CCE
2010

PROGRAM AND ABSTRACT BOOK

2010 7 th INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING, COMPUTING SCIENCE AND AUTOMATIC CONTROL

Tuxtla Gutiérrez Chiapas, Mexico
September 8-10, 2010

Contents

September 2010

Message from the Podium

Editorial.

This year we are celebrating the 7th International Conference, and the third edition in which its organization includes the participation of three academic departments at CINVESTAV: Electrical Engineering, Computer Science and Automatic Control. The conference remains as a specialized forum where local research groups can 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 managers and government officers, keeps a special place in the activities of the conference.

This year, we received 209 submissions from 19 countries (including Mexico), from which 113 were accepted for oral presentation. We received submissions from countries such as the USA, Spain, China, Iran, India, Pakistan, Romania, Germany, Colombia, Russia, Australia, United Kingdom, Yemen and Vietnam, among others, reflecting the international character of this conference.

As Presidents of CCE 2010, we wish to thank the Organizing Committee, the anonymous referees and the supporting personnel for their valuable time and efforts which have made possible to hold a successful 2010 7th International Conference on Electrical Engineering, Computing Science and Automatic Control (CCE). We also wish to give special thanks to the Technological Institute of Tuxtla Gutiérrez, to the Council of Science and Technology of Chiapas (Cocytech) and to the authorities of the State of Chiapas for all their support. In particular, we thank José Luis Herrera Martínez, Adriana González Escobar, Ignacio Arrioja Cárdenas, Roberto Ibáñez Córdova, Daniel Samayoa Penagos, Héctor Ricardo Hernández de León, Roberto Carlos García Gómez, Vicente León Orozco, Apolinar Pérez López, Aída Guillermina Cossío Martínez, Roberto Meza Meneses, Raquel Camacho Méndez, Madain Pérez Patricio, Jorge Luis Camas Anzueto, Nicolás Juárez Rodriguez, Alejandro Medina Santiago, Rubén Herrera Galicia, Walter Torres Robledo, Rafael Mota Grajales, Francisco Ronay López Estrada, Herminio Fernando Chanona Pérez, Ana Díaz Ortega, Beatriz F. Garcés Carrera and Cristina Mendiola Calvo for all their valuable help and support.

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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Oficina de Convenciones y Visitantes
OCV Chiapas

General Information

The Conference will be held in the ***Crown Plaza and Holiday Inn Hotels***, with the support of **Instituto Tecnológico de Tuxtla Gutiérrez**, Chiapas. These hotels are located next to each other and share the rooms where the Conference will be.
Address: Belisario Domínguez KM 1081 B, Tuxtla Gutiérrez, Chiapas, México

Tuxtla Gutiérrez

Is a municipality and the capital city of the Mexican state of Chiapas. It is the seat of the local public administration, the local authorities, and of the federal government delegations in the state. It covers more than 40% of the municipal territory, and continues to grow.

Chiapas is the southernmost state of Mexico, located towards the southeast of the country. Chiapas is bordered by the states of Tabasco to the north, Veracruz to the northwest, and Oaxaca to the west. To the east Chiapas borders Guatemala, and to the south the Pacific Ocean, Chiapas has an area of about 74,211 km^2 (28,653 sq mi).

In general Chiapas has a humid, tropical climate. In the north, in the area bordering Tabasco, near Teapa, rainfall can average more than 3,000 mm (120 in) per year.

The state capital city is Tuxtla Gutiérrez; other cities and towns in Chiapas include San Cristóbal de las Casas, Comitán, and Tapachula. Chiapas is home to the ancient Mayan ruins of Palenque, Yaxchilán, Bonampak, Chinkultic, and Toniná.

http://en.wikipedia.org/wiki/Tuxtla_Gutiérrez

Program

TUTORIAL COURSES
SEPTEMBER 6-7, 2010

Monday September 6, 2010			
TUTORIAL COURSES			
	Room 1	Room2	Room3
10:00-13:00	**Tutorial and Conference Registration**		

Tuesday September 7, 2010				
TUTORIAL COURSES				
	Room 1	Room2	Room3	Room4
08:00-10:00	**Tutorial and Conference Registration**			
10:00-12:00	**TUT1**	**TUT2**	**TUT3**	**TUT4**
12:00-12:30	**Break**			
12:30-14:30	**TUT1**	**TUT2**	**TUT3**	**TUT4**
14:30-16:00	**Lunch**			
16:00-18:00	**TUT1**	**TUT2**	**TUT3**	**TUT4**

Wednesday September 8, 2010				
CCE				
	Room 1	Room2	Room3	Room4
08:00-10:00	**Registration**			
10:00-11:00	**Opening Ceremony**			
11:00-11:30	**Welcome Cocktail**			
11:30-12:30	**PLE1**			
12:30-13:00	**Break**			
13:00-14:00	**PLE2**			
14:00-15:30	**Lunch**			
15:30-16:30	**CS1**	**AC1**	**AC4**	**SSM1**
16:30-16:50	**Break**			
16:50-17:50	**CS2**	**AC2**	**BIO1**	**ICD1**
17:50-18:50	**CS3**	**AC3**	**BIO2**	**SSD1**

Thursday September 9, 2010				
CCE				
	Room 1	Room2	Room3	Room4
08:00-10:00	**Registration**			
10:00-11:00	**PLE3**			
11:00-11:30	**Break**			**Multion**
11:30-12:30	**PLE4**			
12:30-14:00	**Lunch**			
14:00-15:00	**CS4**	**CS5**	**AC5**	**MEC1**
15:00-15:20	**Break**			
15:20-16:20	**CS6**	**AC6**	**AC7**	**MEC2**
16:20-16:40	**Break**			
16:40-17:40	**BIO3**		**AC8**	**SSM2**
17:40-19:00	**BIO4**	**COM1**	**SSD2**	**ICD2**

Friday September 10, 2010				
CCE				
	Room 1	Room2	Room3	Room4
08:00-10:00	**Registration**			
09:00-10:00	**COM2**	**AC9**	**SSM3**	**SSM4**
10:00-10:20	**Break**			
10:20-11:20	**PLE5**			
11:20-11:40	**Break**			
11:40-12:40	**PLE6**			
12:40-14:00	**AC10**	**BIO5**	**MEC3**	**AC11**
14:30	**Closing ceremony, Closing Cocktail**			

SESS	SESSIONS
AC	Automatic Control
BIO	Biomedical Engineering
COM	Communications Systems
CS	Computer Science and Computer Engineering
MEC	Mechatronics
SSM	Solid-State Materials
SSD	Solid State Devices
ICD	Integrated Circuits Design
TUT	Tutorials
PLE	Plenary
Multion	MATLAB: Lenguaje de Computo Técnico y Quanser: Hardware para control en tiempo real
(Company) Talk	

PLE1: Prof. Dr. Christos G. Cassandras

Head, Division of Systems Engineering, and Professor of Electrical and Computer Engineering
Center for Information and Systems Engineering (CISE)
Boston University, Brookline
USA

Plenary talk: *"Cooperative Control and Optimization in an Uncertain Asynchronous Wireless Networked World"*

PLE2: Profesor Dr. Stefano Cagnoni

Department of Computer Engineering of the University of Parma
Italy.

Plenary talk: "*Evolutionary Computation applications beyond off–line optimization"*

PLE3: Profesor Dr. Christian Daul

CRAN-CNRS- Ingénierie pour la Santé
France.

Plenary talk: *"From 2D cartography of hollow organs towards 3D cartography"*

PLE4: Profesor Dr. Romeo Ortega

Laboratoire de Signaux ET Systemes of Supelec in Gif-sur-Yvetteé
France.

Plenary talk: *"Teoría de control: Una disciplina omnipresente"*.

PLE5: Dr. Jorge Moises Murillo Natera

Deputy Manager of infrastructure of hydraulics and electrical projects
FONATUR
México.

Plenary talk: *"Diseño e instalación de una central de generación fotovoltaica de 500 kW"*

PLE6: Profesor Dr. Aldo G. Orozco Lugo

Professor of Communications Section
Electrical Engineering Department
CINVESTAV-IPN
México

Plenary talk: "*Multiple Packet Reception in Communication Networks: Empowering the MAC layer by Digital Signal Processing"*

TUT1: *Control of Autonomous Aerial and Underwater Vehicles*

Prof. Dr. Rogelio Lozano Leal
Research Center of Compiegne, France
Director of the joint France-Mexico research laboratory UMI-LAFMIA

TUT2: Sistemas Fotovoltaicos y Fototérmicos- Principios y Aplicaciones

Ing. José Antonio Urbano Castelán
Electrical Engineering Department
Cinvestav
México, D.F.

TUT3: Seguridad en redes de Computadoras con GNU/LINUX

Prof. Dr. Luis Gerardo de la Fraga
Computer Science Department
Cinvestav
México, D.F.

1. AC1: Automatic Control
Wednesday (15:30 - 16:30) Room 2
Session Chair: **Dr. Hugo Rodríguez Cortéz**

2. AC2: Automatic Control
Wednesday (16:50 - 17:50) Room 2
Session Chair: **Dr. Guillermo Obregón Pulido**

3. AC3: Automatic Control
Wednesday (17:50 - 18:50) Room 2
Session Chair: **Dr. Guillermo Obregón Pulido**

4. AC4: Automatic Control
Wednesday (15:30 - 16:30) Room 3
Session Chair: **Dr. Gerardo Silva Navarro**

5. AC5: Automatic Control
Thursday (14:00 - 15:00) Room 3
Session Chair: **Dr. Jorge Camas**

6. AC6: Automatic Control
Thursday (15:20 - 16:20) Room 2
Session Chair: **Dr. Nicolas Juarez**

7. AC7: Automatic Control
Thursday (15:20 - 16:20) Room 3
Session Chair: **Dr. Isaac Chairez**

8. AC8: Automatic Control
Thursday (16:40 - 17:40) Room 3
Session Chair: **Dr. Isaac Chairez**

9. AC9: Automatic Control
Friday (9:00 - 10:00) Room 2
Session Chair: **Dr. Alejandro Rodríguez Ángeles**

10. AC10: Automatic Control
Friday (12:40 - 14:00) Room 1
Session Chair: **Dr. Jorge Camas**

11. AC11: Automatic Control
Friday (12:40 - 14:00) Room 4
Session Chair: **Dr. Nicolas Juarez**

12. BIO1: Biomedical Engineering
Wednesday (16:50 - 17:50) Room 3
Session Chair: **Dr. Marco Pedro Ramírez Tachiquin**

13. BIO2: Biomedical Engineering
Wednesday (17:50 - 18:50) Room 3
Session Chair: **Dr. Marco Pedro Ramírez Tachiquin**

14. BIO3: Biomedical Engineering
Thursday (16:40 - 17:40) Room 1
Session Chair: **Dr. Marco Pedro Ramírez Tachiquin**

15. BIO4: Biomedical Engineering
Thursday (17:40 - 19:00) Room 1
Session Chair: **Dr. Marco Pedro Ramírez Tachiquin**

16. BIO5: Biomedical Engineering
Friday (12:40 - 14:00) Room 2
Session Chair: **Dr. Cristóbal Vargas**

17. COM1: Communications Systems
Thursday (16:40 - 19:00) Room 2
Session Chair: **Dr. Aldo Orozco Lugo**

18. COM2: Communications Systems
Friday (9:00 - 10:00) Room 1
Session Chair: **Dr. Giselle Galván Tejada**

19. CS1: Computer Science and Computer Engineering
Wednesday (15:30 - 16:30) Room 1
Session Chair: **Dr. Madain Pérez**

20. CS2: Computer Science and Computer Engineering
Wednesday (16:50 - 17:50) Room 1
Session Chair: **Dr. Esteban Tlelo Cuautle**

21. CS3: Computer Science and Computer Engineering
Wednesday (17:50 - 18:50) Room 1
Session Chair: **Dr. Esteban Tlelo Cuautle**

22. CS4: Computer Science and Computer Engineering
Thursday (14:00 - 15:00) Room 1
Session Chair: **Dr. Luis Gerardo de la Fraga**

23. CS5: Computer Science and Computer Engineering
Thursday (14:00 - 15:00) Room 2
Session Chair: **Dr. Raymundo Marcial Romero**

24. CS6: Computer Science and Computer Engineering
Thursday (15:20 - 16:20) Room 1
Session Chair: **Dr. Madain Pérez**

25. MEC1: Mechatronics
Wednesday (14:00 - 15:00) Room 4
Session Chair: **Dr. Nicolas Juárez**

26. MEC2: Mechatronics
Wednesday (15:20 - 16:20) Room 4
Session Chair: **Dr. Gerardo Silva Navarro**

27. MEC3: Mechatronics
Friday (12:40 - 14:00) Room 3
Session Chair: **Dr. Alejandro Rodríguez**

28. SSM1: Solid-State Materials, Electron Devices and integrated Circuits
Wednesday (15:30 - 16:30) Room 4
Session Chair: **Dr. Héctor Hernández de Léon**

29. ICD1: Solid-State Materials, Electron Devices and integrated Circuits
Wednesday (16:50 - 17:50) Room 4
Session Chair: **Dr. Alejandro Medina**

30. SSD1: Solid-State Materials, Electron Devices and integrated Circuits
Wednesday (17:50 - 18:50) Room 1
Session Chair: **Dr. Alejandro Medina**

31. SSD2: Solid-State Materials, Electron Devices and integrated Circuits
Thursday (17:40 - 19:00) Room 3
Session Chair: **Dr. Ruben Herrera Galicia**

32. SSM2: Solid-State Materials, Electron Devices and integrated Circuits
Thursday (16:40 - 17:40) Room 4
Session Chair: **Dr. M. Alfredo Reyes Barranca**

33. ICD2: Solid-State Materials, Electron Devices and integrated Circuits
Thursday (17:40 - 19:00) Room 4
Session Chair: **Dr. Mauricio Ortega López**

34. SSM3: Solid-State Materials, Electron Devices and integrated Circuits
Friday (9:00 - 10:00) Room 3
Session Chair: **Dr. Héctor Hernández de Léon**

35. SSM4: Solid-State Materials, Electron Devices and integrated Circuits
Friday (9:00 - 10:00) Room 4
Session Chair: **Dr. Rubén Herrera Galicia**

Keynote Speakers

PLE1: Prof. Dr. Christos G. Cassandras

Head, Division of Systems Engineering, and Professor of
Electrical and Computer Engineering
Center for Information and Systems Engineering (CISE)
Boston University, Brookline USA

Plenary talk: ***"Cooperative Control and Optimization in an Uncertain Asynchronous Wireless Networked World"***

PLE2: Profesor Dr. Stefano Cagnoni

Department of Computer Engineering of the University of Parma
Italy.

Plenary talk: ***"Evolutionary Computation applications beyond off–line optimization"***

PLE3: Profesor Dr. Christian Daul

CRAN-CNRS- Ingénierie pour la Santé
France.

Plenary talk: ***"From 2D cartography of hollow organs towards 3D cartography"***

PLE4: Profesor Dr. Romeo Ortega

Laboratoire de Signaux ET Systemes of Supelec in Gif-sur-Yvetteé
France.

Plenary talk: ***"Teoría de control: Una disciplina omnipresente"***

PLE5: Dr. Jorge Moises Murillo Natera

Deputy Manager of infrastructure of hydraulics and electrical projects
FONATUR
México.

