adaptive filtering and smoothing of non-stationary signals through distributed LMS and Kalman filtering.

3. “Los Temperature Improvements on the Performance of Planar and Multiple Gate SOI MOSFETs”

Prof. Marcelo Antonio Pavanello
Centro Universitario da FEI
Sao Paulo, Brasil

In the past few years the CMOS device dimensions are being aggressively reduced. In order to sustain this continuous downscaling of dimensions different technologies are being considered as well as devices with two, three or even four gates. For the 32 nm CMOS generation the use of devices with multiple-gates is being considered as an excellent alternative.

In this presentation the MOSFET operation in cryogenic environments will be revisited aiming at the improvements provided with respect to room temperature operation, additionally to those obtained by the device downscaling. The temperature reduction improves the carrier mobility and contributes to the leakage current and subthreshold slope reduction. On the other hand, the threshold voltage increases as the temperature is reduced. The impact of these variations on the performance of planar and multiple-gate Silicon-On-Insulator devices will be discussed, specially looking at the analog figures of merit such as the transconductance, output conductance, unity-grain frequency and open-loop voltage gain. Alternatives such as multiple-gate architectures or channel engineering will be discussed showing their potential not only for digital circuits but also for obtaining high performance analog circuits. Also the typical problems associated to the temperature reduction such as the self-heating effect and the possible saturation threshold voltage degradation will be presented and discussed.

4. “Energy Processing and Control Systems - Joint Past, Common Future”

Prof. Aleksandar M. Stankovic
Northeastern University
Boston, MA, USA

Energy processing systems (power systems, electric drives and power electronics) have had a number of fruitful interactions with the area of control systems. The joint roots are programmatic (systems approach, model-based analysis and design) as well as personal (a number of distinguished engineers have been working in both domains). The first part of the talk will review some past successes (large scale systems, decentralized control and frequency regulation in power interconnections) and current advances (hybrid systems, switched systems and power electronics, geometric nonlinear control and electric drives) and outline likely future intersections. The second part of the talk will present a more personal view, and introduce a Hilbert

space approach which provides a unified exposition of various definitions of reactive (or inactive) power and of various compensation methods for systems with an arbitrary number of phases and harmonics.

Finally, possible future interactions of energy and controls will be presented, with looming global problems like global climate change and energy uncertainty providing both the motivation and the performance metrics.

5. "Computational Intelligence Applications to Prognostics and Health Management (PHM)"

Dr. Piero Bonissone
General Electric Global Research
USA

Within the broad spectrum Computational Intelligence (CI) applications, we will focus on Prognostics & Health Management (PHM) for assets such as locomotives, medical scanners, aircraft engines, etc. The main goal of PHM is to maintain these assets' operational performance over time, improving their utilization while minimizing their maintenance cost. To better understand PHM requirements, we introduce a decision-making framework in which we analyze PHM decisional tasks. This framework is the cross product of the decision's time horizon and the domain knowledge used by SC models. Within such a framework, we analyze the progression from simple to annotated lexicon, morphology, syntax, semantics, and pragmatics. We use this metaphor to monitor the leverage of domain knowledge in SC to perform anomaly detection, anomaly identification, failure mode analysis (diagnostics), estimation of remaining useful life (prognostics), on-board control, and off board logistics actions. We illustrate a case study in anomaly detection, which is solved by the construction and fusion of an ensemble of diverse detectors, each of which is based on different SC technologies.

6. "SURGETICS"

Prof. François Guillemin
Directeur du Centre Régional de Lutte Contre le Cancer,
Nancy, France

La surgétique est un domaine transdisciplinaire visant à introduire les derniers outils des technologies informatique et robotique dans la pratique médico-chirurgicale.

"SURGETICS" Tratará de la robótica quirúrgica, auxiliada con visión en la operación en combinación con la técnica de quimio-hipertérmia local.

Abstract Book

1. AC1: Automatic Control - Nonlinear systems

Wednesday (12:30-13:30) Room 4
Session Chair: Valery R. Nosov

1.1 Complex Dynamics in an Ideal Commutable Pendulum

Valery R. Nosov, Institution: Instituto Politécnico Nacional, SEPI-ESIME
Héctor Domínguez, Institution: Instituto Politécnico Nacional, SEPI-ESIME
José A. Ortega Herrera, Institution: Instituto Politécnico Nacional, SEPI-ESIME

This paper shows complex dynamical behavior in an ideal commutable pendulum. This system is set with two regions of different natural frequencies and complex behavior is present by commuting from one region to the other under certain rules. This commutable commutable pendulum shows a very complex behavior besides the fact that it is based on a simple pendulum model. By varying a single parameter in the model, this commutable pendulum may have simple limit cycle, complex limit cycle and a chaotic behavior. Same complex behavior is extended to mimic other chaotic maps.

1.2 Output Linear Feedback for a Class of Nonlinear Systems based on the Invariant Ellipsoid Method

Gonzalez-Garcia Salvador, Institution: Department of Automatic Control. CINVESTAV
Polyakov Andrey, Institution: Department of Applied Mathematics, Voronezh State University
Poznyak Alexander, Institution: Department of Automatic Control. CINVESTAV

The robust output stabilization problem for a class of nonlinear uncertain systems with disturbances is considered. The suggested control scheme as well as the observation algorithm are based on the invariant ellipsoid method, which allows to obtain the robust linear feedback as a solution of the special linear optimization problem with bilinear constraints. The methods for solving this optimization problem involves the LMI technique. The stabilization of a single link flexible joint manipulator is considered as an illustrative example.

1.3 Modified Carleman Linearization and its Use in Oscillators

Joaquín Collado Moctezuma, Institution: CINVESTAV IPN
Irving Andrés Sanchez Lima, Institution: CINVESTAV IPN

The standard Carleman Linearization states that every analytic n-dimensional nonlinear systems is equivalent to an infinite dimensional linear system. In this paper we truncate this linearization and introduce some modification which reduces the error in the truncation process. We applied this Modified Carleman Linearization to two van der Pol oscillators with slight different frequencies. Each one is approximate by a 14th order linear system; then we coupled this two linear oscillators and look for a synchronization. We conclude that even the approximation is very good, is not possible synchronize high order linear oscillators as the nonlinear oscillators do.

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2. AC2: Automatic Control - Nonlinear Control Applications

Wednesday (15:00-17:00) Room 4
Session Chair: Rubén Alejandro Garrido Moctezuma

2.1 Nonlinear Partial State Feedback Controller for a Single Phase Active Rectifier

Manuel Israel Flota Bañuelos, Institution: Universidad Autónoma de San Luis Potosí-
Ricardo Álvarez Salas, Institution: Universidad Autónoma de San Luis Potosí-
Hugo Rodríguez-Cortés, Institution: Centro de Investigación y Estudios Avanzados-IPN, Departamento de Ingeniería Eléctrica,
Ciro Núñez Gutiérrez, Institution: Universidad Autónoma de San Luis Potosí

This paper presents a partial state feedback controller for an active rectifier to regulate dc output voltage and to guarantee a power factor close to unity. The partial information controller is based on the Exact Tracking Error Dynamics Passive Output Feedback (ETDPOF) technique in conjunction with an Immersion and Invariance based inductor current observer. Numerical simulations are presented to evaluate the performance of the proposed control scheme.

2.2 Application of a Leak Detection Algorithm in a Water Pipeline Prototype: Difficulties and Solutions

Ofelia Begovich, Institution: CINVESTAV-GDL
Alejandro Pizano Moreno, Institution: CINVESTAV-Gdl

The main aim of this paper is to comment about the difficulties encountered during the implementation of a well known analytic leak detection algorithm on a short length water pipeline prototype. In addition, the proposed solutions to overcome these difficulties are described. To improve the algorithm extra filtering to all input signals is added and a different freeze-method for the friction coefficient estimation is proposed. Real data are obtained from flow and head pressure sensors installed upstream and downstream of the pipe and then they are fed to the algorithm. The estimation of the leak size and leak position are presented.

2.3 Closed-Loop Identification of a Velocity Controlled DC Servomotor

Rubén Alejandro Garrido Moctezuma, Institution: CINVESTAV, IPN
Roger Miranda Colorado, Institution: CINVESTAV, IPN

This paper presents a methodology for closed-loop identification of velocity controlled servomotors. The approach considers a PI controller applied simultaneously to the real servomotor and its model. It is shown that under persistently exciting conditions the parameter estimates converges. Experimental results using a laboratory test bed validate the proposed approach.

2.4 Maximum Power Control of Hybrid Wind-Diesel-Storage System

Elkhatib Kamal, Institution: Industrial Electronics and Control Dept., Faculty of Electronic Engineering, Menoufia University Menouf, Egypt
Magdy Koutb, Institution: Industrial Electronics and Control Dept., Faculty of Electronic Engineering, Menoufia University, Menouf

Abd- Azim Ibrahim, Institution: Industrial Electronics and Control Dept., Faculty of Electronic Engineering, Menoufia University Menouf, Egypt
Belal Abouzalam, Institution: Industrial Electronics and Control Dept., Faculty of Electronic Engineering, Menoufia University Menouf, Egypt
Sahar Kaddah, Institution: Electrical Engineering Dept., Faculty of Engineering, Mansoura University,Mansoura

Optimum wind energy extraction is a very important economical target. This paper is concerned with the development of a robust controller for the wind turbines in hybrid wind-diesel storage system (HWDSS). The proposed algorithm, which is based on fuzzy linear matrix equalities (FLME), maximizes the power coefficient for a fixed pitch. Moreover, it reduces the voltage ripple and stabilizes the system over a wide range of wind speed variations. The control scheme is tested for different profiles of wind speed pattern and provides satisfactory results.

2.5 Review of Tokamak Codes

Ma. Goretti Sevillano-Berasategui, Institution: University of the Basque Country
Izaskun Garrido, Institution: University of the Basque Country
Aitor J. Garrido, Institution: University of the Basque Country
Oscar Barambones, Institution: University of the Basque Country

The current worldwide increasing demand of energy has pointed out the need to develop new sources of power. Nuclear fusion has turned out to be a promising source of this power which has lead to an increasing interest in finding solutions for the different tokamak control problems. In order to find suitable controllers, several kind of models have been developed and studied. In this paper, some of the most relevant models and simulation codes are presented with the purpose of providing a state of the art review of the techniques that are nowadays being used in tokamak control. First of all, a summary of the necessary background to deal with control problems in tokamaks is given. With this aim, an introduction to nuclear fusion and tokamak reactors is provided followed by a description of the dynamics of a tokamak. Then, the current control problems present in tokamaks are summarized and briefly described. And finally the diverse models and codes used in the design of controllers are explained.

2.6 A Strategy to Replace the Damaged Element for Fault-Tolerant Induction Motor Drive

Marco Antonio Rodríguez Blanco, Institution: Universidad Autónoma del Carmen (UNACAR) Centro Nacional de Investigación y Desarrollo Tecnológico (CENIDET)
Abraham Claudio Sánchez, Institution: Centro Nacional de Investigación y Desarrollo Tecnológico (CENIDET)
Didier Teilliol, Institution: Centre de Recherche en Automatique de Nancy, CRAN –ESA CNRS 7039 Universite Henri Poincare, Nancy Cedex 1
Luis Gerardo Vela, Institution: Centro Nacional de Investigación y Desarrollo Tecnológico (CENIDET)
Leobardo Hernández, Institution: ESIME-C del I.P.N

In this paper, the best moment to replace to the damaged element in a fault-tolerant induction motor drive working with a open-loop and closed-loop control is presented, a previous stage of fault-diagnostic to detect a

short-circuit or open-circuit failure in the power device is considered. The technique is based on the connection of bidirectional switches to electrically isolate the damaged element by mean of fuse blown corresponding and to replace only the damaged device by another healthful one at the most suitable moment, the main issue is to diminish the tracking error of the motor current during the fault transient. Experimental and simulation results are obtained in order to validate the technique proposed.

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3. AC3: Automatic Control - Sliding Mode Control

Wednesday (17:20-18:00) Room 4

Session Chair: Leonid Fridman

3.1 Super-Twisting Sliding Mode Control for Unified Power Flow Controller in Power Systems

Fidel Arturo Robles, Institution: CINVESTAV Unidad Guadalajara.
José Manuel Cañedo, Institution: CINVESTAV Unidad Guadalajara.
Alexander G. Loukianov, Institution: CINVESTAV Unidad Guadalajara.
Fridman Leonid, Institution: Universidad Nacional Autónoma de México.

In this paper, robust stabilizing controllers for the synchronous generator speed, series power flows, voltage magnitude and DC link voltage, are designed for a power system with FACTS device (UPFC). To design these controllers combined Super-twisting sliding mode (SM) and block control (BC) techniques is implemented. The block control approach is used to design nonlinear sliding manifolds with desired motions. Super-twisting SM control is applied to reject perturbations and avoid the chattering effect. The effectiveness of proposed algorithm is illustrated by simulations.

3.2 Force-Position Exponential Tracking of Redundant Manipulators with Model-Free Sliding PD Control

David Navarro-Alarcón, Institution: Cinvestav
Vicente Parra-Vega, Institution: Cinvestav

A passivity-based model-free second order sliding mode controller is proposed for redundant manipulators under holonomic constraints. The closed-loop system enforces exponential tracking on the exerted contact force and the end-effector cartesian position trajectories as the primary task, while the controller reconfigures dynamically the whole kinematic chain in order to satisfy a secondary task through the redundant constrained degrees of freedom.