Plenary talk: ***"Diseño e instalación de una central de generación fotovoltaica de 500 kW"***

PLE6: Profesor Dr. Aldo G. Orozco Lugo

Professor of Communications Section
Electrical Engineering Department
CINVESTAV-IPN
México

Plenary talk: ***"Multiple Packet Reception in Communication Networks: Empowering the MAC layer by Digital Signal Processing"***

Plenary Conferences Abstracts

Dr. Christos G. Cassandras

Head, Division of Systems Engineering, and
Professor of Electrical and Computer Engineering

Center for Information and Systems Engineering (CISE)
Boston University, Brookline, USA

Plenary talk: Cooperative control and optimization in an uncertain asynchronous wireless networked world.

September 8, 2010

Abstract:

Cooperative control arises when a system consists of multiple distributed components (e.g., nodes in a sensor network) that jointly function to meet a system-wide objective, often in an uncertain environment. It involves communication among components which is typically carried out asynchronously, wirelessly, and subject to limitations such as energy or physical constraints in the environment. We will discuss cooperative control and optimization problems that arise when sensor networks are deployed to meet objectives such as maximizing the detection probability of random events in a given region and tracking data sources (possibly mobile) when they are detected. We also address the broader question: How much communication is needed to achieve optimal cooperation? We show that event-driven, rather than synchronous, communication can guarantee convergence in cooperative distributed schemes while maintaining optimal performance. In dealing with uncertain environments, we will contrast a new “hedge-and-react” approach to traditional “estimate-and-plan” techniques, and apply it to stochastic multi-traveling-salesmen types of problems. The presentation will include interactive software demonstrations and applications to cooperative settings that involve teams of small wireless robots in a laboratory environment.

Dr. Stefano Cagnoni

Department of Computer Engineering of
the University of Parma
Italy.

Plenary talk: Evolutionary Computation applications beyond off–line optimization

September 8, 2010

Abstract:

Evolutionary Computation and other related bio-inspired population-based computational paradigms are mostly looked upon as 'a set of optimization techniques' inspired by natural evolution or other collective behaviors which can be observed in nature.

Although such a definition is fundamentally true, it is also strongly reductive, suggesting that these techniques are essentially off-line tools for finding the optimal settings for the parameters of the solution to some problem which, most often, has been previously hand-designed. Most applications of evolutionary computation techniques still use them, successfully, within this most direct and general, even if limited, application domain. However, more and more applications are being developed in which they play a much more central role, up to becoming the actual core of several algorithms which are used to solve complex problems, even with shortly-deferred when not actually real-time requirements.

A fundamental impulse to the expansion of the scope within which Evolutionary Computation techniques can find effective application is being given by the ever increasing availability of computation power, which has been recently further enhanced by the development of GPUs and friendly environments which allow them to be programmed in high-level languages.

The talk will provide examples of how Evolutionary Computation techniques are becoming more pervasive and central in real-world applications, mostly based on the research on the application of Evolutionary Computation techniques to image analysis problems being carried out at the IBIS (Intelligent Bio-Inspired System) Laboratory at the University of Parma.

Profesor Dr. Christian Daul

Institut National Polytechnique de Lorraine
CRAN-CNRS- Ingénierie pour la Santé
France.

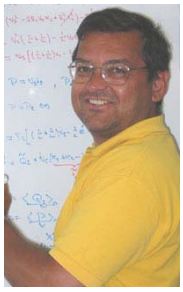
Plenary talk: "From 2D cartography of hollow organs towards 3D cartography"

September 9, 2010

Abstract:

Abstract—Endoscopy is a standard imaging modality commonly used in different medical fields like lesion diagnosis in hollow organs or mini-invasive surgery. Meanwhile, endoscopic data suffer from the fact that each image of a video-sequence only corresponds to a small 2D field of view. This paper presents a mosaicing algorithm leading to visually coherent large field of view maps. The ability of the algorithm to build 2D bladder maps is assessed with both phantom and patient data. This contribution describes also a 3D cartography method and gives preliminary surface reconstruction results on phantoms with bladder textures.

Index Terms—2D image mosaicing, 3D surface construction, 3D cartography, bladder, endoscopy



Dr. Romeo Ortega

Laboratoire de Signaux ET Systemes of
Supelec in Gif-sur-Yvette
France

Plenary talk: Teoría de control: Una disciplina omnipresente

September 9, 2010

Abstract:

En esta plática se destaca la omnipresencia de la teoría de control en los diferentes ámbitos de la sociedad contemporánea. Su campo de aplicación cubre dominios muy diversos, que van mas alla de las áreas de la ingeniería, como la biología, la medicina, la economía y las ciencias sociales. El rigor matemático que caracteriza a la disciplina es similar al de la física teórica, distinguiéndose de ella, así bien como de la física experimental, por su vocación aplicativa, que tiene consecuencias directas en la vida cotidiana de la sociedad. El propósito de esta plática es recordar algunas de las grandes paginas históricas de la teoría de control. También, identificando los retos contemporáneos, pretendemos motivar a las nuevas generaciones a contribuir al desarrollo de su fascinante historia.

Dr. Jorge Moises Murillo Natera

Deputy Manager of infrastructure of
hydraulics and electrical projects

FONATUR
México

Plenary talk: Diseño e instalación de una central de generación fotovoltaica de 500 kW

September 10, 2010

Abstract:

A description of the activities aimed to build the first 500 kW photovoltaic power plant in Mexico is shown in this work. This plant will be installed in the sustainable and integrally planned tourist resort called Teacapan located in the State of Sinaloa providing electricity to several public utilities owned by the developer such public lighting and waste water treatment plants through a scheme of power injection to the electrical local grid authorized by the both National Power Supplier (CFE) and the Regulatory Energy Agency (CRE) in Mexico.

En este trabajo se presenta una descripción de las actividades desarrolladas para la instalación de la primera central generadora fotovoltaica de 500 kW en México, la cual será construida en el desarrollo turístico denominado Teacapán y ubicado en el Estado de Sinaloa. El objetivo de dicha central será la de proveer de energía eléctrica a los diferentes servicios públicos proporcionados por el desarrollador tales como el alumbrado público y el tratamiento de aguas residuales a través del esquema de inyección a la red eléctrica local mediante medición bidireccional de la energía aportada previsto de forma oficial para estos casos por la Comisión Federal de Electricidad (C.F.E.) de México.

Dr. Aldo G. Orozco Lugo

Professor of Communications Section
Electrical Engineering Department

CINVESTAV-IPN
México

Plenary talk: Multiple Packet Reception in Communication Networks: Empowering the MAC layer by Digital Signal Processing

September 10, 2010

Abstract:

This plenary talk addresses the improvement bring in by digital signal processing to the medium access control (MAC) layer in random access communication networks. The throughput in this type of networks depends on the amount of packet collisions. In order to increase the throughput the number of collisions has to be either reduced or resolved. Several approaches have been proposed in the past to accomplish this goal. Traditionally, MAC techniques worked on the assumption that the intended receiver was only able to successfully detect one packet at a time and correct detection would fail whenever two or more packets are simultaneously received. This way, traditional collision resolution approaches focused on limiting the transmissions with the purpose of reducing the collisions. Thus, in the one or none random access channel (ONRAC), collisions can be resolved only when they are completely avoided. However, we can aspire to have more optimistic conditions than those imposed by the ONRAC. With this in mind, we could consider a random access network where the receivers are capable of separating the packets that collide by employing digital signal processing. In such a case, we say that the receivers possess the so-called multiple packet reception capability (MPR). Multiple packet reception is an emerging problem in digital communication networks and represents a very promising way to enhance the performance of the MAC layer. By allowing the receivers to resolve the collisions by separating multiple colliding packets, the ONRAC is effectively transformed into a one or many random access channel (OMRAC) which allows a significant increase in throughput. This presentation gives a broad overview of the state of the art in the field and exposes both the accomplishments and the open problems.

Courses

On September 6-7, 2010, we are organizing tutorial courses to be offered in the instalation of Hotel Holiday Inn-Crowne Plaza Tuxtla Gutiérrez, Chiapas. These courses are oriented to professionals and students of electrical and electronics engineering, Automatic Control or related areas. A maximum of 50 persons can attend each course.

You will have to reserve your place ahead of time. You must send an email with your data (Name, institution, institution address, institution Phone, email, course code).

Dr. Rogelio Lozano Leal

Research Center of Compiegne, France

Director of the joint France-Mexico research laboratory
UMI-LAFMIA

Tutorial: ***Control of Autonomous Aerial and Underwater Vehicles***

Abstract:

Autonomous exploration and navigation vehicles represent one of today's leading developing fields. The increasing interest is due to the vast domain of applications including surveillance, intervention in hazardous or inaccessible areas, rescue operations, detection of forest fires, just to mention a few.

In this talk we will focus on two different types of autonomous systems: small rotorcrafts and mini-submarines. We will present the modeling of UAVs (Unmanned Aerial Vehicles) and AUVs (Autonomous Underwater Vehicles) as well as the controller design and its application to real prototypes). The most common sensors used in these autonomous vehicles will be discussed. Special attention will be given to cameras as a very common technique to estimate the position of the vehicle with respect to land marks in the environment or to compute the translational speed through the use of optical flow. The techniques presented in this tutorial will be illustrated with application in experimental prototypes.

Dr. José Antonio Urbano Castelán

Electrical Engineering Department

Cinvestav, México

Tutorial: ***Sistemas Fotovoltaicos y Fototérmicos-Principios y Aplicaciones***

Abstract:

RESUMEN DEL TALLER FOTO-TÉRMICO.

El presente Taller muestra los resultados de dos prototipos de Estufas Solares, ambas de Concentración Solar del tipo reflectores planos segmentados y foco Semi-puntual. Se diseño como alternativa de cocción de alimentos, como el frijol y la tortilla de maíz base de la dieta Mexicana. Puede hornear pan, cuece carne ya que opera a 250 º C, sobre una olla de presión comercial de 8 litros. Otros beneficios son, la esterilización de instrumental médico, la eliminación de bacterias del agua etc. Tiene un bajo costo de operación por día de $ 3.30 pesos MN para 8 a 10 personas, un con costo aproximado de $ 0.36 pesos MN el KW-h (térmico), y de $ 1.30 USD el W-pico solar, para 5.2 horas pico de radiación solar directa, y 300 días de uso al año al considerar una vida útil de 30 años. La Estufa Urbana, puede desarrollar 500 Joule por hornilla, cuenta con una almacenamiento térmico de 4 a 5 días, ya que contiene un Termo Tanque para dotar a una vivienda sustentable del orden 7.5 kW-h/día de energía. Utiliza aceite reciclado proveniente de los grandes parque vehiculares de las metrópolis. Esta puede dar otros servicios como climatizar el hábitat sin emitir un solo gramo de CO_2 a la atmosfera, sin duda será la solución energética de las generaciones presentes y futuras. También se puede aplicar como calor de proceso a el sector de Comercios y Servicios así como al sector Industrial, Agro industrial y Pesquero, ya que opera dentro del rango de 150 °C a 300 °C.

RESUMEN DEL TALLER FOTO-VOLTÁICO.

El presenta Taller muestra un panorama de las Aplicaciones Solares Fotovoltaicas, que hoy día se tienen, ya que se utiliza en Radios teléfonos de auxilio, alumbrado, equipo de comunicaciones, señalamiento, bombeo de agua, protección catódica, alambradas electrificadas, autos eléctricos, centrales solares de concentración, etc. Con la nueva ley aprobada en el 2007, es posible conectarse a la Red Eléctrica Federal para generar electricidad en la modalidad de autoconsumo. Se explica el funcionamiento, los materiales, la forma de interconectase, sus parámetros y dimensionamiento. Se discuten los modelos matemáticos que la rigen, así como el comportamiento eléctrico a diferentes temperaturas. Da una visión global del estado del arte en este campo, desde las aplicaciones de baja potencia, hasta las centrales espaciales alimentadas con el sol. El efecto fotovoltaico es sin duda una de las formas más elegantes de trasformar la luz solar en electricidad, ya que no hay ruido, movimiento mecánico, ni desgaste del material semiconductor. Hoy día se integra a las fachadas de edificios dando origen a una nueva disciplina, la Arquitectura Fotovoltaica.

Dr. Luis Gerardo de la Fraga

Computer Science Department

Cinvestav, México

Tutorial: ***Seguridad en redes de Computadoras con GNU/LINUX***

Abstract:

Aprenderemos a realizar cortafuegos en el sistema GNU/Linux y a guardarlos en CDROM o en discos USB y arrancarlos desde allí. Como parte del curso revisaremos los fundamentos de las redes TCP/IP y como se configuran usando el sistema operativo GNU/Linux. Veremos como se configuran puertas y cortafuegos, como se crean zonas militarizadas (redes con direcciones IP privadas) y zonas desmilitarizadas con ellos. También se verá como funciona LDAP y su aplicación para autenticar usuarios en una red inalámbrica usando un cortafuegos con reglas dinámicas. Finalmente veremos como crear redes virtuales con las herramientas anteriores. Todas las soluciones presentadas estarán basadas en el sistema GNU/Linux en sistemas de desarrollo empotrados mínimos con el núcleo de GNU/Linux y BusyBox.

Abstract Book

1. AC1: Automatic Control

Wednesday (15:30 - 16:30) Room 2
Session Chair: Dr. Hugo Rodríguez Cortéz

1.1 Robust dissipative observer design for nonlinear systems

Marco Tulio Angulo, Institution: Department of Control Engineering and Robotics, UNAM, México.
Jaime Moreno, Institution: Institute of Engineering, Automation, UNAM, México.
Ricardo Lazaro, Institution: Faculty of Engineering, UNAM, México

A methodology for the design of optimal robust dissipative observers is introduced. The problem is formulated as the minimization of the effect of additive disturbances on the observation error. The mathcal {H}_infty and the minimal invariant ellipsoid are used as performance criteria. The design procedure is reduced to a finite-dimensional optimization problem subject to a matrix inequality constraint. A comparison example is presented to compare the performance under disturbances of the proposed design methodology with the original one.

1.2 Design of Variable Gain Super-Twisting Observer for Nonlinear Systems with Sampled Output

Ivan Salgado, Institution: Faculty of Engineering, National Autonomous University of México
Jaime Moreno, Institution: Engineering Institute, National Autonomous University of México
Leonid Fridman, Institution: Faculty of Engineering, National Autonomous University of México
Alexander Poznyak, Institution: Automatic Control Department. CINVESTAV - IPN
Isaac Chairez, Institution: Professional Interdisciplinary Unit of Biotechnology, National Politechnic Institute

Ost of state observers implemented in real systems are not able to measure the information continuously. The sliding observers are not an exception. Nevertheless, when state observers are used in numerical applications or even in real systems, one must implement a sampled based observer. This means that the output was obtained by means of a Analogical/Digital Converter. Using a zero order hold we can maintain the data until the next measure. In this form the output implemented in the algorithm is continuous. In this paper, a novel Lyapunov based design of a variable-gain super-twisting observer is proposed. That is, the correction terms varies during the time. This variable gain depends on the error trajectories and a known functions that is an upper bound for the disturbances that affect the system. The observer ensures finite time convergence into a boundary layer depending of the sampled period. This structure is applied in a simple pendulum model using several sample periods of time.