To achieve this, the orthogonalization principle and the proposed redundancy resolution technique, are together synthesized for redundant constrained robots. This way, two pairs of orthogonal subspaces arises, the joint velocity and contact force orthogonal pair, and the end-effector velocity and null space orthogonal pair. Therefore, independent control on the end-effector cartesian position and the exerted contact force can be achieved, while proper control of the null space variables will allow to simultaneously carry out a secondary task, by locally optimizing a given cost function. Simulation results of the 7 degrees of freedom PA10 Mitsubishi robot manipulator performing tracking tasks on the cartesian, force, and null space

(redundancy) subspaces are presented.

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4. AC4: Automatic Control - Nonlinear Control Design

Thursday (9:00-10:00) Room 4
Session Chair: Rubén Alejandro Garrido Moctezuma

4.1 Applications of a Novel Tool for Analysis and Design in the Frequency Domain of Multirate Sampled-Data Control Systems

Jesús Sandoval Gio, Institution: Instituto Tecnológico de Mérida
Julian Salt Llobregat, Institution: Universidad Politécnica de Valencia

This work presents two applications of a novel tool developed for the approximate calculation of behavior in the domain of the frequency of Multirate Sampled-Data Control Systems. The cases presented here focus on the designing of digital regulators that operate with more than one sampling frequency, the aim being to stabilize the system in closed loop using relatively low sampling frequencies of the plant output.

4.2 Practical Stability of Neutral Type Time Delay Systems: LMI's Approach

Raul Villafuerte, Institution: Department of Automatic Control. CINVESTAV
Sabine Mondie, Institution: Department of Automatic Control. CINVESTAV
Alexander Poznyak, Institution: Department of Automatic Control. CINVESTAV

In this paper we discuss the practical stability of a class of neutral type time delay systems. We obtain sufficient conditions based on Lyapunov-Krasovskii functionals stated in terms of the feasibility of a set of linear matriz inequalities.

4.3 A Reaction-Diffusion Model for the Production of Autowaves

José-Antonio Medina-Hernández, Institution: CINVESTAV-IPN
Felipe Gómez-Castañeda, Institution: CINVESTAV-IPN
José-Antonio Moreno-Cárdenas, Institution: CINVESTAV-IPN

There are many examples of natural processes in which a substance must travel a trajectory, avoiding obstacles to reach an objective, using a mechanism for orientation and navigation. Such mechanism can be implemented using attraction by autowaves. The linear theory lets to predict the conditions in which a reaction-diffusion system has a raising oscillating behavior in the initial phase. In this paper a model is described for the production of autowaves, in agreement with the linear theory. Some results of simulation obtained with the model are shown.

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5. AC5: Automatic Control - Robotics and Synchronization

Thursday (15:00-17:00) Room 4
Session Chair: Alberto Soria

5.1 Task Space Robot Control using an Inner PD loop

Rubén A. Garrido Moctezuma, Institution: Centro de Investigación y de Estudios Avanzados del IPN.

E. Alberto Canul García, Institution: Centro de Investigación y de Estudios Avanzados del IPN.
Alberto Soria López, Institution: Centro de Investigación y de Estudios Avanzados del IPN.

This paper presents a task-space robot controller composed of two nested loops. The inner loop corresponds to a Proportional derivative joint controller and the outer loop consists of a Proportional Integral controller fed by task space measurements. Stability is studied by means of the Lyapunov method and a visual servoing application is considered for experimentally assessing the performance of the proposed controller.

5.2 Visual PID Control of a Redundant Parallel Robot

Rubén Garrido, Institution: Department of Automatic Control, CINVESTAV-IPN
Alberto Soria, Institution: Department of Automatic Control, CINVESTAV-IPN
Miguel Trujano, Institution: Department of Automatic Control, CINVESTAV-IPN

In this paper, we study an image-based PID control of a redundant planar parallel robot using a fixed camera configuration. The control objective is to move the robot end effector to the desired image reference position. The control law has a PD term plus an integral term with a nonlinear function of the position error. The proportional and integral actions use image loop information whereas the derivative action adds damping using joint level measurements. The Lyapunov method and the LaSalle invariance principle allow assessing asymptotic closed loop stability. Experiments show the performance of the proposed approach.

5.3 Robust Stabilization of a Spacecraft with Flexible Elements using Invariant Ellipsoid Technique

Gonzalez-Garcia Salvador, Institution: Department of Automatic Control. CINVESTAV
Polyakov Andrey, Institution: Department of Applied Mathematics, Voronezh State University
Poznyak Alexander, Institution: Department of Automatic Control. CINVESTAV

The robust stabilization of the angular position of a spacecraft with dynamic elastic elements under dissipative properties is proposed. The control scheme is based on bang-bang control and linear output feedback. The former is based on minimum-time optimal control and the latter is designed with the invariant ellipsoid method. The control is achieved under uncertainty in the system and disturbances in the output measurements.

5.4 Nonlinear Smith-Predictor Based Control Strategy for a Unicycle Mobile Robot

Alejandro Alvarez-Aguirre, Institution: Eindhoven University of Technology, Department of Mechanical Engineering, Dynamics and Control Group.
Martin Velasco-Villa, Institution: ESIME-Culhuacán, Instituto Politécnico Nacional
Basilio del-Muro-Cuellar, Institution: ESIME-Culhuacán, Instituto Politécnico Nacional

This paper consider the remote control of an unicycle mobile robot subject to transport delay. The communication delay effects are considered by means of a discrete time approach that allows to solve the path tracking problem in terms of the delayed input. The causality problem involved in the

proposed solution is carried out by considering an extension to the nonlinear case of the well known Smith predictor compensator that allows the implementation of the noncausal feedback. The performance of the tracking strategy is evaluated by means of numerical simulations.

5.5 Preservation of Hyperbolic Equilibrium Points and Synchronization in Dynamical Systems

Cesar Miranda-Reyes, Institution: Universidad Iberoamericana
Guillermo Fernández-Anaya, Institution: Universidad Iberoamericana
Jose Job Flores-Godoy, Institution: Universidad Iberoamericana

Classic results of the dynamical systems theory are extended and used to study the preservation of synchronization in chaotical dynamical systems. This results show that synchronization can be preserved after changes are made to the linear part of the dynamical system. When the jacobian matrix of the system is evaluated in the hyperbolic points, the sign structure of the eigenvalues of this matrix determines if the system is stable or unstable. In this work, we establish the sufficient conditions to preserve the structure of this hyperbolic points. Also, control tools are used to achieve synchronization in dynamical systems. Numerical simulations to very the effectiveness of the method are presented.

5.6 Chaotic Synchronization Between Oscillators Using Robust GPI Control

Alberto Luviano Juárez, Institution: Cinvestav
John Cortes Romero, Institution: Cinvestav
Hebertt Sira Ramirez, Institution: Cinvestav

We tackle the problem of synchronization of two oscillators as a control problem. The system to control is taken as a chain of integrators control where the remainder of the dynamics is considered as an additive disturbance. This disturbance is locally approximated by a m-order time polynomial and then it is cancelled out by means of a robust Generalized Proportional Integral controller. Two examples are shown. The first one is a Duffing system as a reference and a controlled Van Der Pol as a tracker, and the second example is the synchronization of two Rossler's systems. Some numerical results are shown.

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6. AC6: Automatic Control - Optimal Control

Thursday (17:20-18:00) Room 4
Session Chair: Samuel Moya

6.1 A Priori Error Estimates of Mixed Finite Element Methods for Nonlinear Quadratic Convex Optimal Control Problem

Hongwei Zhang, Institution: College of Math and Computing Science
Zuliang Lu, Institution: Institute for Computational and Applied Mathematics

In this paper, we study an a priori error analysis for the quadratic optimal control problems governed by nonlinear elliptic partial differential equations using mixed finite element

methods. The state and the co-state are approximated by the lowest order Raviart-Thomas mixed finite element spaces and the control is approximated by piecewise constant functions. A priori error estimates for the mixed finite element approximation of nonlinear optimal control problems is obtained. Some numerical examples are presented to confirm our theoretical results.

6.2 Numerical Methods for Stackelberg-Nash Equilibrium Calculation with Favorable and Unfavorable Followers

Samuel Moya, Institution: CINVESTAV, IPN, Department of Automatic Control
Alexander Poznyak, Institution: CINVESTAV, IPN, Department of Automatic Control

Regularized versions of the "Projectional Gradient Technique" and the "Extraproximal Method" are suggested to be applied for finding Stackelberg-Nash equilibrium in a multi-participant static game. A comparative between these methods is shown. There exist two levels of hierarchy in decision making: the first one consists of a leader decision and the second one is formed by the decisions of (N-1)-followers. The followers react to the leader's announced strategy by playing according to the Nash equilibrium concept among themselves selecting those of equilibriums which is most favorable or unfavorable for the leader. The convergence of the suggested procedure is analyzed. Simulation results illustrate the feasibility of this method.

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7. AC7: Automatic Control - Optimal Control

Friday (9:00-10:00) Room 4
Session Chair: Vadim Azhmyakov

7.1 Relationship Between Dynamic Programming and the Maximum Principle for Impulsive Hybrid LQ Optimal Control Problems

Rosalba Galvan-Guerra, Institution: CINVESTAV
Vadim Azhmyakov, Institution: CINVESTAV

This paper deals with optimization techniques for linear impulsive hybrid systems (LIHSs). We study the LQ (linear quadratic) impulsive hybrid optimal control problem (OCP) and apply the corresponding Pontryagin-type Maximum Principle (MP). This paper deals with optimization techniques for linear impulsive hybrid systems (LIHSs). We study the LQ (linear quadratic) impulsive hybrid optimal control problem (OCP) and apply the corresponding Pontryagin-type Maximum Principle (MP). Our aim is to investigate the natural relationship between the above MP and the Bellman Dynamic Programming (DP) approach to the above hybrid OCP under consideration. We derive the associated Riccati-type formalism and discuss some related numerical schemes.

7.2 Stackelberg-Nash Concept Applied to the Traffic Control Problem with a Dominating Intersection

Samuel Moya, Institution: CINVESTAV-IPN
Alexander Poznyak, Institution: CINVESTAV-IPN

A common problem in many cities is the traffic congestion. Intersection traffic controlling is an important aspect of the urban traffic controlling system. The controlling policy depends on the forecasting results about the incoming and outgoing flows at signalized intersection. There exist a lot of approaches to study this problem when the roles of the intersections are symmetric. However, there are other types of traffic problems where one of the way has preference on the other way(s) on an intersection. In this paper, we propose to model signalized intersections as finite controlled Markov chain game. We try to minimize, in each intersection, the queue taking into account that there exists an intersection having the ability to be enforced in his strategy, known as a main intersection. Then, a Stackelberg-Nash game is suggested using a regularized version of the "Extraproximal Method" to find the solution. Experiment results illustrate the feasibility of the method.

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8. BIO1: Biomedical Engineering

Wednesday (12:30-13:30) Room 3

Session Chair: Roberto Muñoz

8.1 A Theoretical Approach for Familiarization with Techniques of Interleaved Echo-Planar Imaging for Functional Magnetic Resonance Imaging and their Features

Md. Manzur Rahman, Institution: Bangladesh University of Engineering and Technology
Abdul Hafiz Ibne Talukder, Institution: Bangladesh University of Engineering and Technology

This paper deals with an analysis of techniques of interleaved Echo-Planar imaging (EPI) method for Functional Magnetic Resonance Imaging (fMRI). In order to have optimum echo time and consequently achieving low image distortion, an approach has been emphasized upon a technique that acquires six images, each with a different echo time, in a single shot. Also investigation has been initiated for the feasibility and pragmatism of this technique. Techniques of reduction of image artifact and Nyquist or N/2ghost are compared for effectiveness on fMRI data sets are also demonstrated. Again this approach focused on the benefits and problems of interleaved EPI system.

8.2 On the Advances of the Two and Three-dimensional Electrical Impedance Equation

Marco Pedro Ramírez Tachiquin, Institution: Escuela de Ingeniería de la Universidad La Salle
Víctor Daniel Sánchez Nava, Institution: Escuela de Ingeniería de la Universidad La Salle
Andrés Fleiz Jaso, Institution: Escuela de Ingeniería de la Universidad La Salle
Octavio Rodríguez Torres, Institution: Escuela de Ingeniería de la Universidad La Salle

We review the state of the art of solutions for the electrical impedance equation div (γ grad φ) = 0; (1) where the function γ = σ + iω□ is the admitivity, σ denotes the conductivity, ω is the frequency, □ is the permittivity, i is the imaginary unit, and φ denotes the electric potential. Considering the three-dimensional case, we show that this equation is equivalent to a Schrödinger equation, and applying the algebra of quaternions, we study one

method for factorizing (1) into two _rst-order differential operators. We also discuss a method for rewriting equation (1) directly into a quaternionic rst-order linear differential equation and we cite some cases when it is possible to solve it analytically. For the two-dimensional case, we show that (1) is equivalent to a Vekua equation, and applying recently discovered properties of pseudoanalytic functions, we explore how to obtain solutions of (1) starting with solutions of a two-dimensional Schrödinger equation. Once we have discussed some elements of Pseudoanalytic Function Theory, we expose how to express the general solution of the Electrical Impedance Equation through Taylor series in formal powers, remarking the impact of this tools in such important questions as the Calderon problem in the plane. Index Terms.Electrical Impedance Equation, Quaternions, Pseudoanalytic Functions.

8.3 Advances in Low Density 3D Surface Reconstruction for Gait Analysis

Rubén Posada-Gómez, Institution: Instituto Tecnológico de Orizaba
Jose Jorge Enriquez-Rodriguez, Institution: Instituto Tecnológico de Orizaba
Giner Alor-Hernández, Institution: Instituto Tecnológico de Orizaba
Albino Martínez-Sibaja, Institution: Instituto Tecnológico de Orizaba
Gerardo Águila-Rodríguez, Institution: Instituto Tecnológico de Orizaba
Lorenzo Leija-salas, Institution: CINVESTAV IPN

Human gait analysis help doctors analyze, diagnose and document aberrant gaits with tools that compare the gait of patients before and after treatment to historical cases of normal and abnormal gaits. Among tools used for walking analysis, 3D scanners are some of the most useful because they can generate high fidelity reconstruction of patient's movement, aiding the specialist in the diagnosis and follow up of the treatment process. This work presents the status of a research seeking to develop a low cost 3D surface scanner as a tool for human gait analysis. In order to reduce computer time processing, the scanner will be able to generate a low density point cloud using points of interest that are visually marked on the target before the scanning process starts.

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9. BIO2: Biomedical Engineering

Wednesday (15:00-17:00) Room 3
Session Chair: Abdelhalim Azbaid

9.1 Epilepsy Stages Diagnosis by Gabor Atom Density According to their Aspect Ratio

Arturo Sotelo Orozco, Institution: Tijuana Institute of Technology
Enrique D. Guijarro Estelles, Institution: Polytechnic University of Valencia
Manuel de Jesus Garcia Ortega, Institution: Tijuana Institute of Technology
Carlos Edgar Vazquez Lopez, Institution: Tijuana Institute of Technology

During epilepsy seizure Electrocorticogram (ECoG) may change dramatically from a nearly chaotic signal (steady state) into a highly synchronized signal during a seizure, characterized by high amplitude and low frequency, and suddenly go back to the steady sate, making hard to identify them from time

series. The epileptic seizure shows some stages as it is evolving, the here studied are: basal, preictal, ictal and posictal. As most of the bioelectrical signal, ECoG is a highly non periodical signal, so the most suitable techniques to analyze them are the Time Frequency algorithms (T-F), allowing to follow up its frequency evolution through the seizure. Each seizure stage has a set of frequency components (atoms), showing up at different time. These components have their own particular characteristics, depending on the influence on time (duration) and frequency (bandwidth) they can be rated in three different classes: Rhythmic, Intermediate and Transitory. There are different amount of these components among stages, based on the density of this atoms, here we try to identify each of the epilepsy stages, decomposing short signal segments (epochs) into their atoms by means of the Matching Pursuit algorithm, an adaptive T-F algorithm. Signals were recorded intracranially from Wistar rats at the cortex level, seizures were elicited by kindling model before recording.

9.2 Experimental Method of MIS Measurement of an Electrolytic Cell with a Passive Wireless Sensor

Jesús Rodarte, Institution: Universidad Politécnica de Cataluña
Javier Rosell, Institution: Universidad Politécnica de Cataluña
Ramón Bragos, Institution: Universidad Politécnica de Cataluña

Is presented a three coil system, with a passive wireless sensor, as an interface for a commercial Network. The objective of this experiment is to achieve that the system measures the impedances of electrolytic solutions using the Magnetic Impedance Spectroscopy method. The interface is based on planar coils over a laminated printed circuit board; one of the planar coil acts as transmission antenna, another one is inside the electrolytic cell and the last acts as a receiver antenna. The receiver is positioned and oriented of such form that its plane is perpendicular to the plane of the transmitting antenna in order to minimize the induced voltage due to the transmission antenna. The inductive-capacitive passive remote sensor circuit consists of a square planar coil in parallel with an inter-digital electrode with a capacitance of 18 pF. It is oriented with an angle of 45° respect to the plane of the transmitting coil. The performance measurements show a good correlation between the measured and calculated induced voltages on the receiver. We measured three different electrolytic solutions inside the cell with different ion concentrations.

9.3 Region and Contour Based Cell Cluster Segmentation Algorithm for In-Situ Microscopy

Sheehy Andrew, Institution: Image Processing and Computer Vision Research Laboratoy (IPCV.LAB), School of Electrical Engineering, University of Costa Rica
Martinez Geovanni, Institution: Image Processing and Computer Vision Research Laboratoy (IPCV.LAB), School of Electrical Engineering, University of Costa Rica
Frerichs Jan-Gerd, Institution: Institute for Technical Chemistry, University of Hannover
Thomas Scheper, Institution: Institute for Technical Chemistry, University of Hannover

In this contribution a new algorithm is proposed for segmenting the image regions of the cell clusters present in a static image captured by an in-situ microscope inside of a bioreactor. A cell cluster is a group of one or more cells that are very close to each other, almost overlapping. The new algorithm combines a contour based segmentation approach with a region based segmentation approach. First, seeds are selected only in the background. To this end, image contours and the first and second moments of the pixels` intensity values in the background and in the cell clusters are evaluated. The moments are estimated from the histogram of the pixels´ intensity values by applying a Maximum-Likelihood estimator. Following, the background region is extracted by region growing from the selected seeds. Finally, the segmented regions of the cell clusters are those image regions which do not belong to the previously extracted background region. Experimental results show an improvement of 33.33% in the reliability and an improvement of 55.1% in the accuracy of the cell cluster segmentation results.

9.4 Classification of Heart Valve Diseases using Correlation Analysis

Mohd Zubir Suboh, Institution: Universiti Malaysia Perlis
Mohd Yusoff Mashor, Institution: Universiti Malaysia Perlis

As a subjective and qualitative method, heart sound auscultation has it's inherit limitations. In this paper, we present an analytical perspective on heart sound auscultation and explain how to classify heart diseases using correlation analysis which is done in frequency domain. Abnormal heart sounds taken from a heart sound simulator is being cross correlated with normal heart sound to get different pattern of graph plot for each abnormality. Seven different heart valve diseases were classified with the aid of artificial neural network system. All tested data was classified correctly to their classes. It is conclude that this study is a simple and effective way to classify heart valve disorder based on heart sounds.

9.5 Classification of Heart Sounds Using Wavelets and Neural Networks

Haslina Mohd Hadi, Institution: Universiti Malaysia Perlis
Mohd Yusoff Mashor, Institution: Universiti Malaysia Perlis

A heart sound feature extraction and classification method has been developed. It used the discrete wavelet decomposition and reconstruction to produce the envelopes of details of the signals for further extracting the features. The Multilayer Perceptron Neural Network training using Levenberg-Marquardt algorithm has been used for classification of heart sound. The performance of the method has been evaluated using 250 cardiac periods from heart sound simulator. The result has shown over 92% correct classification. The method that used can classify heart sound cases in high classification rate.

9.6 Voltage Clamp System with a very low noise Probe for Electrophysiological Measurements

Roberto Ávila-Pozos, Institution: Área Académica de Matemáticas/Instituto de

Ciencias Básicas e Ingeniería, Universidad Autónoma del Estado de Hidalgo
Rafael Godínez Fernández, Institution: Departamento de Ingeniería Eléctrica/DCBI Universidad Autónoma Metropolitana – Iztapalapa

A cell derives its electrical properties mostly from the electrical properties of its membrane. A membrane, in turn, acquires its properties from its lipids and proteins, such as ion channels and transporters. An electrical potential difference exists between the interior and exterior of cells. A charged object, such an ion, gain or loses energy as it moves between places of different electrical potential, just as an object with mass moves up or down between points of different gravitational potential. The potential difference across a cell relates the potential of the cell's interior to that of the external solution. Potential differences between two points that are separated by an insulator are larger than the difference between these points separated by a conductor. Thus, the lipid membrane, which is a good insulator, has an electrical difference across it. This potential difference, called transmembrane potential, amounts to less than 0.1 V, typically 30 to 90 mV in most animal cells, but can be as much as 150 -200 mV in plant cells. On the other hand, the salt-rich solutions of the cytoplasm and the blood are fairly good conductors, and there are usually very small differences at steady state between any two points within a cell's cytoplasm or within the extracellular solution. Electrophysiological equipment enables researches to measure potential differences in biological systems. Electrophysiological equipment can also measure current, which is the flow of electrical charge passing a point per unit of time. Usually, currents measured by electrophysiological equipment range from picoamperes to microamperes. Electrophysiological measurements should satisfy two requirements: they should accurately measure the parameter of interest, and they should produce no perturbation of the parameter. In this work, we present designs of the probe (input stage) and amplifiers that together constitute a system of setting very low noise voltage clamp system.

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10. BIO3: Biomedical Engineering

Thursday (9:00-10:00) Room 2
Session Chair: Arturo Vera

10.1 Bits Planes Technique for Digital Image Processing

José Luis Ramos Quirarte, Institution: Universidad de Guadalajara
Norma Ramírez Hernández, Institution: Universidad de Guadalajara

This work presents a technique for digital image processing. The technique consists on splitting the original image with 256 gray levels into its equivalent 8 binary images. The method is extended for true RGB color images by working out each color plane as a gray scale image and applying the same algorithm development for the former case to convert any intensity level into a byte of 8 bits. The results shown out to be useful for some basic applications such as separating the fine features of an image. Memory space for storing images is reduced since the images can be written in binary formats. Bits planes technique allows for logical

operations and after that, get back to a gray scale image or color image very easily. The potential application of this technique is being studied in order to detect some anomalies in digital mammographies. A script in MatLab has been development with some menus to implement the bits planes technique for different image formats.

10.2 Ultrasound Propagation Speed Measurement of Mimicking Soft Tissue Phantoms Based on Agarose in the Range of 25°C to 50°C

Sergio Alfonso López Haro, Institution: CINVESTAV-IPN
Ivonne Bazan Trujillo, Institution: CINVESTAV-IPN

To simulate the real conditions where the ultrasound will be applied, it is necessary the employment of materials to mimic the ultrasound behavior of tissues; these kind of materials are called phantoms. Therefore, it is important to measure the basic characteristics that must be mimicked; one of them is the ultrasound propagation speed. This characteristic could be employed to estimate the soft tissue temperatures in a non-invasive way. Agarose was used, for phantom preparation, in this work because it is an easy material to work with and also because the change of the ultrasound propagation speed in the phantoms only depends on the quantity of agarose concentration; it makes easier the phantom preparation. Ultrasound signals obtained from the phantom, using the pulse-echo transmission technique, were processed by using cross-correlation to calculate the time-of-flight, which is defined as the difference between the time of the first and the last phantom echo signal, with this information, and the phantom thickness, it is possible to calculate the propagation speed. The results are compared with the ultrasound speed obtained from degassed water, in the range from 25°C to 50°C. The phantom propagation speed with 1.5% agarose concentration had a behavior close to that of the water. A non-linear behavior after 43°C was observed.

10.3 Noise Immunity Analysis of Time Delay Estimation Techniques Used on Ultrasonic Simulated Echoes

Jose Abraham Tellez Morales, Institution: CINVESTAV
Ivonne Bazan Trujillo, Institution: CINVESTAV
Lorenzo Leija Salas, Institution: CINVESTAV
Arturo Vera Hernandez, Institution: CINVESTAV

This paper presents a noise immunity analysis of time delay estimation (TDE) techniques used on ultrasonic echoes for non invasive temperature estimation. Four methods are analyzed. The methodology consists on corrupting a simulated ultrasonic signal (ideal signal) with white noise and a signal-to-noise ratio of 3dB and 6dB. After this, noise immunity analysis is performed for every method. The TDE techniques used in this work are Phase Difference, Phase Shift, Cross-Correlation and Quadrature Phase Demodulation. The purpose of this work is to determine the best method for non invasive temperature estimation.

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11. BIO4: Biomedical Engineering

Thursday (15:00-17:00) Room 1

Session Chair: Carlos Alvarado

11.1 An Easy Wireless Multi-Waveform Urinary Electrical Stimulator "UES"

Ernesto Paredes Martinez, Institution: National Polytechnic Institute (IPN), ESIME Culhuacan, Mexico D.F.
Luis Nino de Rivera Y.Oyarzabal, Institution: National Polytechnic Institute (IPN), ESIME Culhuacán, México D.F.
Daniel Robles Camarillo, Institution: National Polytechnic Institute (IPN), ESIME Culhuacán, Mexico D.F.

This paper proposes a simple wireless multi-waveform Urinary Electrical Stimulator (UES) to stimulate electrically patients with urinary incontinence. This system can generate a set of different programmable bipolar and monopolar waveforms, since pulse generator systems most provide different waveforms suitable for each individual patient [1]. This application discloses 6 distinct types of programmable waveforms. The waveform parameters can be modified by physician changing easy instructions with a software interface (SI). The proposed system lets long distance manipulation of the waveform generator by sending codes that change the characteristics of the waveforms even when the stimulator is implanted in the patient's body. The waveforms used in this work can be applied in other electrical-stimulations in body or tissues. We will show that a multi-waveform stimulator can be built with common electronic circuits. The paper discusses the waveforms code generator in UES consisting on a Radio Frequency device connected between a multi-waveform stimulator and the nerves.