1.3 Fault Diagnosis for a Class of Nonlinear Systems by means of a Polynomial Observer

Juan Luis Mata Machuca, Institution: CINVESTAV-IPN
Rafael Martínez Guerra, Institution: CINVESTAV-IPN
Deyanira Hernández Sánchez, Institution: CINVESTAV-IPN

This paper deals about the problem of fault diagnosis of a class of nonlinear systems using the theory of state observers. In order to reconstruct the faults of the system, a polynomial observer is proposed, which includes in its structure correction terms of high order. The methodology consists of add to the original system the faults as new states, which increase the order of the observer. This scheme reconstructs simultaneously faults and state variables. In addition, as a comparative study, it has been designed an observer of reduced order. Both techniques are applied to fault diagnosis of a three-tank system.

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2. AC2: Automatic Control

Wednesday (16:50 - 17:50) Room 2
Session Chair: Dr. Guillermo Obregón Pulido

2.1 Low Cost Closed loop Identification of a DC Motor

Alberto Soria, Institution: CINVESTAV-IPN
Rubén Garrido, Institution: CINVESTAV-IPN
Antonio Concha, Institution: CINVESTAV-IPN

This paper presents the closed loop identification of a velocity controlled servomechanism using a low cost system based on a microcontroller. The low cost and simplicity of the system enables undergraduate students to build it; programming of the identification algorithm is not complicated because of the low complexity of the identification algorithm. The experimental prototype is built around a PIC microcontroller allowing a low cost implementation

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2.2 An Adaptive Control to Perform Tracking in DC to DC Power Converters

Guillermo Obregón Pulido, Institution: Universidad de Guadalajara
Emmanuel Nuño Ortega, Institution: Universidad de Guadalajara
Karina Castañeda, Institution: Universidad de Guadalajara

Adalberto De Gyves, Institution: Universidad de Guadalajara

In this paper we design a controller that solves the tracking problem for the boost and buck-boost converters. A stable nonlinear system is obtained that produces the necessary inputs in order to exactly track the inductor current reference.
This property is used to track a given reference signal for the capacitor voltage. We also present an study of the bounds that must be satisfied by the current reference in order to track the voltage reference f(t) = A+B sin(w t) in an approximate way.

2.3 A Robust Nonlinear Observer for Rigid Body Attitude Estimation

Heberto Madrigal Sastre, Institution: Facultad de Ciencias de la Electrónica, Benemérita Universidad Autónoma de Puebla
W. Fermín Guerrero Sánchez, Institution: Facultad de Ciencias Físico-Matemáticas, Benemérita Universidad Autónoma de Puebla
Benito Salmerón Quiroz, Institution: ESIME Azcapotzalco, IPN

This paper deals with the attitude estimation of a rigid body equipped with angular velocity sensors and reference vector sensors. A quaternion-based nonlinear observer is proposed in order to fuse all information sources and to obtain an accurate estimation of the attitude. It is shown that the observer error dynamics can break up into two passive subsystems connected in ``feedback". Then, this property is used to show that the error dynamics is Input-to-State Stable (ISS) when the measurement disturbance is seen as an input and the error state as the state. These results allow affirm that the observer is robust towards non ideal inertial sensors measurements.

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3. AC3: Automatic Control

Wednesday (17:50 - 18:50) Room 2
Session Chair: Dr. Guillermo Obregón Pulido

3.1 An Indirect Adaptive Neural Control of a Three Phase Induction Motor Velocity

Ieroham Barouh, Institution: CINVESTAV-IPN
Irving Pavel de la Cruz, Institution: CINVESTAV-IPN

The paper proposed a neural network solution to the indirect vector control of three phase induction motor including a real-time trained neural controller for the IM angular velocity which permitted the speed up reaction to the variable load. The basic equations and elements of the indirect field oriented control scheme are given. The control scheme is realized by one recurrent and two feedforward neural networks. The first one is learned in real-time by the dynamic BP method and the two FFNNs are learned off-line by the Levenberg-Marquardt algorithm with data taken by PI-control simulations. The final set up MSE of the LM algorithm is of the order of 10-10. The graphical results of modelling shows a better performance of the adaptive NN control system with respect to the PI controlled system realizing the same computational control scheme with variable load.

3.2 Adaptive Linearization for Nonlinear Systems Using Continuous Neural Networks

Marisol Escudero, Institution: UPIBI-IPN
Isaac Chairez, Institution: UPIBI-IPN
Alejandro García, Institution: CINVESTAV-IPN

The adaptive linearization of dynamic nonlinear systems remains as an open problem due to the complexities associated with the methods required to obtain the linearized sections. This problem is even more difficult if the system is uncertain, it means, if only partial or null information about the mathematical model of the system is available. This paper presents a proposal of an adaptive linearization method for uncertain nonlinear systems affected by additive perturbations by the Artificial Neural Networks approach. The stability of the identification error is formally boarded and proved by the second Lyapunov's method. Such suggested structure preserves some inherited structural properties that allows this method to behave as the original model as is exposed. A comparison of the developed algorithm with a similar structure without adaptable linear term is carried out, considering a genetic regulation mathematical model. The results of the simulation show that this proposal presents a superior performance as is observed in the trajectories of each identifier and by comparing the performance index of each one.

3.3 Improved DNN Identifier based on Takagi Sugeno Fuzzy Systems

Laura Viana, Institution: UPIBI-IPN
Isaac Chairez, Institution: UPIBI-IPN

Several non-linear systems show complex behaviors. For example, some of those plants present a high degree of oscillations througout the time. Adaptive algorithms used to approximate such difficult behaviors can show important deficiencies. The differential neural network is not an exception. Indeed, when just one neural network is applied to get an adequate approximation, the identification error could be not so close to zero. One possible suggestion to solve this problem is to define a set of neuronal networks that works together. The members of such set will work each one on well defined trajectories subspaces of the uncertain system. In this paper, it

is disscused how to combine the identification properties offered by the continuous neural network and the characteristic decision capabilites arised by fuzzy methods. The selection of which neural network is activated depends on decision achieved by a takagi-sugeno fuzzy system. The Chen circuit will be used to demostrate the superior performance achieved by the suggested class of mixed neural network and fuzzy system, usually so-called neuro-fuzzy system.

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4. AC4: Automatic Control

Wednesday (15:30 - 16:30) Room 3

Session Chair: Dr. Gerardo Silva Navarro

4.1 Quasi-Linear, parametrically excited van der Pol oscillator: free and forced

Olivia Mimila Prost, Institution: Automatic Control Department, CINVESTAV-IPN
Joaquin Collado, Institution: Automatic Control Department, CINVESTAV-IPN

The quasi-linear van der Pol oscillator subject to parametric excitation applied on its natural frequency is studied. The effect of this parametric excitation is analyzed, regular perturbation theory is used to determine the effect on the resulting frequency of oscillation; phase plane analysis and averaging method are both used to determine the effect on the amplitude of the solution. Considering an external signal, the results of the analysis are used to foresee the forcing strength required to suppress the natural frequency of the parametrically excited oscillator; as well as the forcing strength required by the parametrically excited oscillator to suppress the natural frequency of a second oscillator.

4.2 Synchronization of Chaotic Systems: A Real-Time Application to Colpitts Oscillator

Andrés Rodríguez Bollain, Institution: CINVESTAV-IPN
Juan Luis Mata Machuca, Institution: CINVESTAV-IPN
Rafael Martínez Guerra, Institution: CINVESTAV-IPN

In this paper we deal with the synchronization of the Colpitts oscillator. The synchronization problem for chaotic systems is treated as an observation problem, some results based on a differential algebraic approach are used in order to determine observability with the measurements from the system. The strategy consists of proposing a slave system (observer) which tends to follow asymptotically the Colpitts oscillator, refereed as master system. The methodology was tested in a real-time implementation by means of a reduced order observer.

4.3 Optimal Reduced-Order Synchronization of Chaotic Neuron Models with Unknown Parameters

Foroogh Motallebzadeh, Institution: Iran University of Science and Technology
Mohammad Reza Jahed Motlagh, Institution: Iran University of Science and Technology
Zahra Rahmani Cherati, Institution: Babol University of Technology

In this paper, reduced-order synchronization of uncertain chaotic neuron models with different orders is investigated. The identifier and controller modules are designed completely independently. A modified recursive least square algorithm is used to identify the unknown parameters of the slave system, and the control module is designed based on optimal control strategy. A performance index is introduced, and by minimizing a Hamiltonian function both deviation from the desired trajectory and the needed control signal are minimized. The HR neuron model and the cable model of cylindrical cell are considered as the master and slave systems, respectively. Simulation results confirm the effectiveness of the proposed method, even in the present of parameter variations.

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5. AC5: Automatic Control

Thursday (14:00 - 15:00) Room 3

Session Chair: Dr. Jorge Camas

5.1 Automatic Sun Tracking Solar Electric Systems for Applications on Transport

Pavel Vorobiev, Institution: Moscow State University of Railway Engineering
Yuri Vorobiev, Institution: CINVESTAV-IPN, Unidad Querétaro

Technical and economical aspects of application of solar electric systems in city transport are discussed, with the possible use of Sun tracking; the effect of the latter on the solar energy conversion efficiency is analyzed in application to stationary and moving platforms with photovoltaic solar panels. The option of using grid-connected solar panels is taken into account. An analysis made shows that introduction of the “green” systems discussed will have not only positive ecological impact, but it can also be economically justified.

5.2 An Experimental Validation of NICOLET B3 Mathematical Model for Lettuce Growth in the Southeast Region of Coahuila México by Dynamic Simulation

Antonio Juárez Maldonado, Institution: Universidad Autónoma Agraria Antonio Narro
Karim de Alba Romenus, Institution: Universidad Autónoma Agraria Antonio Narro

Marco Iván Ramírez Sosa Moran, Institution: Instituto Tecnológico y de Estudios Superiores de Monterrey Campus Saltillo
Adalberto Benavides Mendoza, Institution: Universidad Autónoma Agraria Antonio Narro
Valentín Robledo Torres, Institution: Universidad Autónoma Agraria Antonio Narro

An experiment was developed to validate the NICOLET B3 model. This model has two state variables: carbon content in the vacuoles and carbon content in the cell structure. Carbon dioxide, temperature and radiation taken inside a greenhouse were used as inputs to the model; the model gave out fresh and dry matter of lettuce aerial part. The model dynamic simulation was carried out using MatLab Simulink. A lettuce crop growth was developed under greenhouse conditions in soilless system, with a set of data loggers to record data. Results have shown that the data obtained from experiment are accurately predicted with this model.

5.3 Testbed for modeling and inventory regulation of dynamic supply chains

Alejandro Rodríguez Ángeles, Institution: CINVESTAV-IPN
Rogelio Guadarrama Mendoza, Institution: CINVESTAV-IPN
América Morales Díaz Institution: CINVESTAV-IPN

There exist several ways to model supply chain systems, from discrete models to stochastic ones. Among them there is a modeling approach based on traffic flow theory which considers inventory levels and material flows. The resulting models are linear, although they are subject to constraints such as maximum production rates, as well as non negative inventory values and material flows. These constraints must be taken into account when designing a control strategy. In previous works of the authors a bounded PI control for inventory level regulation was introduced. The closed loop system was therefore a non liner one, due to the control boundaries. A stability analysis of the closed loop system based on linearization techniques was performed resulting in sufficient conditions for local asymptotic stability. Besides the theoretical framework the work was supported by numerical simulations on a petrochemical plant. In this work a testbed platform form by water tanks is developed. The systems allows applying the proposed modeling and control techniques, such that the experimental results agree with the simulated ones.

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6. AC6: Automatic Control

Thursday (15:20 - 16:20) Room 2
Session Chair: Dr. Nicolas Juárez

6.1 Determination of Constraint Wrenches and Design of Parallel Mechanisms

Thanh Nguyen Minh, Institution: Department of Manufacturing Automation, Hochiminh City University of Transport, Vietnam
Victor Glazunov, Institution: Mechanical Engineering Research Institute, Russian Academy of Sciences, Russia
Vinh Lu Nhat, Institution: Department of Computer Science, University of Thudaumot, Vietnam

This paper addresses determination of constraint wrenches in singularities. The constraint wrenches imposed to the mobile platform by kinematic chains is proposed approach to rely on the theory of screws and influences of the criteria of singularity analysis to corresponding results for design of the parallel mechanisms. Further, using of the screw groups in order to determination of the singular zones of the multi-DOFs parallel mechanisms that make form of continuous areas is considered. Beside, automation of designing a parallel mechanism, which in purpose to achieve an increase their working volume, dexterity, and stiffness is developed. The method is used to propose optimal design of the parallel mechanisms based on the multi-criteria optimization obtaining the Pareto-optimal **.**

6.2 Data Fusion for Multiple Mechanical Fault Diagnosis in Induction Motors at Variable Operating Conditions

José Daniel Martínez Morales, Institution: CIEP-FI Universidad Autónoma de San Luis Potosí
Elvia Palacios, Institution: Facultad de Ciencias, Universidad Autónoma de San Luis Potosí
Daniel U. Campos-Delgado, Institution: Facultad de Ciencias, Universidad Autónoma de San Luis Potosí

In this paper, data fusion based on multi-class support vector machines (SVM) is presented to detect and isolate three mechanical faults in induction motors. First, we construct the feature vector by using signatures created from frequency-domain characteristics. These signatures are obtained from mechanical vibration and line currents measurements. Then, the feature vector is used to feed SVM's to classify different motor conditions (normal, misalignment, unbalanced and bearing fault). Different experiments using a three phase induction motor were performed under variable operational conditions (motor speeds and load torque scenarios) in order to acquire training and validation data. The identified optimal parameters of the SVM's are reported. The SVM's are studied with two types of kernel functions, the radial basis and the polynomial functions. Data acquisition, feature extraction
and SVM's computation were implemented by using LabView programming language. The experimental results show the effectiveness of the proposed approach in diagnosing the studied mechanical faults at different speeds and load

conditions. In these experimental tests, the worst-case accuracy of the proposed method was 97.1%.

6.3 Stable Visual Servoing of an Overactuated Planar Parallel Robot

Miguel Ángel Trujano Cabrera, Institution: Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional
Rubén Garrido Moctezuma, Institution: Centro de Investigacion y Estudios Avanzados del Instituto Politécnico Nacional
Alberto Soria López, Institution: Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional

This work presents an image-based visual servoing scheme applied to a class of overactuated planar parallel robots with revolute joints. The objective is to move the robot end-effector to a desired constant image position. A Proportional Derivative algorithm computes torques for the robot active joints. The Derivative and Proportional actions operate at the visual level. A linear filter allows obtaining velocity estimates from position measurements from a vision system. Lyapunov Stability theory allows concluding closed loop stability without invoking the LaSalle-Krassovsky invariance principle. Experiments on a laboratory prototype permit evaluating the performance of the closed loop system.

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7. AC7: Automatic Control

Thursday (15:20 - 16:20) Room 3
Session Chair: Dr. Isaac Chairez

7.1 Velocity Controller of a Wound Rotor Induction Generator via Block Control Linearization - Second Order Sliding Modes

Onofre Amador Morfin, Institution: Universidad Autónoma de Ciudad Juárez, Chihuahua
Alexander Loukianov, Institution: CINVESTAV, Unidad Guadalajara
Jose Manuel Canedo, Institution: CINVESTAV, Unidad Guadalajara
Manuel Iván Castellanos, Institution: Universidad Autónoma de Ciudad Juárez, Chihuahua

In this paper, a robust non-linear controller based on block control linearization combined with a second order sliding modes technique named super-twisting algorithm is proposed for controlling a wind power system. The control objectives consist on maximize the wind energy capture by the turbine and keep the stator power factor of a wound rotor induction generator in a set point value. The objective is achieved by controlling the rotor velocity and stator reactive power of the induction generator which is connected to an infinity bus and coupled with a wind turbine across a gear box. The performance of the designed controller is validated through simulations.