11.2 Waveform Generator System to Transcorneal Stimulation Based on a Digital Adaptive Model

Daniel Robles Camarillo, Institution: Sección de Estudios de Posgrado e Investigación, Escuela Superior de Ingeniería Mecánica y Eléctrica Unidad Culhuacán, Inst.
Luis Nino de Rivera y Oyarzabal, Institution: Sección de Estudios de Posgrado e Investigación, Escuela Superior de Ingeniería Mecánica y Eléctrica Unidad Culhuacán, Inst
Hugo Quiroz Mercado, Institution: Asociación para Evitar la Ceguera en México
Miriam Jessica López Miranda, Institution: Asociación para Evitar la Ceguera en México

The present work proposes an electronic waveform generator for transcorneal electrical stimulation (TES). The applied waveform model is generated into a digital processor by means of an adaptive finite impulse response (FIR) filter, which output waveform is synthesized form the original one registered from a multi-focal electroretinograph (MF-ERG). The stimulation waveform applied in patients with central retinal artery occlusion (CRAO) in these procedure, is qualitatively different from the one reported by others like Tano et. al. [1, 2]. Results show that CRAO patients stimulated with the proposed waveform, reported phosphenes associated with variations of the filter coefficients.

11.3 Colour Thresholding Method for Image Segmentation Algorithm of Ziehl-Neelsen Sputum Slide Images

Rafiqa Aliana Abdul Raof, Institution: University Malaysia Perlis
Zaleha Salleh, Institution: University Malaysia Perlis
Syahiana Izma Shahidan, Institution: University Malaysia Perlis
Mohd Yusoff Mashor, Institution: University Malaysia Perlis
Siti Suraiya Md Noor, Institution: University Sains Malaysia

Most of the thresholding procedures involved setting of boundaries based on gray values or intensities of image pixels. In this paper, the thresholding is to be done based on color values in images of Ziehl-Neelsen sputum slides. The color thresholding technique is being carried out based on the adaptation and slight modification of the grey level thresholding algorithm. Multilevel thresholding has been conducted to the RGB color information of the bacterium to extract it from the sputum and other objects. Five types of different images have been used in the study of color information. The results showed that by using the selected threshold values, the image segmentation technique has been able to separate the sputum from the mycobacterium.

11.4 Acquisition of Corneal Electrical Signals

Carlos Alonso Herrera Ramírez, Institution: Escuela Superior de Ingeniería Mecánica Eléctrica (ESIME) Culhuacán
José Antonio Loaiza Brito, Institution: Escuela Superior de Ingeniería Mecánica Eléctrica (ESIME) Culhuacán
Luis Nino de Rivera y Oyarzabal, Institution: Escuela Superior de Ingeniería Mecánica Eléctrica (ESIME) Culhuacán
José Martín Herrera Ramírez, Institution: Centro de Investigaciones de Industri-a Militar
Daniel Robles Camarillo, Institution: Escuela Superior de Ingeniería Mecánica Eléctrica (ESIME) Culhuacán

Conventional systems for electroretinography (ERG) use complex electronic circuit to get electrical corneal signals (ECS), they usually use dedicated data acquisition hardware to acquire the signal over the cornea's eye. In this paper we proposed a simple method to acquire the ECS using the computer sound card to put into the PC the ECS. We show the results of the signals acquired from the cornea through microphone's port.

11.5 Prototype of a Portable Platform for ECG Monitoring and Diagnostic Applications

Blanca Tovar Corona, Institution: ITESM CEM
Javier Eduardo González Villarruel, Institution: ITESM CEM
Héctor Becerra Esquivel, Institution: ITESM CEM
Adrián Juárez Carrasco, Institution: ITESM CEM
Antonio Espíritu Santo Rincón, Institution: ITESM CEM

This paper describes the prototype for a portable system that records and analyses electrocardiography signals in real time. The purpose of the system is to monitor patients during normal activity to help physicians to diagnose the long QT syndrome and alerts the patient to prevent sudden death. The system consists of a recording system for three leads electrocardiography signals and an algorithm implemented on a board based on a low power

microcontroller. The system has been tested in non-pathologic subjects showing accurate values for the heart rate and QTc factor. The algorithm has also been tested satisfactory with created signals simulating pathologic and non-pathologic cases. It was also tested with 10 patients from a standard database showing satisfactory results except for signals where any of the characteristic waves of the ECG is not present.

11.6 Control of Blood Glucose Concentration in Type-I Diabetic Patients Applying Hamilton Jacobi and Sliding Mode Techniques

Raúl Robles Arce, Institution: UPIBI-IPN
Adán Alonso Peña Orea, Institution: UPIBI-IPN
Agustín Ignacio Cabrera Llanos, Institution: UPIBI-IPN

Approximately 171 million people in the world suffer of Diabetes Mellitus and it has become an important social problem that has shown to be in continuous growing. For that strong reason it is presented a control description based on Hamilton-Jacobi Technique (HJT) and Sliding Mode Approach (SMA) working jointly with a nonlinear observer (NO), carried out with Differential Neural Networks (DNN) and Sliding Mode Approach, the one which has proven to be useful in real medical procedures to expense of the mathematical model that describes the glucose-insulin dynamics is similar to the real insulin patients response. This Hamilton Jacobi and Sliding Mode Control (HJSMC) gives us the exact dosage that ought to be given to a patient with the purpose of maintaining controlled the blood glucose concentration in normal values.

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12. BIO5: Biomedical Engineering

Thursday (17:20-18:00) Room 2
Session Chair: Alejandro Valentino

12.1 Electromagnetic Field Interaction with a Dielectric Body of Ellipsoidal Shape

Nefi Alejandro Barron Herrera, Institution: Mechanical Engineering Department, ESIME Culhuacán, IPN
Javier Adrian Castañeda Nuñez, Institution: Mechanical Engineering Department, ESIME Culhuacán, IPN
Eduardo Ruiz Sánchez, Institution: Electrical Engineering Department, ESIME Culhuacán, IPN
Iryna Ponomaryova, Institution: Section of Postgraduate Studies and Investigation (SEPI), ESIME Culhuacán, IPN

The objective of this work is to create a theoretical model and to conduct the detail research of the electromagnetic radiation interaction with granular product and insects. The theoretical research on the electromagnetic wave interaction with granular agricultural product and insects is done in the present work through the solving of electromagnetic boundary problem [1]. It is well-known that boundary problems of electrodynamics are the most complicated ones in the mathematical physics and are urgent in the theory of wave processes. We use the methods based on integral equations of macroscopic electrodynamics to avoid complications at consideration of proper boundary problems.

12.2 Synthesis of HAp/chitosan Composites via Electrospinning: Preliminary Results

Fabiola Vázquez Hernández, Institution: CINVESTAV-IPN
Sergio Alfonso López Haro, Institution: CINVESTAV-IPN
Miguel Ángel Meléndez Lira, Institution: CINVESTAV-IPN
María de Lourdes Albor Aguilera, Institution: ESFM UPALM-IPN
Víctor Altuzar, Institution: Universidad Veracruzana
Claudia Oliva Mendoza Barrera, Institution: Universidad Veracruzana

Human bone is a hydroxyapatite HAp (HCa5O13P3) and type I collagen based composite. Nowadays, many methods and techniques have been developed and applied to design advanced materials for bone replacement. A strategy for imitating in a tridimensional way the structure, composition and mechanical properties of a bone is mimicking it at nanometric scale. This can be carried out, by incorporating selective of nanoparticles of apatites into a polymeric matrix by controlling structure and composition of the fibers. In this work we present the preliminary results of HAp/Chitosan composites prepared by the electrospinning technique. HAp/Chitosan fibers were spun from different aqueous solutions, all of them with a pH= 3. The compositional and structural characteristics were obtained by using scanning electron microscopy SEM, energy dispersive spectroscopy EDS, X-ray diffraction XRD, and infrared spectroscopy IRS. EDS and XRD confirmed that the mineral deposits correspond to hydroxyapatite and calcium phosphate monobasic MCP (CaH4O8P2), which are present in the human bones. Comparative studies were made from chitosan and HAp/Chitosan solutions. In this respect IRS analysis showed that the characteristic chitosan stretch band in the 1020-1220 cm-1 range was attenuated when HAp was added. Additionally, from a precursor solution prepared at pH=3, 1% w/v chitosan, and 1% w/v HAp and spun at 20 V, a Ca/P ratio close to bone composition (Ca/Pbone = 1.67) was obtained.

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13. COM1 Communications Systems

Wednesday (17:20-18:00) Room 1
Session Chair: José Oscar Olmedo Aguirre

13.1 Super Testing the Gaussianity of UWB TH-PPM MUI with Imperfect Power Control and Multipath

Fernando Ramirez-Mireles, Institution: ITAM
Sergio Angel Almada Monter, Institution: GEORGIA TECH

We study the statistical nature of the multiuser interference (MUI) from pulse-based ultrawideband (UWB) signals with time-hopping (TH) and pulse position modulation (PPM). We determine the domain of validity for the Gaussian assumption for three different conditions: An ideal propagation channel with perfect and imperfect power control, as well as a multipath channel with "perfect average" power control. Results for imperfect power control suggest that the Gaussian approximation can be used if we consider a large enough number of active users Nu and/or number of pulses per symbol Ns, e.g., for low data rate systems with large number of users. Results for multipath suggest

that in dense multipath environment a low number of Nu and/or Ns is enough to reach Gaussianity.

13.2 Contribution of the Illuminated and Shadowed Areas in the Radiation Pattern of On-Board Antennas

Lorena Lozano, Institution: Universidad de Alcalá
Francisco Saez de Adana, Institution: Universidad de Alcalá
Felipe Cátedra, Institution: Universidad de Alcalá

The numerical integration considering shadow and illuminated currents in Physical Optics (PO), is used to calculate the radiation pattern of antennas on complex structures. This method is used when the antenna is placed a distances less than lambda λ of the structure. The parametric surfaces are used to model the geometry. The contribution of shadow currents present results more similar to the measurements than Stationary Phase Method (SPM) or numerical integration considering only illuminated currents.

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14. COM2 Communications Systems

Thursday (17:20-18:00) Room 1

Session Chair: José Oscar Olmedo Aguirre

14.1 A 4W UHF Si-LDMOS Class AB PA for RFID Applications

Héctor Javier Saavedra Gómez, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N., CINVESTAV unidad Guadalajara.
Juan Luis Del Valle Padilla, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N., CINVESTAV unidad Guadalajara.
José Raúl Loo Yau, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N., CINVESTAV unidad Guadalajara.
Alberto Garcia Osorio, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N., CINVESTAV unidad Guadalajara.

Using measurement techniques and appropriate models for III-V semiconductor compound transistors we have implemented a large signal model for a commercial LDMOS transistor. Based on this model a 4 Watt UHF class AB power amplifier was simulated and evaluated. The power amplifier was characterized using an aluminum test bench and microstrips. Experimental results shown an output power of 36.3 dBm for an input power of 23 dBm and a PAE efficiency of 57%. These results show that the proposed model is appropriate for RFID applications in the UHF band.

14.2 ABBA-VBLAST Hybrid Space-Time Code for MIMO Wireless Communications

Joaquín Cortez González, Institution: Instituto Tecnológico de Sonora
Luis Miguel Bazdresch Sierra, Institution: ITESO A.C.
Deni Librado Torres Román, Institution: CINVESTAV Guadalajara
Ramon Parra Michel, Institution: CINVESTAV Guadalajara

Hybrid MIMO communication systems combine spatial multiplexing with diversity gain to achieve both high spectral efficiency and link reliability.

We present a novel hybrid scheme that allows the use of any number of spatial multiplexing layers, plus one quasi-orthogonal layer (ABBA) of either 3 or 4 antennas. We transform the system equations in terms of linear dispersion codes, from which we derive a low-complexity, ordered, successive interference cancellation receiver based on sorted QR decomposition. Symbol detection is carried out in a unified manner, both for spatial and space-time coded symbols. We show that this novel scheme outperforms other recent proposals in terms of bit error rate, even those using CSI at the transmitter to precode. We also show our proposal has lower complexity, achieved by exploiting the structure of the linear dispersion matrices.

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15. CS1: Computer Science and Computer Engineering

Wednesday (12:30-13:30) Room 2

Session Chair: Debrup Chakraborty

15.1 A Note on "pth Moment Exponential Stability of Stochastic Cohen-Grossberg Neural Networks with Time-varying Delays"

Chuangxia Huang, Institution: College of Mathematics and Computing Science, Changsha University of Science and Technology,
Yigang He, Institution: College of Electrical and Information Engineering, Hunan University

In a very recent paper, Zhu et al. [Neural Process Lett (2007) 26:191-200] proposed an interesting approach to study pth moment exponential stability of stochastic Cohen-Grossberg neural networks with time-varying delays. Unfortunately, since the constructed Lyapunov function is invalid for p = 2k+1, k □ N, the main results obtained are not correct for the general case. This note intends to circumvent these problems by modifying the approach proposed in Zhu et al. [Neural Process Lett (2007) 26:191-200].

15.2 Genetic Optimization of a Type-2 Fuzzy Controller for Output Regulation of a Servomechanism with Backlash

Nohé Ramón Cazarez Castro, Institution: Universidad Autónoma de Baja California
Luis Tupak Aguilar Bustos, Institution: Instituto Politécnico Nacional
Oscar Castillo López, Institution: Instituto Tecnológico de Tijuana

A Genetic - Type-2 Fuzzy Logic Controller (FLC) is proposed to achieve the output regulation of a servomechanism with backlash. The problem is the design of a Type-2 FLC, which will be optimized by a Genetic Algorithm (GA) to obtain the closed-loop system in which the load of the driver is regulated to a desired position. The provided servomotor position is the only measurement available for feedback. Simulations results illustrate the effectiveness of the optimized closed-loop system.

15.3 Integrating Vision-based Motion Planning with Defeasible Decision Making for the Khepera Robot

Edgardo Ferretti, Institution: Universidad Nacional de San Luis, Dpto. de Informática, Laboratorio de Investigación y Desarrollo en Inteligencia Computacional

Roberto Kiessling, Institution: Universidad Nacional de San Luis, Laboratorio de Electrónica, Investigación y Servicios.
Alejandro Silnik, Institution: Universidad Nacional de San Luis, Laboratorio de Electrónica, Investigación y Servicios.
Ricardo Petrino, Institution: Universidad Nacional de San Luis, Laboratorio de Electrónica, Investigación y Servicios.
Marcelo Errecalde, Institution: Universidad Nacional de San Luis, Dpto. de Informática, Laboratorio de Investigación y Desarrollo en Inteligencia Computacional

Intelligent mobile robots need the ability to combine autonomous navigation with high-level reasoning. This paper integrates a defeasible decision making technique and vision-based motion planning. The problem faced comprises a scenario where a Khepera 2 robot has to perform removal tasks of different size objects. This problem can be conceptually divided in two stages: (a) to decide the objects transportation order, and (b) to plan and control the robot motion. The decision making task is carried out using the facilities provided by the cognitive layer of the Khe-DeLP framework, while the motion planning is performed using a smooth shortest path control generated from visual information.

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16. CS2: Computer Science and Computer Engineering

Wednesday (15:00-17:00) Room 2

Session Chair: Francisco Rodríguez Henríquez

16.1 A Reversible Data Hiding Algorithm for Radiological Medical Images

Zobeida Jezabel Guzman Zavaleta, Institution: National Institute for Astrophysics, Optics and Electronics, INAOE, MEXICO
Claudia Feregrino Uribe, Institution: National Institute for Astrophysics, Optics and Electronics, INAOE, MEXICO
Jose Alberto Martinez Villanueva, Institution: National Institute for Astrophysics, Optics and Electronics, INAOE, MEXICO
Rene Cumplido, Institution: National Institute for Astrophysics, Optics and Electronics, INAOE, MEXICO

In this paper we introduce a reversible data hiding algorithm for medical images. Using the advantages of some proved methods and the characteristics of radiological medical images we obtain a large embedding capacity with minimum distortion of the original image using an easy control for recovering the hidden data and the original image.

16.2 Geometric Distortions Resilient Watermarking Technique Based on 2D Color Histogram Modification

Manuel Cedillo-Hernandez, Institution: National Polytechnic Institute
Mariko Nakano-Miyatake, Institution: National Polytechnic Institute
Hector Manuel Perez-Meana, Institution: National Polytechnic Institute

This paper presents a robust watermarking technique against geometric distortions. The proposed technique is based on the modification of the 2D color histogram. Because the histogram of an image is one of the image geometric invariant representations, if the watermark can

be embedded into the histogram, it should survive to most geometric transformations.
The difficulty of the watermarking based on histogram modification is that the relationship between the histogram representation and the pixel representation is not linear; therefore the distortion caused by the histogram modification cannot be measured in advance. In the proposed method, the values of the RGB bins are modified according to watermark bit sequences. The experimental results show robustness against several geometric distortions, such as rotation, scaling, Affine Transformation, cropping among other geometric attacks.

16.3 Content Authentication Schemes for Digital Images

Jose Antonio Mendoza, Institution: National Polytechnic Institute
Clara Cruz Ramos, Institution: National Polytechnic Institute
Mariko Nakano-Miyatake, Institution: National Polytechnic Institute
Hector Manuel Perez-Meana, Institution: National Polytechnic Institute

Nowadays, there are two approaches for digital image authentication: the digital signature based approach and the watermarking based approach. Goal of both approaches is detection of tampered regions of an image, while tolerate incidental manipulations. In this paper two methods that belong to both approaches are developed and compared from tamper detection capability points of view. The digital signature based scheme uses the relationship between wavelet coefficients of different level of decomposition to construct a structural digital signature (SDS), while the watermarking based scheme embeds semi-fragile watermark using a quantization function in the discrete wavelet domain. Performance analysis is realized and experimental results show advantage and disadvantage of both schemes.

16.4 Watermarking Algorithms Analysis on Radiological Images

José Alberto Martínez Villanueva, Institution: Instituto nacional de astrofísica, óptica y electrónica, puebla México
Claudia Feregrino Uribe, Institution: Instituto nacional de astrofísica, óptica y electrónica, puebla México
Z. Jezabel Guzmán Zavaleta, Institution: Instituto nacional de astrofísica, óptica y electrónica, puebla México

This article presents the results of the implementation and evaluation of the most common algorithms on medical images watermarking. The algorithms were modified to bring them to its maximum insertion capacity, and also modified to work with images of more than 8 bits, due to radiological images work with 8, 12 and 16 depth bits in gray scale depending on the study type. The algorithms were tested with a set of DICOM images which have been left available online. The DICOM watermarked images were tested with common attacks to evaluate the behavior of the algorithms. Conclusions were drawn based on the algorithms performance applied to medical images.

16.5 FPGA Implementation Cost and Performance Evaluation of the IEEE 802.16e and IEEE 802.11i Security Architectures Based on AES-CCM

Ignacio Algredo-Badillo, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
Claudia Feregrino-Uribe, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
René Cumplido, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
Miguel Morales-Sandoval, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)

Software radios are communication devices with different configurations that enable to operate in different communication networks. Considering the OSI model, the main development of these radios is focused on the lower layers, which are implemented in hardware. Security is a key element for using software radios, because they can enter to different wireless networks and use the air like transmission medium, being vulnerable to possible attacks to the transmission of data. Several security architectures have been standardized for different networks, such as IEEE 802.11i-2004 for WLANs (Wireless Local Area Networks) and IEEE 802.16e-2005 for WMANs (Wireless Metropolitan Area Networks), operating on the MAC (Medium Access Control) sublayer. In this work, hardware implementations of these architectures are evaluated in terms of FPGA implementation costs and performance to be considered in a reconfigurable hardware platform, which supports both security architectures, working on the MAC sublayer. For the design of the reconfigurable platforms, it is required to examine characteristics such as hardware resources, throughput and reconfigurable/nonreconfigurable modules with focus in the software-radio applications. These implementations of the proposed hardware architectures are based on the AES-CCM algorithm that is one of the most important cryptographic algorithms.

16.6 A Comparative Performance Analysis of Nine Blind Signature Schemes

Lourdes López-García, Institution: CINVESTAV-IPN
Luis Martínez-Ramos, Institution: CINVESTAV-IPN
Francisco Rodríguez-Henríquez, Institution: CINVESTAV-IPN

In this paper we present a comparative performance analysis of nine blind signature schemes that have been proposed since 1983 until 2008, spanning a total of 25 years of active research in this topic. We give a brief description of all the schemes studied, including a computational analysis of the most important cryptographic operations required by them. This includes customary arithmetic building blocks such as modular exponentiation, elliptic curve scalar multiplication, bilinear pairing computation and the implementation of a special hash function that maps arbitrary input strings to elliptic curve points (the so-called map-to-point hash function). Furthermore, we developed a C language library that implements all the above mentioned building blocks. We then conducted timing tests of the nine selected blind signature schemes on a Pentium IV processor working at 2.0

GHz, which allow us to report a software performance comparison of the nine cryptographic schemes studied in this paper.

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17. CS3: Computer Science and Computer Engineering

Wednesday (17:20-18:00) Room 1

Session Chair: José Guadalupe Rodriguez García

17.1 Reprogramming Wireless Sensor Networks with a Selective and Incremental Approach

Issac Noé García Garza, Institution: Centro de Investigación Científica y de Educación Superior de Ensenada

José Antonio García Macías, Institution: Centro de Investigación Científica y de Educación Superior de Ensenada

A wireless sensor network can be formed by nodes from different manufacturers, as long as their radio component enables communication with each other. Sometimes it is necessary to change the program in the nodes and several over-the-air reprogramming mechanisms have been proposed for that purpose. We base our work in one of such mechanisms, Deluge, adding some important contributions: we allow the selection of a set of nodes to be reprogrammed (not only the whole network) and we allow incremental reprogramming (not only sending complete program images). Through experiments with a real network we show that our proposal brings several benefits related to less traffic and less time spent in reprogramming tasks, which saves energy by using less the radio interface.

17.2 Panel Cointegration Modeling and Forecasting of Power Tariff

Yang Hongming, Institution: College of Electrical and Information Engineering, Changsha University of Science and Technology

He Enfeng, Institution: College of Mathematics and Computing Science, Changsha University of Science and Technology

Tong Xiaojiao, Institution: College of Mathematics and Computing Science, Changsha University of Science and Technology

Power tariff is an important economic lever of power market. Accurate relationship analysis and forecast of power tariff has played an important role on the rational adjustment of power demand by using the pricing policies. This paper applies recently developed panel unit root and panel cointegration techniques to estimate the long-run and short-run relationship between the power tariff and demand. It takes advantage of an unusual combination of cross-sectional and time-series data sets in order to improve the performance of small sample data and solve the spurious regression problem. With the panel data of power tariff and demand from 1990 to 2005 in United States, the results indicate that the power tariff and demand are non-stationary and have obvious panel cointegration relationship. Then, the fixed effects model based on cross-section weightings is proposed in order to accurately forecast the power tariff.

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18. CS4: Computer Science and Computer Engineering

Thursday (9:00-10:00) Room 1
Session Chair: Xiaoou Li

18.1 Toward the Semantic Search by Using Ontologies

Dulce Aguilar-Lopez, Institution: Laboratory of Information Technology, Cinvestav-Tamaulipas
Ivan Lopez-Arevalo, Institution: Laboratory of Information Technology, Cinvestav-Tamaulipas
Victor Sosa-Sosa, Institution: Laboratory of Information Technology, Cinvestav-Tamaulipas

This work describes a Web search approach taking into account the semantic content of Web pages. Eliminating irrelevant Web pages, the time-consuming task of revise the obtained results from actual search engines is reduced.
The proposed approach is focused on Web pages that are not defined with semantic Web structure (most of the actual Web pages are in this format). The challenge is extract the semantic content from heterogeneous and human oriented Web pages. The approach integrates structures of ontologies, WordNet, and a hierarchical similarity measure to determine the relevance of a Web page.

18.2 An Algorithm for Mining Frequent Itemsets

Raudel Hernández León, Institution: Centro de Aplicaciones de Tecnologías de Avanzada, Cuba
Airel Pérez Suarez, Institution: Centro de Aplicaciones de Tecnologías de Avanzada, Cuba
Claudia Feregrino Uribe, Institution: Instituto Nacional de Astrofísica, Óptica y Electrónica
Z. Jezabel Guzmán Zavaleta, Institution: Instituto Nacional de Astrofísica, Óptica y Electrónica

In this paper, we propose a new algorithm for mining frequent itemsets. This algorithm is named AMFI (Algorithm for Mining Frequent Itemsets). This algorithm compresses the data while maintaining the necessary semantics for the frequent itemsets mining problem and it is more effcient that traditional compression algorithms. The AMFI efficiency is based on a compressed vertical binary representation of the data and on a very fast support count. AMFI performs a breadth first search through equivalence classes. We compare our proposal with an implementation using PackBits algorithm.

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19. CS5: Computer Science and Computer Engineering

Thursday (15:00-17:00) Room 2
Session Chair: Luis Gerardo de la Fraga

19.1 A Model for Service Discovery with Incomplete Information

Christian Sanchez, Institution: Mexican Petroleum Institute
Leonid Sheremetov, Institution: Mexican Petroleum Institute

Conceptualization of the Web as a universal medium for data, information, and knowledge exchange, has drawn attention both of the software engineering and AI communities to semantic Service Oriented Architecture (SOA). One of the challenges of SOA is to deal with service matching which is uncertain and ambiguous. A service requester must be prepared to cope

with situations where no required services are found or, on the other hand, multiple matching services are found. The paper proposes a formal model of service discovery with incomplete information defined using set theory, description logic and fuzzy logic. The algorithm for dynamic service composition based on missing information matching implementing the proposed model is described. The approach is illustrated by a case study, in which the algorithm is compared with the previously reported ones and its advantages are discussed.

19.2 Performance Evaluation of Mobile Software Systems: Challenges for a Software Engineer

Vahid Rahimian, Institution: Sharif University of Tech
Jafar Habiib, Institution: Sharif University of Tech

New Advances in mobile computer technology, along with rapid growth of quality and quantity of wireless networks, introduce new capabilities, applications, and concerns to computer science and industry. Unique requirements and constraints of mobile systems bring new challenges to software development for such environments. It demands reconsidering the traditional approaches of information access, software design, and performance evaluation.
Despite the various constraints and problems, research endeavors aimed at ameliorating the status quo through enhancing/devising software design and performance evaluation techniques for mobile software systems have been relatively few and far in between.
In this paper, we aim to investigate the challenges of development and performance evaluation of mobile software systems. After reviewing mobile systems' characteristics, we investigate the current status of different approaches on improvement and evaluation of performance of mobile software systems. Then, the factors that make performance evaluation of mobile systems a challenging task are categorized. At last, we collect a set of performance metrics for evaluation of mobile systems, with the purpose of considering special characteristics of mobility.