7.2 Sliding Mode Control for Antilock Brake System

Marcos Israel Galicia Cueva, Institution: Department of Automatic Control, CINVESTAV Unidad Guadalajara
Juan Diego Sánchez Torres, Institution: Department of Automatic Control, CINVESTAV Unidad Guadalajara
Alexander G. Loukianov, Institution: Department of Automatic Control, CINVESTAV Unidad Guadalajara
Jorge Rivera Domínguez, Institution: CUCEI - Universidad de Guadalajara

An Sliding Mode (SM) Block Control is proposed to control an Antilock Brake System (ABS). The control problem is to achieve reference tracking for the slip rate, such that, the friction between tyre and road surface is sufficiently good enough to control the car. The closed-loop system is robust against matched and unmatched perturbations. To show the performance of the proposed control strategy, a simulation study is carried on, where results predict a good behavior of the ABS under variations in the road friction.

7.3 Explicit Switching Times and Locations Detection for Linear Hybrid Systems

Rosalba Galván Guerra, Institution: Departamento de Control Automático, CINVESTAV
Juan Eduardo Velázquez Velázquez, Institution: Departamento de Ingeniería de Control y Automatización, ESIME-IPN
Vadim Azhmyakov, Institution: Departamento de Control Automático, CINVESTAV

This paper is concerned with the exact calculus of the switching times for linear time invariant hybrid systems. We study the systems behavior that incorporates dynamical switches from a current location to another and propose an explicit procedure for a constructive treatment of the switching times. An implementable computational method elaborated in this paper makes it possible to solve the multidimensional problem of switching times detections in an algorithmic form. In this sense, the above numerical procedure also determines the sequence of locations of the hybrid system. Finally, we apply the proposed constructive approach to two illustrative examples.

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8. AC8: Automatic Control

Thursday (16:40 - 17:40) Room 3
Session Chair: Dr. Isaac Chairez

8.1 Mixed finite element methods for identification distributed parameters

Zuliang Lu, Institution: College of Mathematics and Computer Sciences, Chongqing Three Gorges University

We study a priori error estimates of mixed finite element methods for identification distributed parameters.
The state and the co-state are discretized by the lowest order Raviart-Thomas mixed finite element spaces and the control is discretized by piecewise constant elements. We derive a priori error estimates for the coupled state and control approximation.

8.2 Robust Identification of Uncertain Schrödinger type Complex Partial Differential Equations

Rita Quetziquel Fuentes, Institution: CINVESTAV-IPN
Isaac Chairez, Institution: Professional Interdisciplinary Unit of Biotechnology-IPN
Alexander Poznyak, Institution: CINVESTAV-IPN
Tatiana Poznyak, Institution: ESIQIE-SEPI-IPN

Schrödinger equation is a well known example of the so-called complex partial differential equations (C-PDE). This paper presents a technique based in the differential Neural Networks (DNN) methodology, for the nonparametric identification of systems described by C-PDE. In this case, the DNN is proposed as two coupled DNN: the first one is used to approximate the real part of the complex valued equation and the second reproduces the imaginary part. Convergence of the identification is obtained by a modified Lyapunov function in infinite dimensional spaces. The adaptive laws for complex weights ensure the convergence of the DNN trajectories to the PDE complex-valued states. In order to investigate the qualitative behavior of the suggested technique, it is analyzed, as an example, the approximation of Schrödinger equation. The suggested no parametric identifier converges to the trajectories of the uncertain complex systems. This novel methodology that explores the application of the DNN method for the identification of complex PDE has shown its ability to produce a numerical model of an uncertain complex valued system.

8.3 Efficient Computation of Robust Positively Invariant Sets with Linear *State-feedback Gain as a Variable of Optimization*

Furqan Tahir, Institution: Degree Institution: Imperial College London Current Affiliation: COMSATS Institute of Information Technology

In this paper, we develop an algorithm for the efficient computation of Robust Positively Invariant sets for linear discrete-time systems subject to bounded additive disturbances and polytopic input constraints. The proposed algorithm simultaneously computes both the optimal invariant set and the corresponding state-feedback control law in one step by solving a single semidefinite program. Ellipsoidal as well as a polytopic characterization of the invariant sets is derived. In addition to the input constraints, the proposed method also allows for the incorporation of state constraints in a non-conservative manner. Furthermore, it is shown that for the case with a fixed control law, the proposed algorithm computes the optimal polytopic invariant set by solving a single Linear Program. The viability of the proposed scheme is demonstrated through numerical examples.

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9. AC9: Automatic Control

Friday (9:00 - 10:00) Room 2
Session Chair: Dr. Alejandro Rodríguez

9.1 Input-Output Linearization and Generalized PI Control of a Single-Phase Active Multilevel Rectifier

Adrián René Ramírez López, Institution: Centro de Investigación y Estudios de Posgrado, Facultad de Ingeniería, UASLP
Nancy Visairo Cruz, Institution: Centro de Investigación y Estudios de Posgrado, Facultad de Ingeniería, UASLP
Ciro Alberto Núñez Gutiérrez, Institution: Centro de Investigación y Estudios de Posgrado, Facultad de Ingeniería, UASLP
José de Jesús Lira Pérez, Institution: Centro de Investigación y Estudios de Posgrado, Facultad de Ingeniería, UASLP
Hebertt Sira Ramírez, Institution: Centro de Investigación y Estudios Avanzados del IPN

A two stages robust Generalized PI feedback controller for a single-phase active multilevel rectifier is proposed. The controller is based on the system modeled in the d-q synchronous reference frame. Based on input-output linearization theory a current controller that decouples the d-q components and compensates unknown perturbations is obtained. Performing a transformation of the system, stability of zero dynamics is verified. Due to the fact that the internal dynamics contains variables of interest; an external control loop by means of a Generalized PI controller connected in cascade with the current loop in the d-axis is designed to regulate its behavior and compensate an unknown load demand. This control scheme achieves fast regulation of the DC voltage without steady state errors, high power factor, low harmonic content and robustness in face of unknown perturbations. The presented control scheme is tested by simulations on a switched model.

9.2 Noise Behavior Improvement of Adaptive Control Systems with a Filtering Strategy

Fatemeh Pahlavanzadeh, Institution: student of Engineering Shahrood University of Technology
Heidar Tusian Shandiz, Institution: Faculty of Engineering Shahrood University of Technology

Hamid Khaloozadeh, Institution: Faculty of Engineering K.N.Toosi university of Technology

In many control designs, noise tolerance is an important goal because of the robustness property of the designed controller. In this paper, we propose a filtering strategy for the transient and specially noise behavior performance improvement of model reference adaptive control (MRAC) for continuous time single-input single-output (SISO) systems with linear time varying (LTV) plant parameters. The controller to be applied is linear periodic controller; In fact, we apply filtered signals to the plant and controller instead of initial signals. Simulation results are presented to indicate the improvement in performance that can be achieved.

9.3 Constraint Robust Stochastic Discrete-Time Tracking: Attractive Ellipsoids Technique

Hussain Alazki, Institution: Automatic Control, Centro de Investigación y de Estudios Avanzados del IPN
Alex Poznayak, Institution: Automatic Control, Centro de Investigación y de Estudios Avanzados del IPN

In this paper, we study the behavior of stochastic discrete-time models controlled by an output linear feedback during a tracking process in the case of a constraint on the control signal. The controlled system is assumed to be nonlinear satisfying the global "quasi-Lipschitz" condition and subjected to stochastic input and output disturbances. Two gain matrices (in a feedback and in an observer) define an ellipsoid in the tracking-error space where all system's trajectories arrive "with probability one". The selection of the "best" gain matrices is realized numerically by application of the Robust Attractive Ellipsoid Method (RAEM) with the Linear Matrix Inequality (LMI) technique application

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10. AC10: Automatic Control

Friday (12:40 - 14:00) Room 1
Session Chair: Dr. Jorge Camas

10.1 Combining Algebraic identification and a Least Squares Method for DC servomechanism identification

Rubén Garrido, Institution: Departamento de Control Automático CINVESTAV-IPN
Antonio Concha, Institution: Departamento de Control Automático CINVESTAV-IPN

This contribution presents a parameter identification method for estimating a four-parameter model of a DC servomechanism. The proposed approach uses a parametrization derived using the Operational Calculus and employed in some Algebraic Identification Methods recently proposed in the literature. The procedure for obtaining this parametrization eliminates the constant disturbances affecting the servomechanism and filters out the high frequency measurement noise. A standard continuous-time Least Squares algorithm uses this parametrization for identifying the servomechanism parameters thus circumventing the problem of singularities found on the Algebraic Identification Methods. Experimental results on a laboratory prototype allow comparing the results obtained using both, the Algebraic Identification and the proposed methods.

10.2 Reduced order dynamical model for supercapacitors

Aldo Romero-Becerril, Institution: Universidad Nacional Autónoma de México
Luis Alvarez-Icaza, Institution: Universidad Nacional Autónoma de México

A novel dynamical model for a single cell electric double-layer capacitor is proposed. The model was derived from a distributed-parameter electrochemical model, first reformulated and then approximated to reduce its order. Finite dimension approximations were obtained by applying finite differences, finite element and differential quadrature semidiscretization methods. The best approach was obtained with differential cuadrature and the final result is a linear time invariant dynamical model relating the input current and the output voltage in the supercapacitor. The model has physical meaning, high accuracy, low order and few parameters, is controllable, observable and well suited for control design, dynamical analysis and numerical implementation.

10.3 DSP Application of a Water-Leak Detection and Isolation Algorithm

Ofelia Begovich, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional. Unidad Guadalajara
Gerardo Valdovinos Villalobos, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional. Unidad Guadalajara

In this paper we present an application of a Digital Signal Processor (DSP) system to detect and isolate a water-leak. The programmed algorithm is based on a Sensitivity Model-Based Approach. The DSP system is tested on-line in a water pipeline prototype. The model used to design the algorithm to isolate the leak is obtained from a Preissmann Scheme. An adaptive estimation of the friction factor is incorporated to attain real-time isolation. Comments about the implementation are given. The estimation results of the leak size and leak position are presented.

10.4 Isolation of Two Non-concurrent Leaks in Water Pipelines

Alejandro Pizano Moreno, Institution: CINVESTAV-IPN, Unidad Guadalajara
Ofelia Begovich, Institution: CINVESTAV-IPN, Unidad Guadalajara

In the present work a well known algorithm to detect and isolate only one leak has been enhanced to achieve the isolation of two non-concurrent water leaks. This LDI algorithm uses measurements of flow rate and pressure head at the ends of the pipeline. In this work, the isolation of a second leak is achieved using a steady state relation between the estimated parameters of the first isolated leak and the parameters of an equivalent leak. The leaks can appear at any spatial order and can be isolated thanks to the use of a proposed logic rule. Finally, this scheme is tested using synthetic data obtained from a pipeline simulator.

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11. AC11: Automatic Control

Friday (12:40 - 14:00) Room 4
Session Chair: Dr. Nicolas Juárez

11.1 Adaptive synchronization of uncertain hyperchaotic Lorenz systems based on parameters identification

Saleh Sayyad Delshad, Institution: Electrical Engineering Department, Tarbiat Modares University, Tehran, Iran
Amirhossein Abolmasoumi, Institution: Electrical Engineering Department, Tarbiat Modares University, Tehran, Iran
Mohammadtaghi Hamidi Beheshti, Institution: Electrical Engineering Department, Tarbiat Modares University, Tehran, Iran

In this paper, adaptive synchronization of uncertain hyperchaotic Lorenz systems is investigated. Based on the Lyapunov stability theory, a novel nonlinear controller is designed and adaptive schemes are derived to guarantee the global asymptotical stability of the origin of considered system when the parameters of slave system are uncertain. Finally, numerical simulations are provided to show the effectiveness of proposed control design.

11.2 Generalized projective synchronization of the fractional-order hyperchaotic Lorenz systems via a vector transmitted signal

Saleh Sayyad Delshad, Institution: Tarbiat Modares University
Mohammadtaghi Hamidi Beheshti, Institution: Tarbiat Modares University

In this paper, based on the idea of nonlinear observer, a drive-response synchronization method with linear output error feedback is presented for generalized projective synchronization (GPS) of a class of fractional-order hyperchaotic systems via a vector transmitted signal. Through this, the approach arbitrarily scales a drive system attractor and hence a similar chaotic attractor of any desired scale can be realized with the help of a synchronizing scaling factor. Finally, numerical simulations are provided to show the effectiveness of proposed control design.

11.3 Economic Evaluation and State Time-delayed Feedback Chaos Control of Dynamic Supply Function Model in Power Market

Meng Zhang, Institution: Changsha University of Science and Technology
Hongming Yang, Institution: Changsha University of Science and Technology
Delun Yang, Institution: Changsha University of Science and Technology
Mingyong Lai, Institution: Hunan University
Yongxi Zhang, Institution: Changsha University of Science and Technology

The dynamic supply function model considering the decision-marking of market participants and transmission constrains of power network in power market is established. The different dynamic behaviors are analyzed, such as Nash equilibrium, period and chaos. With the average profit as the economic evaluation index, the economic performances of dynamic behaviors in the states of Nash equilibrium, period and chaos are analyzed and compared for three-node power market. Among them, the optimal performance appears in the state of Nash equilibrium. In view of the chaotic behaviors in power market, the state time-delayed feedback chaos control method is proposed. Finally, by means of the proposed control method, the chaotic state is controlled to the stable equilibrium point so that the economic performance of dynamic power market is effectively improved.

11.4 Adaptive Robust Synchronization of Chaotic Systems Using Particle

Masoud Jahromi Shirazi, Institution: School of Mechanical Engineering, Sharif University of Technology, Tehran, Iran
Ramin Vatankhah, Institution: School of Mechanical Engineering, Sharif University of Technology, Tehran, Iran
Mehrdad Boroushaki, Institution: Department of Energy, Sharif University of Technology, Tehran, Iran
Hassan Salarieh, Institution: School of Mechanical Engineering, Sharif University of Technology, Tehran, Iran
Aria Alasty, Institution: School of Mechanical Engineering, Sharif University of Technology, Tehran, Iran

In this paper, a robust control design strategy is introduced to synchronize two different chaotic

systems. The controller is based on particle swarm optimization (PSO). Particle swarm optimization is a well-known evolutionary optimization algorithm inspired by organism behavior of birds flocking and fish schooling. Our control approach is based on defining a suitable cost function in such a way that minimizing it guarantees the control of system. Due to the nature of PSO algorithm, the designed controller is strongly robust. It is shown that the proposed controller can overcome the parameter uncertainty without any extra information about the system. Comparison of proposed method with previous works is performed during simulations.

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12. BIO1: Biomedical Engineering

Wednesday (16:50 - 17:50) Room 3
Session Chair: Dr. Marco Pedro Ramírez Tachiquin

12.1 Mathematical modelling of arbovirus diseases

Cristóbal Vargas, Institution: Departamento de Control Automático, CINVESTAV-IPN
Lourdes Esteva, Institution: Facultad de Ciencias-UNAM
Gustavo Cruz Pacheco, Institution: IIMAS-UNAM

Arbovirus constitute a group of virus that are transmitted by arthropod's bites. Examples of diseases produced by these kind of virus are Dengue, Yellow Fever, and West Nile Virus, among others. These desases are a major health problem in the world.
In this work we study the dynamics of an infection produced by arbovirus. For this, we consider the population of host (humans, birds, mammals, etc.), and vectors (mosquitoes, ticks, etc.) The aim of this study is to understand and predict the formation of outbreaks from a a variety of initial conditions. Control measures of the mosquito population are discussed in terms of threshold conditions, which governs the existence and stability of the endemic equilibrium.

12.2 Algorithm for identification of motor unit action potentials based on wavelet transform and neural networks

Alejandro Pedro Márquez Lázaro, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional
Alfredo Ramírez García, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional
Roberto Muñoz Guerrero, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional

Nowadays, it is common to identify some neuromuscular disorders from the myoelectric signals (MES). Often, these disorders are reflected in the basic components of the MES, the motor unit action potentials (MUAP). This work presents an approach for the decomposition of intramuscular MES in its essential MUAPs, through analysis (wavelet transform) and classification (neural networks) tools. Decomposition aims to obtain the largest number of MUAP and its features.

The wavelet transform was used to identify the MUAPs; after, an artificial neural network was implemented as a first approach of classification; and finally, a second sorting was carried out through the firing rate. As a result, in a record were identified more than 100 MUAP and these were grouped into three classes with 2 subclasses each one. Finally firing rates and average errors for each group were obtained.

12.3 On the Computational Methods Employed in Two-Dimensional Electrical Impedance Tomography

Marco Pedro Ramírez Tachiquin, Institution: Escuela de Ingeniería de la Universidad La Salle
Cesar Marco Antonio Robles González, Institution: Escuela de Ingeniería de la Universidad La Salle
Rogelio Adrian Hernández Becerril, Institution: Escuela de Ingeniería de la Universidad La Salle

We analyze the State of Art in computational methods, employed for analyzing the two-dimensional Electrical Impedance Tomography problem (EIT). We broach an assortment of techniques that may be considered among the most important innovations on this area, emphasizing that the Finite Element Method has played a central role for solving the forward problem of the Electrical Impedance Equation, backbone of EIT. We finally study a novel numerical method, based onto the modern theory of Pseudoanalytic Functions, that could well improve the quality of the reconstructed images, when applied in lieu of the Finite Element Method.

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13. BIO2: Biomedical Engineering

Wednesday (17:50 - 18:50) Room 3
Session Chair: Dr. Marco Pedro Ramírez Tachiquin

13.1 Characterization of Ultrasound Images of HIFU-induced Lesions by Extraction of its Morphological Properties

Salomón Elieser Márquez Villalobos, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional.
Lorenzo Leija Salas, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional.
Arturo Vera Hernández, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional.

The purpose of this work is to compute several image processing techniques, applied to US images of HIFU-induced lesions, to characterize the shape, contour, position and the orientation of thermal lesions. In order to obtain real-time monitoring of HIFU treatment, a B-mode US imaging system and HIFU were synchronized. First, the HIFU sonication procedure consisted of applying an initial power of 10 W over an 8% BSA tissue-mimicking polyacrylamide gel until a hyperechoic spot appeared. Afterwards, the power was gradually increased up to 40 W for 4 min. The frame acquisition rate was set to 5 fps. Then, the region of interest (ROI) was manually selected and an image segmentation algorithm was implemented to isolate the thermal lesion based on different image pre-processing techniques and morphological operations. Thereafter, parameters such as area growing, the center of mass, eccentricity and the orientation of the equivalent ellipse were calculated to extract some morphological lesion features. This approach can be used as feedback system of the thermal lesion formation to determine more accurately the ablation zone.

13.2 Modeling the Acoustic Field of Physiotherapy Ultrasound Transducers using Non Uniform Acoustic Pressure Distributions

Mario Ibrahin Gutiérrez Velasco, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Electrical Engineering Department, section Bioelectronics
Lorenzo Leija Salas, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Electrical Engineering Department, section Bioelectronics
Arturo Vera Hernández, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Electrical Engineering Department, section Bioelectronics

In ultrasonic physiotherapy, the therapeutic effect is produced in the first 5 cm, into the Fresnel zone. Models are focused principally in the Fraunhofer zone which is too far from the therapeutic region. More realistic models are required to express the overlapping commonly produced near the transducer face. This paper presents the modeling of the acoustic field of physiotherapy ultrasonic transducers under non-uniform pressure distributions by using the finite element method. Theoretical approaches are compared with measurements to determine their accuracy. Although the non-uniform vibration models were presented years ago, their validation is still not complete. The results show the efficacy of modeling the real transducers under the free vibrating, simply supported and clamped conditions in relation to the overlapping in the Fresnel zone. In was concluded that the Fresnel zone is not correctly modeled with any of the approaches of this paper which were proposed in the literature.

13.3 Preparation of membranes of Poly (vynilidene fluoride) as temperature sensors via Electrospinning for biomedical applications

Carlos Omar González, Institution: CINVESTAV - IPN
Carlos Javier Rodríguez, Institution: CINVESTAV - IPN
Ernesto Suaste, Institution: CINVESTAV - IPN

Solution of poly(vinylidene flouride) PVDF in the mixed solvent of N, N- Dimethylformamide DMF was used to electrospin in order to obtain ultrafine fibers for biomedical use as temperature sensors. This membranes made of PVDF were characterized optically using a lab- made setups to determine its wavelength changes in a transmittance and reflection mode. A SEM was done in order to see the size of the fibers. The temperature sensors has a good performance in any human being (37oC), neonatal body (36.5 oC to 37.5 oC) and other bio-applications up to 80 oC.

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14. BIO3: Biomedical Engineering

Thursday (16:40 - 17:40) Room 1
Session Chair: Dr. Marco Pedro Ramírez Tachiquin

14.1 Measurement of breast - tumor phantom dielectric properties for microwave breast cancer treatment evaluation

Rocío Ortega Palacios, Institution: CINVESTAV-IPN
Lorenzo Leija, Institution: CINVESTAV-IPN
Arturo Vera, Institution: CINVESTAV-IPN
Mario Francisco Jesús Cepeda Institution: CINVESTAV-IPN

This article proposes a solid breast - tumor phantom for microwave breast cancer treatment evaluation. Dielectric property measurements were performed to analyze phantom according to tissue reported values. Dielectric constant and electrical conductivity were measured by using a Network Analyzer and Dielectric Probe Kit for both breast and tumor phantom. Measurements were carried out at frequency range from 2 GHz to 3 GHz because microwave operation frequency is usually 2.45 GHz, according to ISM. At 2.45 GHz breast phantom has an electrical conductivity of 0.1304±0.0680 S/m and a dielectric constant of 4.4401 ± 1.2514. At the same frequency, tumor phantom has an electrical conductivity of 2.7015 ± 0.0783 S/m and a dielectric constant of 55.2566 ± 1.1899.

14.2 Wireless Trans-corneal Stimulus for the Optical Nerve Based on Adaptive Modeling using Continuous Neural Networks

Mariel Alfaro, Institution: National Polytechnic Institute

Jorge Isaac Chairez, Institution: National Polytechnic Institute
Luis Niño de Rivera, Institution: National Polytechnic Institute

Retinal prosthesis design has become a hot field of researching around the world. Restoring partial vision to the blind patients that suffer from degenerative disease has become an important medical and scientific task. However, there are some doubts on how to propose the stimulation signals. The same question arises when the stimulation may be done by trans-corneal or transdermic pathways. One method that could be used is to apply a no-parametric algorithm to obtain a nonlinear model representing the relationship between the optical nerve response signal and the stimulus inputs. Then, it can be applied an inverse model methodology to identify the unknown inputs required to obtain the desired optical nerve response. In this study, we proposed an adaptive modeling based in continuous neural networks (CNN) to obtain an artificial model of the relationship between the optical nerve response and the selective stimulation. This model tries to determine the adequate stimulation signals that will be applied on the trans-corneal or transepidermic part of the eye. Indeed, the input signal effectiveness will be measured as the degree of accuracy obtaining the desired response in the optical nerve (ON). A set of CNN working as a parallel identifier provides the adaptive model of the aforementioned relation. An artificial optical nerve response was developed as well as the electrical stimulator for the trans-corneal area. These both designs were applied into the CNN identifier to test the methodology suggested in this paper. The numerical results demonstrate the accuracy achieved by the modeling algorithm

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14.3 Magnetic Excitation System (Without the electromagnetic component

Daniel Lorias Espinoza, Institution: I.T. Morelia/ CINVESTAV- IPN
David Elias Viñas, Institution: CINVESTAV-IPN Department of Electrical Engineering
Arturo Minor, Institution: CINVESTAV-IPN Department of Electrical Engineering
Juan Antonio Gutiérrez Necchie, Institution: I.T. Morelia
Victo Hugo Olivares Peregrino, Institution: I.T. Morelia

Various studies describe the magnetic excitation generated by coils, however the electromagnetic component is present when using this type of device. For this reason, the objective of this article is to present a system of magnetic excitation of low magnitude and variable frequency that does not include the electromagnetic component.

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15. BIO4: Biomedical Engineering

Thursday (17:40 - 19:00) Room 1
Session Chair: Dr. Marco Pedro Ramírez Tachiquin

15.1 Coaxial Antenna for Microwave Coagulation Therapy in Ex Vivo Swine Breast

Mario Francisco Jesús Cepeda Rubio, Institution: CINVESTAV-IPN
Arturo Vera Hernández, Institution: CINVESTAV-IPN
Lorenzo Leija Salas, Institution: CINVESTAV-IPN

Breast cancer is a major health problem and is the most common cancer in women in industrialized countries. In North America one in eight women will develop breast cancer during her lifetime. With the improvements in imaging techniques that have allowed the earlier detection of smaller breast cancers and the desire for improvements in cosmetic outcome, a number of minimally invasive techniques for the treatment of early stage breast cancers are being investigated. Ablative therapies, including laser ablation, focused ultrasound, microwave ablation, radiofrequency ablation, and cryoablation have been described [2]. Microwaves applied to the tissue produce dielectric heat by stimulation of the water molecules within the tissue and the cells. The rapid agitation of the water molecules results in frictional heating and thermo-induced coagulation necrosis. Thermal ablation of tissues has also been investigated with the use of focused microwaves. Microwave energy is an attractive strategy because of the specificity of the tissue ablation. Tissues with high water content, such as breast cancers, are heated and damaged more rapidly than those with lower water content, such as breast glandular and adipose tissues [3]. The MWA modeling using Finite Element Method (FEM) and several antenna designs are conducted in the liver tissue. The FEM model used in this study was adapted from a coaxial slot antenna general model, developed by COMSOL Multiphysics, for microwave cancer therapy. The purpose of this model is to compute the temperature field, radiation field and the specific absorption rate (SAR) in the breast tissue, when using a thin coaxial slot antenna used in microwave coagulation therapy. The temperature distribution in the tissue is computed using the bioheat equation. Nevertheless using this model, the power level versus ablation zone size and reflection coefficient was evaluated. To validate the performance of the COMSOL Multyphisics applicator model, a slot applicator was constructed and experimental validation in ex vivo swine breast is shown.

15.2 System for acquisition and analysis of multichannel electrogastrogram

Laura Ivonne Garay Jiménez, Institution: Unidad Profesional Interdisciplinaria de Ingeniería y Tecnologías Avanzadas.
Antonio Servin Mojica, Institution: Unidad Profesional Interdisciplinaria de Ingeniería y Tecnologías Avanzadas.
Miguel Ángel Mayen García, Institution: Unidad Profesional Interdisciplinaria de Ingeniería y Tecnologías Avanzadas.
Tania Jetzabel Contreras Uribe, Institution: Unidad Profesional Interdisciplinaria de Ingeniería y Tecnologías Avanzadas.

This paper presents the development of a system for recording and analysis of three electrogastrogram (EGG) signals and two monitor signals: respiration and body movement and its route along the stomach wall. The signals were recorded from three pairs of electrodes located on the external abdominal wall, filtered with a low pass filter with cut off frequency of 1 Hz and acquired with a sampled frequency of 10 Hz. This system obtains the pacemaker frequency from the power spectrum of the EGG signal and computes parameters associated with the pacemaker frequency such as percentages of bradygastria, taquigastria, arrhythmia and typical range during the recording time. The analysis is performed on-line and signals can be reanalyzed off-line. Because the system will be used for generating an EGG database for specific use, it was required a specific classification. All recordings contain a clinical and technical sheet in order to be useful in further processing. The system were characterized and validated with simulated and real signals presenting a friendly and easy use with good performance and it is compatible with Windows 2000/XP and Vista ® .

15.3 ECG Feature Extraction via Waveform Segmentation

Antonio Espíritu Santo Rincón, Institution: Tecnológico de Monterrey, Campus Estado de México
Cuauhtémoc Carbajal Fernández, Institution: Tecnológico de Monterrey, Campus Estado de México

The analysis of the ECG signal is widely used for detecting a variety of cardiac pathologies. Most of the clinically useful information embedded in the ECG is related to the duration and amplitude of its individual components. Producing algorithms for the automatic extraction of the ECG features is complicated due to the time-varying nature of the signal resulting of variable physiological conditions and the presence of noise. This paper presents an algorithm for detecting the individual components of the ECG signal. First the R wave is precisely detected using wavelets, and then the other ECG features are extracted using a waveform segmentation approach. The algorithm was tested on the QT Database.

15.4 Sequential Injection Analysis System for Electronic Tongues Modeling and Calibration Process

Rocío Berenice Domínguez Cruz, Institution: CINVESTAV
Roberto Muñoz Guerrero, Institution: CINVESTAV
Herlinda Araiza Lizarde, Institution: CINVESTAV

Electronic tongues (ET) are low cost instruments to real time liquid samples determination. There is a vast field of application for ET (i.e. chemical, pharmaceutical, food and environmental analysis). Main disadvantage of ET is the large amount of data implied in the modeling and calibration process. To overcome this disadvantage an automated Sequential Injection Analysis (SIA) system is implemented in this work. By aspirating and mixing sequentially reactive and solutions a lot of samples can be obtained in a fully automated way. Totally controlled by a virtual instrument (VI) developed in LabVIEW 2009, the SIA system was operated at flow rates from 8.89 ml/min to 10.12 ml/min with a maximum standard deviation of 4.03% (lower was 1.5%). After flow rate characterization process an automated dilution process was successfully tested with an ion selective electrode of Sodium. Concentration range from 0.0365μM to 0.04 M was tested. Both steady state and transient response were acquired by the system and log period operation was also obtained. Coupling the system with a sensor array and an appropriate math tool is the next step in order to obtain an ET.

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16. BIO5: Biomedical Engineering

Friday (12:40 - 14:00) Room 2
Session Chair: Dr. Cristobal Vargas

16.1 A Virtual Upper Limb Prosthesis as a Training System

José Antonio Barraza Madrigal, Institution: CINVESTAV
Alfredo Ramírez García, Institution: CINVESTAV
Roberto Muñoz Guerrero, Institution: CINVESTAV

A virtual reality system that improves to the functional adjustment between an amputee and an active prosthesis is described. It includes the development of a virtual prosthesis and a myoelectric interface integration. The main purpose of this work is to provide a training system as a previous stage, to subjects who need to use an upper limb myoelectric prosthesis, which will allow that the users control easily a real prosthesis, which will allow that the users control easily a real prosthesis, optimizing the adaptation process through virtual training.