19.3 Moodle Security Vulnerabilities

Miguel Ángel León Chávez, Institution: Benemérita Universidad Autónoma de Puebla, Facultad de Ciencias de la Computación
Juan Carlos Galán Hernández, Institution: Benemérita Universidad Autónoma de Puebla, Facultad de Ciencias de la Computación

Moodle (Object-Oriented Dynamic Learning Environment) is an Administrative System oriented on course management, it offers tools for course creation and uploading material as well as handling and following up services build around the activities for each module. Moodle has been developed under the General Public License and many of its components were developed without a specific design documentation including its security services. This article presents an object oriented model of Moodle using the Unified Model Language and solutions to its security vulnerabilities.

19.4 Colour-based Texture Image Classification using the Complex Wavelet Transform

Maria E. Barilla, Institution: Universidad Autónoma del Estado de México
Michael Spann, Institution: The University of Birmingham

In this paper we present an experimental analysis of colour-based texture image classification in order to evaluate whether colour and texture information should be used jointly or separately. Various colour spaces are used for colour information extraction. The complex wavelet transform is used to extract texture information. Results show that colour and texture information should be treated separately. As well, they evidence that colour is highly important when present in textured images.

19.5 Smooth Three-Dimensional Reconstruction from Contour Maps

Luis Gerardo de la Fraga, Institution: Cinvestav, Computer Science Department

In this paper a method to perform a smooth three-dimensional reconstruction from a contour map of a terrain is presented. The input data to the proposed method is 3D points of polygonal lines that represent contour maps with the elevation information included; such data is available at INEGI in the case of Mexico. The obtained 3D reconstruction is represented by a triangle mesh. The main idea of the proposed method is to include intermediate points among contour lines to avoid the problem of flat triangles, thus a good reconstruction with smooth changes in its surface can be achieved. The intermediate points are selected from the skeleton of the contour lines, and their heights are calculated automatically. The method is tested with simulated data to shown its effectiveness.

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20. MEC1: Mechatronics

Wednesday (12:30-13:30) Room 1
Session Chair: Luis Govinda García Valdovinos

20.1 Development of a Mecatronic Unit applied to the Manipulation of Explosives

Luis Adrian Zúñiga Aviles, Institution: centro de ingeniería y desarrollo industrial (CIDESI)
Juan Carlos Pedraza O., Institution: CIDIT-Facultad de Informática Universidad AutÃ³noma de Querétaro
Efrén Gorrostieta Hurtado, Institution: CIDIT-Facultad de Informática Universidad Autónoma de Querétaro
Luis Govinda García Valdovinos, Institution: centro de ingeniería y desarrollo industrial (CIDESI)

This paper presents the development of a mecatronic unit EOD/IEDD [1] (explosive ordinance disposal/improvised explosive device disposal), by carrying out a modeling and simulation of a proposed PID control, this unit is applied to perform hazardous-duty operations. The mechatronic unit uses an interchangeable gripper, a robotic arm with 5 degrees of freedom Stanford type, a climbing system and 3 CCD cameras, from which one of them is controlled through wireless signal. Two simulations are executed, one simulation for the arm and the other for the vehicle, such that the errors in the

model can be detected and later confined by control.

20.2 Immersion and Invariace based Experimental Attitude Estimation for Mobile Robots with Low Acceleration Profiles

Iván Estrada Sánchez, Institution: CINVESTAV
Hugo Rodríguez Cortes, Institution: CINVESTAV
Martin Velasco Villa, Institution: CINVESTAV

In this paper we address the attitude estimation problem, with respect to the gravity vector, for mobile robots moving on a rough terrain.
The proposed algorithm is based on the immersion and invariance technique. The performance of the proposed estimation algorithm is evaluated experimentally on a low cost mobile robot equipped with an inertial measurement unit.

20.3 Optimal Linearization of the Dynamic Behavior of an on/off Actuated Single Pneumatic Cylinder

José Alfredo Rosas-Flores, Institution: Unidad Profesional Interdisciplinaria en Ingeniería y Tecnologías Avanzadas-IPN
Juan Alejandro Flores-Campos, Institution: UPIITA-IPN
Leonel German Corona-Ramirez, Institution: UPIITA-IPN

The purpose of this work is to obtain a simple optimal linear model of a single pneumatic cylinder, which is controlled by two on/off solenoid valves. Here it is proposed an strategy to find a relation between the driving times to handle the on/off valves and a single continuous control input.
This relation represents an open loop control that generates a system with linear input/output response, with maximum speed response, and with zero deadband. So, this relation improves the results of the pulsing scheme given in [1].

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21. MEC2: Mechatronics

Thursday (9:00-10:00) Room 3
Session Chair: Gerardo Silva Navarro

21.1 Finite Element Modeling and Unbalance Compensation for a Two Disks Asymmetrical Rotor System

Manuel Arias, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Departamento de Ingeniería Eléctrica - Sección de Mecatrónica
Gerardo Silva, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Departamento de Ingeniería Eléctrica - Sección de Mecatrónica

In this work a LQR scheme for vibration control in a rotor system is presented. The rotor system has two disks in an asymmetrical configuration along the shaft and its model is obtained by applying finite element techniques. A reduced order seven degrees of freedom model is experimentally validated for the synthesis of active LQR control laws, using both an output feedback (one disk displacement) and an estimated state feedback controller. The controller is tuned to reduce the vibrations caused by the rotor imbalance in the two disks using only an actuator (active magnetic bearing). Some simulation and experimental results are included to show the transient and steady-state behavior of the overall closed loop system.

21.2 Application of an Active Pendulum-Type Vibration Absorber for Duffing Systems

Macias-Cundapi Liliana, Institution: Cinvestav, Departamento de Ingeniería Eléctrica, Sección Mecatrónica.
Silva-Navarro Gerardo, Institution: CINVESTAV-IPN, Departamento de Ingeniería Eléctrica- Sección de Mecatrónica
Vázquez-Gonzales Benjamín, Institution: Universidad Autónoma Metropolitana-Azcapotzalco, Departamento de Energía

This paper deals with the passive/active vibration control problem for damped Duffing systems, using a nonlinear pendulum-type vibration absorber. The primary system is a damped Duffing system affected by exogenous forces with excitation frequencies close to the principal parametric resonance. The design of the (passive) autoparametric vibration absorber is obtained by using an approximation of the nonlinear frequency response, computed via the multiple scales method. Then, in order to improve the overall system performance against variations on the amplitude and excitation frequency in the external force, it is incorporated a servomechanism to manipulate the pendulum length and, therefore, the autoparametric pendulum-type absorber can be automatically tuned into a given frequency bandwidth, by means of the application of a nonlinear control law combining feedback and feedforward compensation terms. The design of the autoparametric absorber, frequency analysis, control algorithm, stability analysis and closed-loop system performance are discussed. Finally, some simulations results are included to illustrate the dynamic performance of the overall system.

21.3 A Semiactive Control Scheme for a 6-DOF Model of a Rotor-Bearing System with a MR Suspension

Álvaro Cabrera Amado, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N.
Gerardo Silva Navarro, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N.

This work deals with the problem of balancing control of a rotor − bearing system, which consist of one rotor mounted on two nonorthotropic supports, one of them a traditional journal bearing and the other a journal bearing supported by an arrangement of two radial Magneto−Rheological (MR) dampers, whose rheological properties depend on the current inputs. The mathematical model of the 6 degrees of freedom rotor − bearing system consists of one disk with unbalance mounted on a shaft and two nonorthotropic supports. For control design purposes a Choi−Lee−Park polynomial model is considered for the two MR dampers, which are quite consistent with the nonlinear and complex hysteresis behavior and also simplifies the implementation issues of the balancing control scheme. The controller for the unbalance response is synthesized using sliding − mode control techniques. Finally, some simulation results are reported to illustrate the dynamic performance of the overall open − loop and closed − loop system.

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22. MEC3: Mechatronics

Friday (9:00-10:00) Room 1

Session Chair: Hebertt José Sira Ramírez

22.1 Optimal Control of External Force and Damping in one Mechanical System

Nosov Valery R., Institution: SEPI- ESIME Zacatenco, Instituto Politécnico Nacional, México
Meda- Campana Jesús Alberto, Institution: SEPI- ESIME Zacatenco, Instituto Politécnico Nacional, México
Gómez-Mancilla Julio Cesar, Institution: SEPI- ESIME Zacatenco, Instituto Politécnico Nacional, México

Pontryagin´s maximum principle is used for constructing optimal trajectories in bilinear system with controllable damping. In this paper the bilinear control system is partitioned into simpler linear problems. Then, the overall control law is obtained in a very practical way, from the adequate combination of the partial solutions. It is also shown that systems with controllable damping can be taken to the origin in less time than systems without damping or constant damping, in general.

22.2 Vibration Absorption in a Multi-Mass Mechanical System Using Positive Position Feedback

Max Adolfo Ríos-Gutiérrez, Institution: CINVESTAV-IPN
Gerardo Silva-Navarro, Institution: CINVESTAV-IPN

This paper is about a mechanical system with a mechanical system coupled with two passive vibration absorbers, one mass-spring type and one cantilever beam type. The overall system is made active with the addition of an external control force, then the open loop dynamics is properly modified with a Positive Position Feedback control to improve its robustness properties with respect to frequency variations or simultaneous resonant frequencies.

22.3 Robust Control of a Rotational System via on-line Inertia Identification

Joel Muñoz Castillo, Institution: Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional
Carlos García Rodríguez, Institution: Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional
Hebertt José Sira Ramírez, Institution: Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional

The present work deals about the simultaneous control and identification of a rotational mechanical system constituted by a tandem connection of disks and rotational springs. We consider the rotational system to be controlled as constituted by the first disk alone. This is to be modeled by a simple second order controlled dynamics affected by unknown perturbations arising from the cascade attachment of similar disks and springs in an unknown quantity and of unknown values. The only involved parameter in the robust perturbation rejection controller design is, then, the moment of inertia of the first disk, which is also assumed to be unknown. The on-line disk inertia identification process is carried out using the recently introduced algebraic identification technique. The on-line identification is achieved using

exponential modulation functions, instead of the traditional convolutions with suitable powers of the time variable. The control law is a robust generalized proportional integral controller which regards the unknown dynamics as a locally bounded polynomial perturbation. The feasibility of this scheme is shown through numerical simulations as well as laboratory experimental results.

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23. SSM1 (a): Materials, Characterization

Wednesday (15:00-16:00) Room 1

Session Chair: Alejandro Ávila García

23.1 Raman Scattering and Photoluminescence Studies on Cu_2O

Horacio Solache Carranco, Institution: Cinvestav IPN
Ramón Peña Sierra, Institution: Cinvestav IPN
Gabriel Juárez Díaz, Institution: Universidad de Puebla

Cuprous oxide (Cu_2O) crystals were grown by the two step crystallization method in air atmosphere conditions from polycrystalline copper plates. The method comprises two stages; in the first one the copper plates are oxidized at 1020°C by some hours in line with its initial thickness. In the second stage the growth of large crystalline areas is promoted by annealing the Cu_2O samples at 1100°C for long periods. The effects on the crystalline structure and photoluminescence (PL) response were studied as a function of the conditions used in the second stage of the synthesis method. Raman scattering an X-ray measurements demonstrates the existence of the single phase Cu_2O. PL spectra were taken from 10 to 180K to define the main radiative recombination paths. Besides of the near band excitonic transitions, two strong emission bands at 720 and 920 nm associated with relaxed excitons at oxygen and copper vacancies were detected. Both excitonic-vacancy bond transitions presented similar intensities which can be associated with the preparation method. The PL and the Raman scattering measurements were used to assess the evolution of the crystalline quality.

23.2 A Comparative Analysis between Nitride Films on GaAs and Epitaxial Films of GaN by MOCVD System

Héber Vilchis, Institution: Cinvestav-IPN
Víctor Manuel Sánchez, Institution: Cinvestav-IPN
Arturo Escobosa, Institution: Cinvestav-IPN

In this paper we report the conclusions about the analysis between the characteristics of nitrided thin gallium nitride (GaN) films on GaAs and epitaxial GaN films on buffer nitrided films. We use the Metal-organic Chemical Vapour Deposition technique for synthesize these films. Also ones films were characterized using X-ray diffraction (XRD), photoluminescence (PL) and atomic force microscopy (AFM).

23.3 Characterization of Nanocrystalline ZnO Grown on Silicon Substrates

Gabriel Juarez-Diaz, Institution: Cinvestav-IPN
Gabriel Romero-Paredes, Institution: Cinvestav-IPN

Alejandro Esparza-García, Institution: Centro de Ciencias Aplicadas y Desarrollo de Tecnología-UNAM
Javier Martínez-Juárez, Institution: Centro de Investigación en Dispositivos Semiconductores, BUAP
Ramón Peña-Sierra, Institution: Cinvestav-IPN.

The aim of the work was to study the effect of postgrowth thermal annealing processes on the characteristics of the zinc oxide films grown on silicon substrates by dc reactive magnetron sputtering. The growth temperature of the ZnO thin films was fixed at 230°C and then the samples were annealed in dry air atmosphere at 800°C for one hour. The surface of the ZnO samples was analyzed with a scanning electron microscope (SEM) and using an atomic force microscope (AFM). The structural properties were assessed by X-ray diffraction (XRD), Raman scattering, and Photoluminescence (PL) measurements. The XRD and Raman studies revealed the ZnO films crystallizes in the wurtzite structure with a certain amount of amorphous material in the as-grown films, after the thermal treatment a preferential orientation along the c-axis was observed. The films are constituted by crystallites of similar nanosize dimensions in spite of high temperature used in the annealing process. The most relevant result of this study was the observation of excitonic-like transitions in the PL response at the near band gap region at room temperature. The PL response also shows a broad defect-related green band at 516 nm. Both bands are clearly linked to the nanostructure and the point defects content of the ZnO films.