16.2 Establishment of Electrical Equivalent Circuits from Electrochemical Impedance Spectroscopy Study of Corrosion Inhibition of Steel by Imidazolium Derived Ionic Liquids in Sulphuric Acidic Solution

Jonathán Boanerge Pérez Navarrete, Institution: Division of Basic Sciences, Universidad Autónoma Metropolitana, Unidad Iztapalapa (UAMI)

This paper describes the use of the Electrochemical Impedance Spectroscopy technique (EIS) in order to establish Electrical Equivalent Circuits to study the corrosion inhibition process of steel in 1.0 M H2SO4 solution at the open circuit potential (OCP). Two ionic liquids derived of Imidazolium with different alkyl chain long, known as Long Chain (LC) and Short Chain (SC), as corrosion inhibitor has been examined. The Nyquist diagrams consisted of a capacitive semicircle at high frequencies followed by a well-defined inductive loop at low frequency values. The impedance measurements were interpreted according to suitable equivalent circuits.

16.3 Image reconstruction FPGA prototype applied to a mini gamma camera

Griselda Saldaña González, Institution: Facultad de Ciencias Físico-Matemáticas BUAP
Uvaldo Reyes, Institution: Facultad de Ciencias Físico-Matemáticas BUAP
Humberto Salazar, Institution: Facultad de Ciencias Físico-Matemáticas BUAP

In this work a read out electronics prototype for reconstruction of two-dimensional images based on Field Programmable Gate Arrays (FPGAs) is presented. The front-end includes two main modules, the data acquisition electronics and a hardware architecture for data processing. The read out electronics consists mainly of a Resistive Chain, analog-to-digital converters and a FPGA Virtex IV of the Xilinx's family. This module reads the electrical signals produced by a position-sensitive photomultiplier tube (PS-PMT) coupled to a Cerium-doped Lutetium Yttrium Orthosilicate (LYSO) crystal. The hardware architecture takes the digitized signals produced by the acquisition module and processes them to determine the position of the interactions based on the Anger logic to form a planar image. The hardware architecture performs arithmetic operations, formats and stores the data in order to send them to the displaying stage. The resulting image represents a 2D histogram for the intensity distribution of the radioactivity. Both systems interact to operate at a clock frequency of 322 MHz reducing the processing time to reach real time performance. Using parallel techniques and an appropriate management of memory, the necessary logic to implement the system has been developed improving flexibility for adjustment to new requirements or new algorithms. The main contribution of this work consists on validating the use of a FPGA in the image processing stage in a nuclear medicine application, such as the Gamma Camera.

17. COM1: Communications Systems

Thursday (16:40 - 19:00) Room 2
Session Chair: Dr. Aldo Orozco Lugo

17.1 An UWB microstrip feeding quasi circular antenna

Edson Garduño Nolasco, Institution: Instituto Politécnico Nacional ESIME
Jorge Roberto Sosa Pedroza, Institution: Instituto Politécnico Nacional ESIME
Hildeberto Jardón Aguilar, Institution: Centro de Investigación y Estudios Avanzados del IPN

We present the analysis of a quasi circular planar antenna for UWB applications. Analysis includes comparison of coplanar and microstrip feeding. Evolution from the circular antenna requires modifications in the structure and ground plane to soften the edges obtaining improvements in the antenna parameters agreing with the theory proposed by John Kraus.
Evolution is performed for a circular antenna with a design frequency of 4.5 GHz with a bandwidth of approximately 20 GHz. The antenna feeding impedance is proposed as 50 ohms, built over a substrate of RF35-A 0.762 mm X 35 mm X 50 mm. The improvements obtained are reflected in the number of resonances of the antenna throughout the operating bandwidth

17.2 Air Substrate Patch and Monopole Antennas in Compact Array for MIMO Applications

María Susana Ruiz Palacios, Institution: University of Guadalajara
Martín Javier Martínez Silva, Institution: University of Guadalajara

Search for antennas to meet more complex requirements for new wireless technologies is a continuous industrial and academia activities. Two dual antennas in compact array for MIMO applications are presented in this paper. An air substrate patch antenna is used in combination with a quarter wavelength monopole, and with a small L monopole to form two compact arrays of antennas. These arrays offer pattern diversity and compactness because monopole antenna is located over the patch. Design procedure, simulation results and experimental data are presented for a central frequency of 2.4GHz.

17.3 Throughput Analysis for Multiple Packet Reception with Different Window Overlapping Lengths

Fernando Téllez Alcaraz, Institution: CINVESTAV, IPN. Department of Electrical Engineering
Aldo G. Orozco-Lugo, Institution: CINVESTAV, IPN. Department of Electrical Engineering
Mauricio Lara, Institution: CINVESTAV, IPN. Department of Electrical Engineering

We consider the case of a Mobile Ad-Hoc Network (MANET), with nodes that have multiple packet reception (MPR) capability This is done by segmenting the incoming signal in a series of time-overlapping windows, each to be processed by an algorithm that separates each transmitter signal, as suggested in other works We will focus on the effect of varying the overlapping length. In this paper we addressed the impact caused on the network throughput and on the relative computational complexity when the overlapping-length between consecutive analysis windows is varied, which has not been previously studied. We obtain theoretical expressions for both parameters in some cases and simulation results are presented in others.

17.4 Multiple Packet Reception Based on the Time-Varying Transmitted Power form of Implicit Training

Aldo G. Orozco-Lugo, Institution: CINVESTAV-IPN
Mauricio Lara, Institution: CINVESTAV-IPN
Desmond C. McLernon, Institution: University of Leeds
Lang Tong, Institution: Cornell University

We propose a new algorithm for the multipacket reception task. In our proposal, the transmitters change their output power in a symbol by symbol fashion. To achieve packet separation, we exploit the time-varying power variation of the sources. The separation solution is obtained in closed form and it is shown that perfect interference cancellation is asymptotically obtained under noiseless conditions. Furthermore, when noise is present, the method asymptotically approaches the optimum minimum mean square error solution. Simulations results are presented that corroborate the theory and illustrate the performance of the proposed approach for finite length data packets.

17.5 Multiple Packet Reception in Ad Hoc Networks Exploiting Differences in the Symbol Rates of Sources

Aldo G. Orozco-Lugo, Institution: CINVESTAV-IPN

A new approach for empowering ad hoc networks with multiple packet reception (MPR) capabilities is introduced in this paper. In multiuser communication networks, a common symbol (baud) rate (or chip rate in the case of CDMA) is normally employed for all the sources. We propose to alter the symbol rates of the sources in order to aid the receivers in the separation of colliding packets. The symbol rates of the transmitters in the network are thus selected from a predetermined set that contains the allowed transmission rates. These rates are slightly different from each other in order to make the system as bandwidth efficient as possible. The receivers separate the colliding packets by using an antenna array where the algorithm that specifies the weights of the spatial filter takes advantage of the distinct transmission rates.

18. COM2: Communications Systems

Friday (9:00 - 10:00) Room 1
Session Chair: Dra. Giselle Galván Tejada

18.1 WiMAX Urban Coverage Based on the Lee Model and the Deygout Diffraction Method

Giselle M Galván Tejada Institution: CINVESTAV-IPN

A study of WiMAX coverage prediction for an urban area at 3.5 GHz is presented in this paper. Provided that the area under analysis is the down town of Mexico City, the central idea is based on an implementation of the Deygout diffraction method on the Lee model. This model needs what is known as standard conditions, which are specified by Lee for the operational frequency band of the traditional mobile cellular systems, but not for fixed WiMAX. Thus, to overcome this lack of information, parameters of measurements carried out in cities of UK and their corresponding results for the 3.5 GHz band are taken into account, such that it is possible to constitute the standard conditions for the scenario considered. Simulation results are contrasted with measurements with an acceptable convergence, corroborating the feasibility to use the Lee-Deygout binomial for WiMAX coverage prediction in urban areas.

18.2 Performance Comparison between MADM Algorithms for Vertical Handoff in 4G networks

José Daniel Martínez-Morales, Institution: Centro de Investigación y Estudios de Posgrado - Facultad de Ingeniería - Universidad Autónoma de San Luis Potosí (UASLP)
Ulises Pineda-Rico, Institution: Facultad de Ciencias - Universidad Autónoma de San Luis Potosí (UASLP)
Enrique Stevens-Navarro, Institution: Facultad de Ciencias - Universidad Autónoma de San Luis Potosí (UASLP)

In a fourth generation (4G) wireless environment, the need for an user to be always best connected (ABC) anywhere at anytime leads to execute a

vertical handoff decision for guaranteeing service continuity and quality of service (QoS). Several strategies have been proposed in the literature for addressing this problem, being multiple attribute decision making (MADM) one of the most promising methods. A comparative analysis of these
methods including SAW, MEW, TOPSIS, ELECTRE, VIKOR, GRA, and WMC is illustrated with a numerical simulation, showing their performance for different applications such as: voice and data connections, in a 4G wireless system.

18.3 Coxian Distribution Modeling for the Generalized and Unified Teletraffic Analysis of Mobile Cellular Networks

Anum Leopoldo Enlil Corral Ruiz, Institution: CINVESTAV-IPN
Felipe Alejandro Cruz Pérez, Institution: CINVESTAV-IPN
Genaro Hernández Valdez, Institution: Universidad Autónoma Metropolitana Unidad Azcapotzalco

In this paper, the Coxian distribution model to characterize users' mobility (through cell dwell time) is proposed and its application for the teletraffic analysis of mobile cellular networks is presented. To the best authors' knowledge, Coxian distribution has not been previously considered in the literature to characterize users' mobility in cellular networks. The Coxian distribution includes as particular cases several relevant previously proposed models in the literature (i.e., hyper-exponential, Erlang, hypo-exponential, and hyper-Erlang). We demonstrate that, when the cell dwell time has a Coxian distribution, the residual cell dwell time can be represented by a Coxian model. More important, it is shown that the Coxian distribution assumption for the cell dwell time naturally leads to a joint representation of the cell dwell time and residual cell dwell time distributions by a Coxian distribution of the, so called, global cell dwell time. Consequently, our teletraffic model is made computationally tractable by keeping track in a single state variable all the calls (new and handed off) in a phase (of any stage) with both the same mean permanence time and order within the stages. Thus, the analytical model proposed in this paper provides a simple, general, unified, and versatile framework for the teletraffic analysis of mobile cellular networks.

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19. CS1: Computer Science and Computer Engineering

Wednesday (15:30 - 16:30) Room 1
Session Chair: Dr. Madain Pérez

19.1 Mutual Information and Intrinsic Dimensionality for Feature Selection

Wilfrido Gómez Flores, Institution: Information Technology Laboratory, CINVESTAV-IPN, Ciudad Victoria, México
Lorenzo Leija Salas, Institution: Department of Electrical Engineering, CINVESTAV-IPN, México City, México
Arturo Díaz Pérez, Institution: Information Technology Laboratory, CINVESTAV-IPN, Ciudad Victoria, México

In this article we proposed a feature selection method based on mutual information (MI) and intrinsic dimensionality (ID) estimators. First, MI ranks the normalized feature space in accordance to minimal-redundancy-maximal-relevance (mRMR) criterion. Next, ID estimates the minimum number of features to represent the observed properties of the data. Two techniques of ID were tested: principal component analysis (PCA) and maximum likelihood estimator (MLE). Support vector machine (SVM) was used to classify five medical datasets. Receiver operating characteristics (ROC) analysis evaluated the classification performance before and after feature selection. Results showed that MI and ID are effective techniques for feature selection to reduce the classification error

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19.2 Integrate and Fire Neurons and their Application In Pattern Recognition

Roberto A. Vázquez, Institution: Escuela de Ingenieria - Universidad La Salle
Aleister Cachon, Institution: Escuela de Ingenieria - Universidad La Salle

In this paper, it is shown how a Leaky Integrate and Fire (LIF) neuron can be applied to solve non-linear pattern recognition problems. Given a set of input patterns belonging to classes, each input pattern is transformed into an input signal, then the LIF neuron is stimulated during ms and finally the firing rate is computed. After adjusting the synaptic weights of the neuron model, we expect that input patterns belonging to the same class generate almost the same firing rate and input patterns belonging to different classes generate firing rates different enough to discriminate among the different classes. At last, a comparison between a feed-forward neural network and the LIF neuron is presented when applied to solve non-linear problems.

19.3 Fused Variational Analysis Technique for High-Resolution Reconstruction of Remote Sensing Imagery

José Tuxpan Vargas, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional
Stewart Rene Santos Arce, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional

In this study, we apply the robust error estimation theory as a basis to develop an appropriate procedure that performes the processing and enhancement of the remote sensing (RS) image contaminated by composite noise (additive and multiplicative) and degraded by the data acquisition system. The first reconstruction stage is performed using the Bayesian statistical estimators referred to as WCMAP { WCLS (Weighted Constrained Least Squares) and MAP (Maximum a Posteriori Probability) algorithms } which significantly increase the gain of image sharpness. Subsequently, we employ the isotropic diffusion and anisotropic diffusion methods for obtaining the optimal balance in reference to increasing the perceptual quality of RS images. The effectiveness of the proposed fused WCMAP method were evaluated through the comparative simulation of different RS image reconstructive techniques.

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20. CS2: Computer Science and Computer Engineering

Wednesday (16:50 - 17:50) Room 1
Session Chair: Dr. Esteban Tlelo Cuautle

20.1 Evaluation of Multimodal Medical Image Registration Based on Particle Filter

Isnardo Reducindo, Institution: Universidad Autónoma de San Luis Potosí, Facultad de Ciencias.
Edgar Román Arce-Santana, Institution: Universidad Autónoma de San Luis Potosí, Facultad de Ciencias.
Daniel Ulises Campos-Delgado, Institution: Universidad Autónoma de San Luis Potosí, Facultad de Ciencias.
Alfonso Alba, Institution: Universidad Autónoma de San Luis Potosí, Facultad de Ciencias.

This paper presents a performance evaluation of a new multimodal image registration algorithm which is based on Bayesian estimation theory, specifically on Particle Filters. The results point to an efficient, easy to implement and robust to noise algorithm. The registration method showed good performance when using partial data, and it was compared with an algorithm based on maximization of mutual information and a Hyperplanes optimization method. Finally, we showed that the algorithm may be parallelizable, so that it is possible to reduce the computation time for image registration.

20.2 Support Vector Candidates Pre Selection Strategy Based on Non Convex Hulls

Asdrúbal López Chau, Institution: CINVESTAV
Xiaoou Li, Institution: CINVESTAV
Wen Yu, Institution: CINVESTAV
Jair Cervantes, Institution: CINVESTAV

In this paper, we present an algorithm to speed up the training of SVM. The proposed algorithm is based on SV candidates selection strategy, exploiting the observation that typically from a set of elements with the same label, if there exist SV, then most of them are on the boundary of the set. We compute the non convex hull sets that envelop the elements with the same label, this sets have in general a few elements compared with the entire data set. To train the SVM we use only the non convex hulls sets, which improves the training time. According to the results, our algorithm gives good accuracy and the training time is reduced considerably (under certain run conditions), the proposed algorithm is suitable for datasets with small number of features yet

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20.3 On Implementation of a Practical Crypto-System in the Limited Access Model

René E. Henríquez García, Institution: CINVESTAV IPN
Iván Cabrera, Institution: CINVESTAV IPN
Debrup Chakraborty, Institution: CINVESTAV IPN

Most of the existing encryption schemes used for practical applications rely on un-proven assumptions. The limited access model proposed by Michael Rabin, describes a crypto-system which is provably unbreakable without any assumption on the computational power of an adversary. But this model makes assumption on the inaccessibility of a distributed source of randomness. In this paper we describe precisely an encryption scheme in the limited access model, which provides improvements over some previous attempts. We also describe the design of a physical random number generator required for the model. Also, we provide values for certain parameters involved in the scheme and argue about its security. Finally we provide some implementational details of a prototype which we implemented.