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24. SSM1 (b): Integrated Electronic Circuits

Wednesday (16:00-17:00) Room 1
Session Chair: Antonio Cerdeira Altuzarra

24.1 Voltage Current Converter for a Memory Current Cell Using Floating

Agustín Santiago Medina Vázquez, Institution: CINVESTAV-IPN
Felipe Gómez Castañeda, Institution: CINVESTAV-IPN
José Antonio Moreno Cadenas, Institution: CINVESTAV-IPN
Jesús de la Cruz Alejo, Institution: CINVESTAV-IPN

This paper presents the analysis, design and implementation of a Voltage Current Converter (VIC), for a Memory Current Cell (MIC) using Floating Gate MOS transistors, fabricated in 1.2 um CMOS technology. Mathematical analysis of each cell shows the advantages the floating gate transistor has versus conventional MOS transistor. Also, the cells are designed taking into account low supply voltage and consequently, low power dissipation. The analytical results are according to simulation results. Both cells present good performance and linearity with a supply voltage of 1.7 V, despite the long channel technology. These characteristics are very important in analog and mixed signal applications, like mobile communications systems.

24.2 Electronic Potentiometer Cell using a CMOS Floating-Gate Memory

Jesús de la Cruz-Alejo, Institution: CINVESTAV-IPN
Felipe Gómez-Castañeda, Institution: CINVESTAV-IPN
José Antonio Moreno-Cadenas, Institution: CINVESTAV-IPN

This paper describes the experimental design of an electronic potentiometer cell (e-pot cell) using a CMOS floating-gate memory fabricated in 1.2 µm CMOS process. Attention is focus to the fact that e-pot will be programming applying tunneling and injection hot electrons processes, to provide reference voltages. It takes into account the long-term voltage storage as charge on the floating gate of a transistor pMOS which is the core of the memory cell. Experimental results justifying these processes are also including. The circuit performed very well and can provide an output voltage in the range that is nearly rail to rail.

24.3 Prototype Chip and Methodology for Characterization of Phototransistor

Gelacio Castillo-Cabrera, Institution: CINVESTAV-IPN
M. Alfredo Reyes-Barranca, Institution: CINVESTAV-IPN
Jair García-Lamont, Institution: Universidad Autónoma de Hidalgo
Luis-Martin Flores-Nava, Institution: CINVESTAV-IPN
Oliverio Arellano-Cárdenas, Institution: CINVESTAV-IPN

A prototype chip for characterization of optical devices is presented based on a simple architecture. This is very useful for the characterization of Phototransistors and photodiodes and also for custom design pixels for image cameras. Phototransistors and photodiodes in a matrix of 6x4, have been used, this is, six rows by four columns. Reading is carried out in the voltage-mode which is different from other reported architecture, where current-mode is used. The pixel architecture is based on four p-channel transistors: shutter, reset, row-select and buffer integrator. The transistor called buffer-integrator in the pixel, converts the photocurrent from the photosensor into voltage. Both, the transistor buffer-integrator and a current source, form a voltage amplifier, with gain close to 32dB. The capacitance in the integrating node was estimated from the L-Edit software extractor. Photocurrent, dark current, dynamic range and quantum efficiency, were estimated from data such as, capacitance, integrated voltage, voltage gain and time of integration. Good approximation between simulation during design and measurement on chip, was obtained which demonstrates the great powerful application of design tools.

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25. SSM2: Solar Cells

Wednesday (17:20-18:00) Room 3
Session Chair: Victor Sánchez Reséndiz

25.1 Hetero-junction (HIT) Silicon Solar Cell Model for AMPS-1D Simulation

Norberto Hernández-Como, Institution: CINVESTAV-IPN
Arturo Morales-Acevedo, Institution: CINVESTAV-IPN

Mono and poly-crystalline silicon solar cell modules currently represent between 85 and 90% of the PV world market. The reasons are the stability, robustness and reliability of this kind of solar cells as compared to those of emerging technologies. Then, in the mid-term, silicon solar cells will continue playing an important role for their massive terrestrial application. One important approach is the development of silicon solar cells processed at low temperatures (less than 300º C) by depositing amorphous silicon layers with the purpose of passivating the silicon surface, and avoiding the degradation suffered by silicon when processed at temperatures above 800º C. This kind of solar cells are known as HIT cells (Hetero-junction with an intrinsic layer) and are already produced commercially (Sanyo Ltd), reaching efficiencies above 20. In this work these solar cell are simulated by means of AMPS-1D, which is a program developed at Pennsylvania State University. We shall discuss the modifications required for simulating this kind of structures since this program explicitly does not take into account interfaces with high interfacial density of states as occurs at the amorphous-crystalline silicon interface. Finally, optimization of the HIT cells will also be discussed.

25.2 Cat-CVD Deposited Inverted mc-Si:H/c-Si Heterojunction Solar Cell

Yasuhiro Matsumoto, Institution: CINVESTAV-IPN
Mauricio Ortega, Institution: CINVESTAV-IPN
Francis Wünsch, Institution: Hahn-Meitner-Institut
Yu Zhenrui, Institution: Electronics Department, INAOE

Catalytic chemical vapor deposition (Cat-CVD), is a new technology to obtain device-quality thin films at low substrate temperatures. In the other hand, the inverted microcrystalline-silicon / crystalline-silicon (mc-Si/c-Si) hetero-junction, consists of a solar cell illuminated on the backside, the c-Si part of the hetero-structure. This, structure configuration avoids the light absorption in the heavily-doped emitter (dead-layer) and also eludes the use of transparent conducting oxide (TCO) on the emitter. If the back-surface is properly treated, this structure has the advantage to absorb major part of the solar spectrum. Very thin intrinsic hydrogenated amorphous silicon (i-a-Si) as a buffer-layer, and boron-doped hydrogenated microcrystalline silicon (p-mc-Si) were deposited using Cat-CVD system on crystalline-silicon (c-Si) substrate. Solar cells were fabricated on Czochralsky (CZ)-grown phosphorous-doped c-Si within 0.5 to 1 ohm-cm. The tungsten catalyst temperature (Tfil) was settled to 1600 °C and 1950 °C for i-a-Si and p-□c-Si films, respectively. Silane (SiH4) and hydrogen (H2) gases were used and diluted diborane (B2H6) for p-doping at the substrate temperatures (Tsub) of 200 °C. The preliminary I-V characteristics under natural solar radiation and corrected to 100mW/cm2 are: Jsc =19.24 mA/cm2; Voc = 480 mV; Jm = 19.24 mA/cm2; Vm = 320 mV; FF = 49.5%. Being an active area efficiency of 6.15%.

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26. SSM3 (a): Digital Circuits, Signal Processing

Thursday (15:00-16:00) Room 3
Session Chair: Rodolfo Quintero Romo

26.1 Energy-Efficient High-Speed CMOS Pipelined Multiplier

Mariano Aguirre-Hernández, Institution: National Institute of Astrophysics, Optics and Electronics
Mónico Linares-Aranda, Institution: Institution: National Institute of Astrophysics, Optics and Electronics

This work presents the design and fabrication of an energy-efficient high-speed 8x8-bits CMOS pipelined multiplier, based on a full adder cell built with an alternative internal logic structure and a swing-restored complementary pass-transistor logic style, that reduce static power dissipation while retaining a complete voltage swing at internal nodes. Post-layout simulations show that this multiplier is able to operate up to 1.2GHz when supplied with 3.3V, and the power savings obtained when compared against similar pipelined multipliers are about 20% when operating with transitioning input data, 25% with non-transitioning input data and 80% with the clock signal disabled. A test chip containing the multiplier was fabricated in a 0.35um CMOS technology and the experimental measurements confirm its operation at 1.2 GHz with a power consumption of 180mW for a supply voltage of 3.3V.

26.2 Comparative Analysis in the Implementation of Subtraction and Thresholding for Digital Image Processing

Carlos Lujan, Institution: INSTITUTO TECNOLOGICO DE MERIDA
Francisco Mora, Institution: UNIVERSIDAD POLITÉCNICA DE VALENCIA
José Ramón Atoche, Institution: INSTITUTO TECNOLÓGICO DE MÉRIDA

The aim of this work is to demonstrate the advantages and disadvantages of different ways of implementing subtraction and thresholding in the processing of digital images. The four different systems will be analysed: first in a PC computer with a Borland C++ program, second with an embedded microprocessor programmed in C++, third with a DSP also programmed in C++, and finally with a hardware designed in VHDL.

26.3 Implementation of Blind Source Separation for Multi-input

L. Noé Oliva-moreno, Institution: ESCOM-IPN
Miguel A Alemán Arce, Institution: ESCOM-IPN
Jair García-Lamont, Institution: Universidad Autónoma del Estado de Hidalgo
José A. Moreno-Cadenas, Institution: CINVESTAV-IPN

The present work shows, implementation of neural ICA algorithms with multiple inputs using VHDL Design in a Field Programmable Gate Array (FPGA). We designed a architecture modular using INFOMAX algorithm in order to add n inputs for audio signals. Some simulations results using VHDL are presented using music and voice recorded.The study of performance is made in a net 2x2 and also a net of 3x3.

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27. SSM3 (b): Materials, Fabrication and Characterization

Thursday (16:00-17:00) Room 3
Session Chair: Mauricio Ortega López

27.1 Two-Stage Crystallization Process in Ge2Sb2Te5 Alloys

Eduardo Morales Sánchez, Institution: CICATA-IPN UNIDAD QUERETARO
Martín A. Hernández Landaverde, Institution: CINVESTAV DEL IPN UNIDAD QUERETARO
Evgene Prokhorov, Institution: CINVESTAV DEL IPN UNIDAD QUERETARO
Gerardo Trapaga, Institution: CINVESTAV DEL IPN UNIDAD QUERETARO
Jesús González Hernández, Institution: CIMAV

The aim of this work is to investigate the amorphous-to-crystalline phase transformation process in Ge2Sb2Te5 ternary alloys. The experiments were carried out using impedance and X-ray diffraction measurements. The results have shown that the crystallization process in an amorphous Ge2Sb2Te5 alloy starts from nuclei, which appear below Tc and which were identified as the crystalline Ge1Sb4Te7. As the temperature increases above Tc these nuclei were transformed into fcc-Ge2Sb2Te5 crystals. In order to establish the mechanism of crystallization for this system, the Brugerman effective medium approximation was implemented to analyze nucleation and growth of the two stage involved (i.e., metastable Ge1Sb4Te7 and stable Ge2Sb2Te5) through impedance measurements. The results of the simulations demonstrate a close agreement with experimental ones showing that phase transformation in Ge2Sb2Te5 is carried in two steps.

27.2 A comparative Analysis of Synthesizing Gallium Nitride films: on Gallium Arsenide and Sapphire Substrates

Cesia Guarneros, Institution: CINVESTAV-IPN
Héber Vilchis, Institution: CINVESTAV-IPN
Víctor Manuel Sánchez, Institution: CINVESTAV-IPN
Arturo Escobosa, Institution: CINVESTAV-IPN

The characteristics of gallium nitride (GaN) films growth on gallium arsenide (GaAs) and sapphire (AlO3) by Metal-organic vapor phase epitaxy (MOVPE) system are presented. Compare the results we can saw the advantages and disadvantages of use one or other substrate in order to find the bets experimental conditions for obtain c-GaN films with good properties.

27.3 Spinodal Decomposition in the $GaSb_xN_yAs_{1-x-y}$ Alloys

Salvador Felipe Diaz Albarran, Institution: Escuela Superior de Ingeniería Mecánica y Eléctrica Unidad Culhuacán del IPN
Alicia Guillermina González Noguez, Institution: Comisión Nacional de Seguridad Nuclear y Salvaguardias
Elyukhin Vyacheslav Alexander, Institution: CINVESTAV-IPN
Patricia Rodríguez Peralta, Institution: Escuela Superior de Ingeniería Mecánica y Eléctrica Unidad Culhuacán del IPN

Spinodal decomposition of the GaSb(x)N(y)As(1-x-y) quaternary alloys lattice-matched to the GaAs as the result of the internal deformation and coherency strain energies is described. The alloys are represented as quasiternary regular solutions.
The internal deformation energy is presented by the interaction parameters between the constituent compounds estimated within the framework of the valence force field

model. Ranges of spinodal decomposition of the GaSb(x)N(y)As(1-x-y) alloys up to y<0.035 with and without coherency strain energy are demonstrated.

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28. SSM4 Materials, characterization

Thursday (17:20-18:00) Room 1
Session Chair: María de la Luz Olvera Amador

28.1 Electron Field Emission from Films of Palladium Oxide Nanoparticles

Roberto Baca Arroyo, Institution: CINVESTAV-IPN
Claudia López Rodríguez, Institution: CINVESTAV-IPN
Miguel Galván Arellano, Institution: CINVESTAV-IPN
Gabriel Romero Paredes Rubio, Institution: CINVESTAV-IPN
Ramón Peña Sierra, Institution: CINVESTAV-IPN

Electron Field Emission at atmospheric pressure from films of palladium oxide (PdO) nanoparticles is demonstrated. PdO nanoparticles with average height of 9 – 45nm were grown on silicon substrates by oxidizing film of Pd nanoparticles. The field emission current was measured in a parallel plate diode configuration structure with 1□m of separation between cathode and anode. The current-voltage characteristics of the structure were measured with voltages between □100V. The electrical current of the structure without film of nanoemitters was 4 nA at 100V, the maximum current measured with films of PdO nanoemitters was of 1μA at the same voltage.

28.2 Photo- and Cathodo-Luminescence of Hydrogenated Silicon Rich Oxide

Rosa Elvia López Estopier, Institution: Instituto Nacional de Astrofísica, Óptica y Electrónica
Mariano Aceves Mijares, Institution: Instituto Nacional de Astrofísica, Óptica y Electrónica
Zhenrui Yu, Institution: Instituto Nacional de Astrofísica, Óptica y Electrónica
Carlos Zúñiga, Institution: Instituto Nacional de Astrofísica, Óptica y Electrónica
Ciro Falcony, Institution: CINVESTAV-IPN

Photoluminescence and Cathodoluminescence of hydrogenated Silicon Rich Oxide (SRO:H) films were studied. The samples were prepared by Low Pressure Chemical Vapor Deposition (LPCVD) on Si substrates, some samples were thermally annealed at high temperature and hydrogenation was made by low temperature annealing in forming gas. Strong red PL (Photoluminescence) and CL (Cathodoluminescence) in almost all the visible range were obtained. It was found that it is necessary to apply thermal treatment at high temperatures in order to obtain strong Photo and Cathodo-luminescence. Samples with lower silicon excess show maximum luminescence (CL and PL) while samples with higher silicon excess show poor luminescence. The hydrogen promotes the PL emission, but electron beam irradiation (after CL measurements) quenches the red band observed by PL. The results are analyzed to find the dependency of the PL and CL with respect to hydrogenation, silicon excess and thermal treatment. An explanation is

presented in order to interpret these experimental results.

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29. SSM5 Solar Cells and Related Topics

Friday (9:00-10:00) Room 3

Session Chair: Lourdes Albor Aguilera

29.1 Photobiostimulation Effects caused by a High Power IR Laser with L=850nm in Wheat (Triticum aestivum L)

Mauricio Hernández Vizuet, Institution: Instituto Politécnico Nacional
Alexandre Michtchenko, Institution: Instituto Politécnico Nacional
Francisco Javier Gallegos Funes, Institution: Instituto Politécnico

This paper has as principal objective to determine the value of some parameters of light that are determinants in the activation or inhibition of the growth stimulus of wheat seeds (Triticum aestivum L). In this case intensity and dose, as important parameters, were considered. GaAlAs laser with L=850 nm was used to irradiate the biological system. The growth of main shoot was considered. All data were processed using statistical methods. Results obtained indicate that when the appropriate light parameters are used activation can occur.

29.2 Electrical Characterization of Al, Ag and In Contacts on CuInS2 Thin Films Deposited by Spray Pyrolysis

Juan Manuel Peza-Tapia, Institution: CINVESTAV del IPN
Arturo Morales-Acevedo, Institution: CINVESTAV del IPN
Mauricio Ortega-López, Institution: CINVESTAV del IPN

The specific contact resistivity for Aluminum (Al), Silver (Ag) and Indium (In) metallic contacts on CuInS2 thin films have been determined, from I – V measurements, with the purpose of having the most appropriate ohmic contact for TCO/CdS/CuInS2 solar cells. Specific Contact resistivity was measured using the transmission line (TLM) method for the metallic contacts evaporated on CuInS2 thin films deposited by spray pyrolysis with ratios x = [Cu] / [In] = 1.0, 1.1, 1.3 and 1.5 in the spray solution. The results show that In contacts have the lowest especific contact resistivity values for CuInS2 samples grown with x = 1.5. The minimum especific contact resistivity was 0.26 ohm-cm2 for the In contacts. This value, although not very low, will allow the fabrication of CuInS2 solar cells with a small series resistance.

29.3 Physical Concepts for Improving Solar Cells based upon Graded $CuInGaSe_2$

Arturo Morales-Acevedo, Institution:.
CINVESTAV del IPN

Some basic concepts related to variable band-gap absorbing semiconductors in solar cell structures such as the associated quasi-electric

field will be discussed. The effects of this quasi-electric field upon the minority carrier drift-diffusion length and the back surface recombination velocity will cause a larger generated carrier collection with the corresponding increase of the illumination current density. It will also be shown that an additional improvement of the open-circuit voltage is possible when the band-gap is reduced within the space charge region so that the dark saturation current density is reduced there. Our estimation is that in the case of a solar cell where the band-gap reduces from 1.35 eV to 1.15 eV, at the space charge region (of the order of 0.2 □m), an increase of the open-circuit voltage by around 65-70 mV will be observed with respect to the single gap absorbing material case. A similar (increasing) band-gap variation in the bulk of the material will cause an increase of the drift-diffusion length of minority carriers by a factor of 4 with respect to a single band-gap material. Therefore, based on these physical concepts, two possible structures with variable band-gap CIGS layers are proposed in order to have higher efficiencies than for cells without any band-gap grading.

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30. WS1: Workshop CASI 2008: Special Session 1 - Multi-Sensor Adaptive Data Fusion and Imaging

Tuesday (9:20-10:40) Room 1

Session Chair: Iván Esteban Villalón Turrubiates

30.1 Fusion of Multiple-Look Synthetic Aperture Radar Images at Data and Image Levels

Ram M Narayanan, Institution: Dept. of Electrical Engineering, The Pennsylvania State University, University Park, PA 16802, USA

Synthetic aperture radar (SAR) and inverse synthetic aperture radar (ISAR) have proven capabilities for non-cooperative target recognition (NCTR) applications. Multiple looks of the same target (at different aspect angles, frequencies, etc.) can be exploited to enhance target recognition by fusing the information from each look. Such fusion can be performed at the raw data level or at the processed image level depending on what is available. At the data level, physics based image fusion techniques can be developed by processing the raw data collected from multiple inverse synthetic aperture radar (ISAR) sensors, even if these individual images are at different resolutions. The technique maps multiple data sets collected by multiple radars with different system parameters on to the same spatial-frequency space. The composite image can be reconstructed using the inverse 2-D Fourier Transform over the separated multiple integration areas. An algorithm called the Matrix Fourier Transform (MFT) is proposed to realize such a complicated integral. At the image level, a persistence framework can be used to enhance target features in large, aspect-varying datasets. The model focuses on cases containing rich aspect data from a single depression angle. The goal is to replace the data's intrinsic viewing geometry dependencies with target-specific dependencies. Both direct mapping functions and cost functions are presented for data transformation. An

intensity-only mapping function is realized to illustrate the persistence model in terms of a canonical example, visualization, and classification

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30.2 Experiment Design-Based Robust Spatial Spectral Analysis Techniques for Enhanced Imaging with Remote Sensing Data

Yuriy Shkvarko, Institution: CINVESTAV-IPN, Unidad Guadalajara.
Héctor Pérez Meana, Institution: ESIME-IPN, Unidad Culhuacan.

A new approach to optimization of the signal processing techniques for enhanced imaging with remote sensing (RS) data based on the concept of descriptive experiment design regularization (DEDR) is addressed. The RS imaging problem is treated as a nonlinear statistical inverse problem of reconstructing the spatial spectrum pattern (SSP) of the wavefield sources distributed in the environment via processing the RS data signals distorted in the stochastic measurement channel. We propose to aggregate the paradigms of statistical estimation theory, experiment design and descriptive regularization to solve the SSP reconstruction problem with the system-level and model-level uncertainties attributed to imperfect system calibration and random signal perturbations in inhomogeneous propagation medium. Advanced robust adaptive signal processing techniques that employ the proposed DEDR method for enhanced RS imaging in both certain and uncertain operational scenarios are developed and evaluated through computer simulations.

30.3 A Methodology for Advanced Change Detection with Fuzzy Image Classification

Rene Roland Colditz, Institution: National Commission for the Knowledge and Use of Biodiversity (CONABIO)
Michael Schmidt, Institution: German Aerospace Center â€“ German Remote Sensing Data Center (DLR-DFD)
Stefan Dech, Institution: German Aerospace Center â€“ German Remote Sensing Data Center (DLR-DFD)

High-quality land cover mapping and land cover change analysis are important for regional and global studies. Time series of satellite imagery seem suitable for land cover mapping, by integrating processes on the Earth surface into the classification result. However, the coarse spatial resolution in contrast to small-scale land cover patches as well as the mapping of transition zones or inherently defined mixed classes necessitate fuzzy image classification. This study describes a methodology of fuzzy image classification using a decision tree approach and bagging. The presented bi-annual change detection technique builds directly on the fuzzy classification result and presents the change in land cover composition for each class or each pixel. Furthermore, the discrete map agreement is presented as a function of classification confidence. Results based on MODIS time series for South Africa and Germany illustrate the change detection approach.

30.4 Hardware/Software Co-Design for Near Real Time Enhancement of Remote Sensing Imaging

Alejandro Castillo Atoche, Institution: CINVESTAV-IPN, Unidad Jalisco.
Deni Torres Román, Institution: CINVESTAV-IPN, Unidad Jalisco.

In this paper, we propose a novel Hardware/Software co-design architecture of an iterative fixed-point projection regularization algorithm for near real time implementation of high-resolution reconstruction of remote sensing (RS) imagery. The proposed technique design is based on a Field Programmable Gate Array (FPGA) and implements the image enhancement/reconstruction tasks in an efficient concurrent processing architecture that meets the (near) real time imaging systems requirements in spite of conventional computations. Finally, we report and discuss the results of the Hardware/Software co-design implementation in a Xilinx Virtex-4 XC4VSX35-10ff668 for reconstruction of large scale real world RS images of 1K x 1K pixel format.

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31. WS2: Workshop CASI 2008: Special Session 2 - Features extraction, Signatures Field Mapping and RS Image Understanding

Tuesday (11:20-12:40) Room 1

Session Chair: Héctor Pérez Meana

31.1 Multispectral Image Processing Under Fuzzy and Directional Techniques

Alberto Jorge Rosales Silva, Institution: National Polytechnic Institute of Mexico
Volodymyr Ponomaryov, Institution: National Polytechnic Institute of Mexico

Multispectral images provide information for different applications. These images are corrupted by noise, so denoising schemes are necessary to outperform the signals obtained by different sensors. Here, it is proposed a novel scheme to enhance important characteristics in this kind of images, such as, edges and fine details.

31.2 Weighted Pixel Statistics for Multispectral Image Classification of Remote Sensing Signatures: Performance Study

Ivan Villalón-Turrubiates, Institution: Los Valles University Center, University of Guadalajara

The extraction of remote sensing signatures from a particular geographical region allows the generation of electronic signature maps, which are the basis to create a high-resolution collection atlas processed in continuous discrete time. This can be achieved using a new multispectral image classification approach based on pixel statistics for the class description. This is referred to as the Weighted Pixel Statistics Method. This paper explores the effectiveness of this novel approach developed for supervised segmentation and classification of remote sensing signatures, with a comparison with the traditional Weighted Order Statistics Method. The extraction of remote sensing signatures from real-world high-resolution environmental remote sensing imagery is reported to probe the efficiency of the developed technique.

31.3 A Method Based on Tree-Structured Markov Random Field and a Texture Energy Function for Classification of Remote Sensing Images

Erika Lopez-Espinoza, Institution: National Institute of Astrophysics, Optics and Electronics (INAOE)
Leopoldo Altamirano-Robles, Institution: National Institute of Astrophysics, Optics and Electronics (INAOE)

A method for classification based on tree-structured Markov random field (TS-MRF) and a texture energy function (TEF) is presented. The TEF consists of a second-order prior energy function with homogeneous-non internal and external fields obtained from 2-D Wold decomposition. Thus, in TEF is possible to characterize a combination of stochastic and structural texture. The TEF is used into binary MRF\'s defined in the TS-MRF model. The extended model TS-MRF/TEF is tested on remote sensing images for mangrove cover classification. An evaluation is carried out comparing results with a thematic map of study area. The classification results using TS-MRF/TEF are compared with results produced using supervised and unsupervised pixel-based classification methods. We show that incorporating the TEF into TS-MRF model the quality of the mangrove classification is improved.

31.4 Automatic Processing of Near-Real Time Operational MODIS Ocean Products applied to Mexico Seas Monitoring

Sergio Cerdeira-Estrada, Institution: Comisión Nacional para el Conocimiento y uso de la Biodiversidad, CONABIO
Gerardo López-Saldaña, Institution: Comisión Nacional para el Conocimiento y uso de la Biodiversidad, CONABIO

In this paper we present a automatic processing of Moderate Resolution Imaging Spectroradiometer (MODIS) images using the SeaDAS software, to provide continuous information regarding phytoplankton content and sea surface temperature values of Mexican seas. This automatic processing has permitted obtaining near-real-time ocean products (Level 2): Ocean Color [Chlorophyll-a concentration Pigment OC3 Algorithm, Diffuse Attenuation Coefficient at 488 nm (K490), Total Suspended Matter concentration from Clark, Chlorophyll Fluorescence Line Height, Remote Sensing Reflectance, Water-leaving radiance at 488 nm, and Aerosol optical depth at 868 nm], and the Sea Surface Temperature. The generated products are being used in time series analyses and for testing their relationship with other ecological parameters in various projects of Mexican institutions.

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