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21. CS3: Computer Science and Computer Engineering

Wednesday (17:50 - 18:50) Room 1
Session Chair: Dr. Esteban Tlelo Cuautle

21.1 A Novel Quantum Differential Evolutionary Algorithm for Non-permutation Flow Shop Scheduling Problems

Tianmin Zheng, Institution: SoftAgency Co., Ltd
Mitsuo Yamashiro, Institution: Department of Systems and Information Engineering, Ashikaga Institute of Technology.

This paper is the first to propose a novel quantum differential evolutionary algorithm (QDEA) based on the basic quantum-inspired evolutionary algorithm (QEA) for the non-permutation flow-shop

scheduling problem (NPFSP). In this QDEA, the quantum chromosomes are encoded by using the quantum rotating angle and a simple converting mechanism for determining job sequence is proposed for the representation of NPFSP firstly. Then we merge the advantages of differential operation, local search and QEA by adopting the differential operation to perform the updating of quantum gate and the local search to perform exploitation in the promising permutative-based solutions. We adopt this approach to minimize the makespan for NPFSP and make the simulation. The comparisons with other state-of-the-art approaches based on well-known benchmarks demonstrate the effectiveness of the proposed QDEA

21.2 Sensitivity Analysis in the Optimal Sizing of Analog Circuits by Evolutionary Algorithms

Ivick Guerra Gómez, Institution: INAOE
Esteban Tlelo Cuautle, Institution: INAOE
Luis Gerardo de la Fraga, Institution: CINVESTAV

The sensitivity analysis based on finite differences and Richardson approximation for the optimal sizing of analog circuits by applying the multi-objective evolutionary algorithm NSGA-II, is presented. The proposed sensitivity analysis approximation allows to calculate the partial derivatives of the circuit performance without an explicit equation. In this manner, both the optimization task and the sensitivity analysis are executed by linking HSPICE in order to compute the circuit performances.
The case of study is the optimal sizing of the voltage follower, for which it is shown the usefulness of applying the sensitivity analysis approach to identify the solutions that are not reliable, i.e. those degrading the circuit performances.

21.3 An Adaptive Multi-Heuristic Ant Colony System for Finding Optimal Elimination Orderings in Bayesian Networks

Xuchu Dong, Institution: Jilin University
Yonggang Zhang, Institution: Jilin University
Dianbo Cai, Institution: China Telecom Corporation Limited
Haihong Yu, Institution: Jilin University
Yuxin Ye, Institution: Jilin University

To find an optimal elimination ordering for Bayesian networks, a multi-heuristic-based ant colony system named MHC-HS-ACS is proposed. MHC-HS-ACS uses a set of heuristics to guide the ants to search solutions. The heuristic set can evolve with the searching procedure in an adaptive way. MHC-HS-ACS also utilizes a heuristic-based local search to accelerate its convergence. Computational experiments show that MHC-HS-ACS can find very high quality solutions.

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22. CS4: Computer Science and Computer Engineering

Thursday (14:00 - 15:00) Room 1
Session Chair: Dr. Luis Gerardo de la Fraga

22.1 On the Interplay of Generator and Archiver within Archive Based Multiobjective Evolutionary Algorithms

Xavier Esquivel, Institution: CINVESTAV
Oliver Schütze, Institution: CINVESTAV

In this work we deal with the design of archive based multi-objective evolutionary algorithms (MOEAs) for the numerical treatment of multi-objective optimization problems (MOPs). In particular, we design two generational operators—one mutation and one crossover operator— that are tailored to a class of archiving strategies and propose a new volutionary strategy that can be viewed as a variant of epsilon-MOEA, a well known archive based MOEA. Comparisons of the performance of the two algorithms on a class of benchmark functions indicate that this approach, namely to investigate the interplay of generator and archiver of a MOEA, is a promising step toward the design of fast and reliable algorithms for the numerical treatment of MOPs

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22.2 A Predictor Corrector Method for the Computation of Boundary Points of a Multi-Objective Optimization Problem

Oliver Schütze, Institution: CINVESTAV-IPN
Erick Ignacio Mejía Estrada, Institution: CINVESTAV-IPN

Recently, a gradient based method has been proposed which allows to steer a given candidate solution of a multi-objective optimization problem (MOP) $F : Q \subset \mathbb{R}^n \to \mathbb{R}^k$ in any direction $\alpha \in \mathbb{R}^k$ defined in objective space. Since in the context of optimization improvements are sought, α is typically a descent direction, and the resulting curve of improving solutions steers in case the objectives are bounded below toward a boundary solution, i.e., a point x^* whose image $F(x^*)$ is at the boundary of. $F(Q)$ **.** The efficient computation of such points is of particular interest both for descent methods (i.e., to find solutions of the MOP) or for methods that move along the solution set of a MOP. Here we present a predictor corrector algorithm for the computation of such points that increases the performance of the above mentioned steering method.

22.3 Optimized Infomax-ICA algorithm on FPGA Architecture for Blind Source Separation

Luz Noe Oliva Moreno, Institution: The Superior School of Computer Sciences, National Polytechnic Institute
Jesús de la Cruz Alejo, Institution: Tecnológico de Estudios Superiores de Ecatepec
Jose Antonio Moreno Cárdenas, Institution: Department of Electrical Engineering, CINVESTAV-IPN

This work presents a optimized Implementation on Field Programmable Gate Array (FPGA) Architecture for an Infomax algorithm based on Independent Component Analysis (ICA). We use this algorithm to solving Blind Source Separation (BSS) problems in real-time mixed signal processing in order to clean speech signals under noisy environments and to probe the potential of this kind of algorithms embedded in hardware architectures. The work shows a new digital architecture of neural network composed by two dimensional arrays, the output signals present successful results according to theorical analysis and achieving the signals separation.

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23. CS5: Computer Science and Computer Engineering

Thursday (14:00 - 15:00) Room 2
Session Chair: Dr. Raymundo Marcial Romero

23.1 A Mediator for Biospatial Information Systems

Renato Barrera, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
Abraham Alcántara González, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
Carlos Alegría Galicia, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
Carlos Ricardo Cruz Mendoza, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
Augusto Dobeslao Hernández López, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
David Esparza Bórquez, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
Luis Francisco Sanabra Serna, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México
José Luis Plata Ramírez, Institution: Centro de Ciencias Aplicadas y Desarrollo Tecnológico - Universidad Nacional Autónoma de México

This article describes a mediator system to enable access to those information systems at the National Autonomous University of Mexico that are related to Biodiversity and the Environment.

This system associates existing Geographic Information Systems as well as Standard Relational Databases in a federation,allows the contents of the individual Information Systems to be consulted by the user in a transparent way using a single query interface, and permits the exports of the systems' data in convenient open formats under a corresponding set of permissions. The current mediator implementation offers similar performance in spatial-join and non-spatial-join operations compared with a traditional data base management system.

23.2 Modeling methodology for NPC's using interpreted Petri Nets and feedback control

Alejandra Santoyo Sánchez, Institution: Universidad de Guadalajara Departamento de Computación
Miguel Ángel Pérez Martínez, Institution: Universidad de Guadalajara Departamento de Computación
Carlos Alberto De Jesús Velásquez, Institution: Intel Tecnología de México S.A. de C.V. Compatibility Validation
Luis Isidro Aguirre Salas, Institution: Universidad de Guadalajara Departamento de Ingeniería CUCSUR
María Victoria Álvarez Ureña, Institution: Universidad de Guadalajara Departamento de Ingeniería Industrial

In the context of video games design Artificial Intelligence (AI) a broad of techniques have been used to generate the behavior of Non-Players Characters (NPC's). In this document, is explored the use of Supervisory control in Discrete Event Systems for design the behavior of NPC's, where the interaction between them it is not blocking. The modeling tool used is Interpreted Petri Nets (IPN) which are an extension of Petri Nets (PN) allow to relate input signals and output signals for PN models

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23.3 A Numerical Study of Discrete Non-Linear Elastic Strings in Two Dimensions

Cristobal Vargas Jarillo, Institution: Department of Automatic Control. CINVESTAV-IPN
Germán González Santos, Institution: Department of Mathematics, ESFM-IPN

We propose a quasimolecular simulation of a non-linear elastic string by means of a molecular type approach. The discrete model is an array of masses connected by springs with nearest-neighbor interactions. The no linearity is introduced by the geometry of the problem.

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24. CS6: Computer Science and Computer Engineering

Thursday (15:20 - 16:20) Room 1
Session Chair: Dr. Madain Pérez

24.1 Characterization of Biosensors for the detection of pesticides using a Sequential Injection Analysis System

Diana Bueno Hernández, Institution: Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional

This paper presents a proposal for the implementation of biosensor's characterization process using a sequential injection analysis (SIA). Characterized biosensors were used for detection of organophosphate pesticides. Initially, sensors were tests with traditional manual techniques, after that an automated probe was made with the same sensors. Different flow rates generated by the SIA system were tested. A satisfactory behavior was obtained at flow rates of 13.3µl/s and 33.3µl/s, with an operating time of 8 minutes and 4 minutes respectively. This results show the feasibility of a full automated characterization process to improve not only the time but also allow the possibility of working with more than one sensor at a time.

24.2 Better Crop Management with Decision Support Systems Based on Wireless Sensor Networks

Rolando Arturo Cárdenas Tamayo, Institution: Centro de Investigación Científica y de Educación Superior de Ensenada
María Guadalupe Lugo Ibarra, 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

The agricultural sector constitutes one of the most important sources of income and production worldwide; its activities are directly related to issues such as water availability, soil conservation, pests and diseases. Therefore, it is important to have adequate control of environmental parameters and make efficient use of the resources through the implementation of constant monitoring systems. The environments of crops are highly dynamic; therefore systems that support the decision-taking process constitute a very valuable tool. We conducted the design and implementation of a decision-support system for monitoring crops using technologies such as wireless sensor networks. The prototype implemented includes tools that provide real-time information about the crop status, surrounding environment and potential risks such as pests and diseases. Moreover, we carried out an experimental evaluation based on the technology acceptance model (TAM) using the prototype with a group of potential users, as well as an evaluation of a predictive model for pests and diseases. This allowed us to gather their perception about usefulness, ease and intention of use, as well as the scope of the predictive model and its reliability. We believe that our proposal has the potential to reduce costs and using precise information, improve the management of resources for crop production.

24.3 A Scalable Intelligent Room Based on Wireless Sensor Networks and RFIDs

Iván Cabrera Altamirano, Institution: CINVESTAV-IPN
Francisco Rodríguez Henríquez, Institution: CINVESTAV-IPN

We present the analysis, design and implementation of an intelligent classroom whose two main components are realized using two emergent wireless technologies, namely, wireless sensor networks and Radio-frequency identification (RFID) tags. The combination of these two technologies produces a powerful and versatile solution that can offer automated access control to a classroom as well as the monitoring of relevant environment variables such as temperature,humidity and room lighting. We claim that our architecture is readily scalable to a set of interconnected classrooms, by means of a routing protocol especially designed for achieving a multi-hop communication network.

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25. MEC1: Mechatronics

Thursday (14:00 – 15:00) Room 4
Session Chair: Dr. Nicolas Juárez

25.1 Active Unbalance Control in a Two Disks Rotor System Using Lateral Force Actuators

Manuel Arias Montiel, Institution: CINVESTAV-IPN
Gerardo Silva Navarro, Institution: CINVESTAV-IPN

This work deals with the problem of modelling and analysis in rotordynamics as well as the active control of vibrations caused by unbalance in a rotor system. The system model was obtained by Finite Element Method taking into account the gyroscopic effects. The finite element model is used to get the Campbell diagram, the critical speeds, the modal shapes and to design the control scheme to attenuate the vibrations amplitude by an active suspension which uses linear electromechanical actuators. Due to the great number of states involved in the model, a state observer is necessary in order to apply a Linear Quadratic Regulator with full state feedback. The controller is applied considering the dynamics of actuators in the active suspension. Some numerical simulations to verify the controller-observer performance and experimental results on a novel test rig to prove the closed loop behavior are presented.

25.2 Suppression of Mechanical Vibrations in a Building Like Structure by Means of a Piezoelectric Patch Actuator an Positive Acceler

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

This paper is about suppression of mechanical vibrations in a building like mechanical structure. The suppression is achieved by the use of a piezoelectric patch in the base of the structure. The overall system is modeled using finite element analysis and validated using modal analysis. The control law used to properly attenuate mechanical vibrations is a positive acceleration feedback. The whole data acquisition task and control law calculation are done in a personal computer using National Instruments hardware and software. Some results in numerical simulations as well as in experimental tests are presented

25.3 Control of a Rigid-Flexible Two-link Robot using Passivity-based and Strain-feedback approaches

Juan Fernando Peza Solís, Institution: Centro de Investigación y de Estudios Avanzados del IPN
Gerardo Silva Navarro, Institution: Centro de Investigación y de Estudios Avanzados del IPN
Rafael Castro Linares Institution: Centro de Investigación y de Estudios Avanzados del IPN

In the present work, the modeling of a rigid-flexible two link robot via the Euler-Lagrange formalism, is outlined. The flexible-link is considered to be an Euler-Bernoulli beam with a mass attached at its free end simulating a payload. Two control schemes which are known to yield acceptable results for single flexible-link robots are extended and applied to achieve regulation for the joints of the system and for the tip of the flexible-link. These control schemes are the so-called Passivity-based velocity feedback and Strain-feedback schemes. Finally, some simulation results are presented for both control schemes in which it can be seen that the system has a better performance when the Strain-feedback control scheme is used.

26. MEC2: Mechatronics

Thursday (15:20 – 16:20) Room 4
Session Chair: Dr. Gerardo Silva Navarro

26.1 Mechanical Energy Optimization in Trajectory Planning for Six DOF Robot Manipulators Based on Eighth-Degree Polynomial Functions and a Genetic Algorithm

Waldemar Perez Bailon, Institution: Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, México.
Edmundo Barrera Cardiel, Institution: Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, México.
Ignacio Juárez Campos, Institution: Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, México.
Antonio Ramos Paz, Institution: Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, México.

Optimal trajectory planning for robot manipulators is a very important issue in the research field of robotics. Many applications require smooth trajectories and the minimization of a performance index, usually the traveling time or the mechanical energy of the actuators. This paper presents a novel algorithm that uses eighth-degree polynomial functions to generate smooth trajectories for the parametric representation of a given path. The optimization algorithm presented in this paper minimizes the mechanical energy consumed in the robot manipulator. To solve the optimization model, a genetic algorithm is implemented. A software platform has been developed to test this optimal trajectory-planning algorithm. The software includes modules to solve the direct kinematics, the inverse kinematics, and the dynamics of the robot manipulator.

26.2 Approximate Slipping Effects Analysis and Compensation on a Biped Robot

José Alejandro Vázquez Santacruz, Institution: Centro de Investigación y de Estudios Avanzados del IPN
Martín Velasco Villa, Institution: Centro de Investigación y de Estudios Avanzados del IPN

This work is focused on the slipping effects analysis and the model based control of a class of biped robots over a complete walking cycle restricted to the sagittal plane. It is known that the effect of the impact of the swing leg with the walking surface produces a change in the articular velocities that forces a change on the initial conditions for the new step. Based on a simplification of the dynamic model of the system, in this work, we establish theoretical conditions to prevent or compensate possible undesirable slipping conditions on the single or double support phase. For doing this, it is considered a modification of the posture of the robot via the modification of the reference trajectories.

26.3 Trajectory-Tracking Control of an Input Delayed Omnidirectional Mobile Robot

Carlos López Uribe, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional
Hebertt Sira Ramírez, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional

Martín Velasco Villa, Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional

This article describes the design of a linear observer-linear controller-based robust output feedback scheme for output reference trajectory tracking tasks in an input delayed omnidirectional mobile robot. The unknown, possibly state-dependent,additive nonlinearity influencing the tracking error dynamics, is modeled as an absolutely uniformly bounded, additive unknown "time-varying disturbance" input signal. This procedure simplifies the system tracking error description to that of three independent chains of second order integrators with, known, position-dependent control input gain matrix, while additively being perturbed by the unknown, smooth, time-varying signal.
A GPI observer is the basis of a suitable perturbation prediction scheme, aimed at perturbation cancelation in the forward system, which allows to reduce the nonlinear delayed input control problem to that of a weakly perturbed linear delayed system. The approximate cancelation of the perturbation input facilitates the use of the classical Smith Predictor Compensator in the resulting dominantly linear problem. The results are implemented on a laboratory prototype.

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27. MEC3: Mechatronics

Friday (12:40 – 14:00) Room 3

Session Chair: Alejandro Rodríguez

27.1 Vibration Absorption in a Rotor-Bearing System Using a Cantilever Beam Absorber

Cabrera Amado Álvaro, Institution: Centro de investigación y de Estudios Avanzados del I.P.N.
Arias Montiel Manuel, Institution: Centro de investigación y de Estudios Avanzados del I.P.N.
Silva Navarro Gerardo, Institution: Centro de investigación y de Estudios Avanzados del I.P.N.

This work treats the problem of vibration control in a rotor-bearing system using a passive absorber with controllable stiffness. The primary system consists in a rotor systemmounted on two supports at its ends, one of them is a classical journal bearing and the other one is a bearing on a slider which can be displaced in order to change the distance between supports. The passive absorber is a concentrated mass mounted at the end of a cantilever beam which is an extension of the flexible shaft of the rotor system. The vibration attenuation in the rotor system is achieved modifying the system dynamics by the displacement of the slider bearing which causes changes in the absorber and primary system stiffness and as a consequence in their natural frequencies. The rotor-bearing system with the passive absorber is modeled using Finite Element Methods (FEM). To control the slider bearing position a PD control scheme is used, which is parameterized in terms of the spin speed of rotor. The vibration control scheme proposed is validated by numerical results, obtaining reductions up to 84% in the unbalance response of the primary system in relation with the open loop operation.

27.2 Algebraic identification and control of an uncertain DC motor using the Delta Operator Approach

Alberto Luviano Juárez, Institution: CINVESTAV Electrical Engineering Department. Mechatronics Section.
John Alexander Cortes Romero, Institution: Universidad Nacional de Colombia. Faculty of Engineering, Electrical Engineering Department.
Hebertt Sira Ramírez, Institution: CINVESTAV Electrical Engineering Department. Mechatronics Section.

An algebraic parameter identification method for, high rate, sampled linear systems is proposed for the output feedback control of a completely unknown DC motor. The parameter estimation method is based on the algebraic methodology (introduced by Fliess and Sira-Ramirez) for continuous time systems. In this article, we adapt the algebraic parameter identification methodology so that it takes into account sampling effects. We apply the algebraic identification method within the delta operator framework developed by Middleton and Goodwin. Delta operators constitute an effective alternative, over the Z-transform, for working with fast sampled systems. One of its advantages ensures a smooth transition between a continuous and a high sampled discrete sampled system. We use a delta operator-based algebraic identification scheme for the construction of the involved linear regressor in combination with a special invariant filtering to improve the identifier against additive noise effects. Our invariant filtering coincides with the least squares solution of the linear regressor equation. A delta-operator based output feedback controller of the Generalized Proportional Integral (GPI) type is also proposed for the solution of the output trajectory tracking problem, for the DC-motor, as a certainty equivalence controller. The fast identification of all system parameters is used in the certainty equivalent feedback control law design. Some experimental results are presented which validate the effectiveness of the proposed approach.

27.3 Dynamic Stiffness Control and Acceleration Scheduling for Unbalance Compensation in a Rotor-Bearing System: Experimental Results

Flavio López Medina, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Departamento de Ingeniería Eléctrica - Sección de Mecatrónica
Gerardo Silva-Navarro, Institution: Centro de Investigación y de Estudios Avanzados del I.P.N. Departamento de Ingeniería Eléctrica - Sección de Mecatrónica

This work deals with the application of an active unbalance compensation scheme for a rotor-bearing system by simultaneously using two control strategies, consisting in the synthesis of a dynamic stiffness controller and the acceleration scheduling for the rotor speed. The rotor-bearing system consists of an asymmetrical Jeffcott-like rotor system with a servomechanism to position a sliding bearing support such that the rotor lateral dynamics can be modified by controlling the effective rotor length and, as a consequence, the natural frequencies can be arbitrarily shifted into a small range, where the resonance can be passed and highly attenuated during typical run-up or coast-down operations. The system is modeled by a 4-DOF nonlinear system dynamics, with neglected gyroscopic terms, and two indirect control inputs, that is, the translational force applied to the sliding bearing and the torque in the rotor speed dynamics. The dynamic stiffness control is then performed by adding a servomechanism based on a cd motor and a ball-screw to locate in proper positions the movable bearing support, by applying a fast and robust PD feedback control scheme, which is also parameterized and monitored in terms of the actual rotor speed. In addition, the rotor speed dynamics is controlled in such a way to asymptotically track a smooth speed profile, computed by means of Bézier polynomials, which can be manipulated to reduce the overall unbalance response when the rotor is forced to pass over the first critical speed. In summary, the overall unbalance response in the rotor-bearing system can be reduced up to 40% with respect to the open-loop response, which is validated with numerical and experimental results for a small physical platform designed and constructed for this purpose. The setup consists of a steel shaft between a rigid support and the movable support is controlled with a servomotor, ball-bearing, optical encoder and a PD control scheme. The unbalance response is measured with two noncontact sensors and the rotor speed is controlled by a PID driver. Moreover, the unbalance control scheme is integrated into a PC with an I/O acquisition card and a Matlab/Simulink flexible platform.

27.4 User wearable interface based on inertial sensors for unilateral master-slave robot teleoperation

Alejandro Rodríguez Angeles, Institution: CINVESTAV-IPN
Juan Luis Guzmán Gutiérrez, Institution: CINVESTAV-IPN
Carlos Cruz-Villar, Institution: CINVESTAV-IPN

In this work an interface based on inertial sensors with applications for unilateral master - slave robotic teleoperation is developed. In such tasks the interface with which the user interacts plays a key role. In general the interface should be confortable and to allow free user motion. The interface here proposed is composed of two portable inertial sensor units which are placed on the upper and lower arm to obtain acceleration and turning rates. The data is internally processed by a DSP in the sensors which yield real time orientation measurements of the bodies they are attached. Then the 3D wrist human Cartesian trajectory is determined by using kinematic models of the human arm, this trajectory becomes the desired trajectory to the slave robot.
Finally by means of a control technique the slave robot is capable to track wrist human movements. For validation purposes a master - slave teleoperation system is implemented with a three degree of freedom (dof) delta configuration parallel robot as slave system.

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28. SSM1: Solid-State Materials, Electron Devices and integrated Circuits

Wednesday (15:30 – 16:30) Room 4
Session Chair: Dr. Héctor Hernández de Léon

28.1 Chemical Bath Method for ZnS Thin Films Preparation

Andrés Iván Oliva Arias, Institution: CINVESTAV IPN Unidad Mérida
Irving González Chan, Institution: CINVESTAV IPN Unidad Mérida
Víctor Rejón Moo, Joel Rojas, Institution: CINVESTAV IPN Unidad Mérida
Rodrigo Tarkus Patiño Díaz, Institution: CINVESTAV IPN Unidad Mérida
Daniel Aguilar Treviño Institution: CINVESTAV IPN Unidad Mérida

We report a chemical bath method to prepare ZnS thin films on glass substrates for solar applications. The proposed method is based on the experience to deposit CdS thin films by chemical bath but replacing some chemical reagents. The bath is composed of zinc chloride, potassium hydroxide, ammonium nitrate, and thiourea. During films deposition, the chemical bath is agitated with a magnetic stirrer; meanwhile its temperature is maintained at 90 ºC. The critical parameter of the bath for obtaining high quality films is the pH, with 11.5 as initial value. Obtained ZnS films were optically transparent with band gap energies values between 3.5-3.7 eV. Zn:S (1.0:1.2)

stoichiometry ratio of films was measured by energy dispersive spectroscopy (EDS). By x-ray diffraction analysis, a sphalerite-type cubic structure with a (111) as main diffraction peak were found in films. Subsequent annealing process of the ZnS films at 200 ºC and 400 ºC in Argon atmosphere maintains the films crystalline structure and diminishes their optical band gap energy value

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28.2 Heat Capacity Determination of Metallic Thin Films Using Temperature Profiles at Room Conditions: Theory

Jesús Manuel Lugo Quintal, Institution: Centro de Investigación y de Estudios Avanzados del IPN Unidad Mérida
Andrés Iván Oliva Arias, Institution: Centro de Investigación y de Estudios Avanzados del IPN Unidad Mérida
Héctor Gerardo Riveros Rotge, Institution: Centro de Investigación y de Estudios Avanzados del IPN Unidad Mérida
Oscar Gervacio Ceh Soberanis Institution: Centro de Investigación y de Estudios Avanzados del IPN Unidad Mérida

An analytical model for heat capacity determination based on energy conservation to obtain the heating/cooling temperature profiles of a film-substrate system is discussed. The proposed model integrates the heat transfer by convection and radiation on films to obtain the temperature profiles such that thermal properties can be obtained from these profiles at room conditions. We demonstrated that the resulting time constants of the analysis are the key parameters to obtain experimentally some thermal properties of the film/substrate system. The methodology and the theoretical results to estimate the heat capacity of gold (100 nm) on Kapton (0.125 mm) and on glass (0.5 mm) substrates are analyzed and reported. Simulations with experimental results reported for copper films by this methodology are in good agreement with our results.

28.3 Symbolic Behavioral Modeling of Low Voltage Amplifiers

Esteban Tlelo Cuautle, Institution: INAOE
Elyoenai Martínez Romero, Institution: INAOE
Carlos Sánchez López, Institution: Instituto de Microelectrónica de Sevilla
Sheldon X.-D. Tan, Institution: University of California Riverside

We present the generation of symbolic expressions of low voltage amplifiers by using nullors equivalents of the transistors (MOSFETs) which include only the dominant parasitic elements in order to make a simplification before generation. That way, a reduced system of nodal equations is formulated which can be solved easily by determinant decision diagrams. The advantage of the proposed method is that the resulting symbolic behavioral model is reduced to a minimum order and contains just the dominant circuit elements providing a good insight, which is very useful for analog designers.

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29. ICD1: Solid-State Materials, Electron Devices and integrated Circuits

Wednesday (16:50 – 17:50) Room 4
Session Chair: Dr. Alejandro Medina

29.1 Floating-Gate MOSFET Parallel Analog Network for Assignment Problems

Lizeth González Carabarín, Institution: CINVESTAV
Felipe Gómez Castañeda, Institution: CINVESTAV
José Antonio Moreno Cadenas Institution: CINVESTAV

Floating-Gate-MOS Transistor (FGMOSFET) has several applications on analog circuit design; in some cases FGMOSFET simplifies high-complexity circuits because of its inherent properties. On the other side, working with FGMOSFET on subthreshold regime has allowed non-linear function implementation such as exponential and natural logarithm functions. Moreover, working on subthreshold regime is one of the most useful techniques for low-power designs.
Taking advantage of FGMOSFET's properties, this work shows an analog CMOS circuit that finds the best solution of the combinatorial task of assignments in terms of Lagrange multipliers. This is in contrast to the Hopfield paradigm, which is often VLSI-costly. The building block in this circuit uses FGMOSFET transistors, has low silicon complexity and exhibits good electrical performance according to PSpice simulations. Final simulations were developed for a 0.5µm CMOS technology and the output currents reach an optimal solution in all cases. It might include threshold voltage programming circuits for reducing mismatch effects.

29.2 Behavioral Modeling of a Sigma-Delta Modulator for Sensing Photocurrent in a CMOS Image Sensor

Sergio Garduza González, Institution: Research and Advanced Studies Center Interdisciplinary Professional Unit on Advanced Engineering and Technology (UPIITA-IPN) and Research and Advanced Studies Center (CINVESTAV-IPN)
Felipe Gómez Castañeda, Institution: Research and Advanced Studies Center
Victor Hugo Ponce-Ponce, Institution: Computer Research Center
J. Antonio Moreno Cárdenas, Institution: Research and Advanced Studies Center

We propose behavioral time-domain modeling for a Sigma-Delta Modulator (ΣΔM) to sense photocurrent in a CMOS Image Sensor (CIS). The model starts from transfer function for first-order single-bit ΣΔM in discrete-time, and then adds noise sources and nonlinearities by introducing noise floor and harmonic distortion, which determine system performance. The results were compared with the measurements of a CIS based ΣΔM circuit prototype fabricated with CMOS technology. The model showed good agreement with measurements.

29.3 Mismatch Compensation in Current Mirrors with FGMOS Transistor

Jesús de la Cruz Alejo, Institution: División de Maestría en Ingeniería Mecatrónica, TESE
L. Noe Oliva Moreno, Institution: ESCOM IPN

This paper presents a technique to solve mismatch compensation problems in current mirrors using the floating gate transistor. To reduce mismatches, the tunneling and injection processes are applied. It takes into account the long-term voltage storage as charge on the floating gate of a transistor pMOS. Experimental results justifying these processes are also including. The output current present successful results according to theorical analysis and achieving the mismatch compensation.

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30. SSD1: Solid-State Materials, Electron Devices and integrated Circuits

Wednesday (17:50 – 18:50) Room 4
Session Chair: Dr. Alejandro Medina

30.1 3D Structure Simulation and Proceeding to Extract Mobility Parameters for FinFETs Varying Channel Length

Jorge Evaristo Conde Díaz, Institution: CINVESTAV
Antonio Cerdeira Altuzarra, Institution: CINVESTAV

In this paper we present the 3D trapezoidal structure for analyzing FinFET MOSFETs using three different mesh regions, one at the top and two in the sidewalls of the fin, which allows the consideration of different carrier mobility at each region due to crystalline orientation and technological processing. A procedure for the extraction of the mobility parameters in each region is developed. Validation of the proposed structure was made with two different FinFET arrays. One with fixed fin width and another with fixed channel length. A very good agreement is obtained between experimental and simulated characteristics

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30.2 Nonlinear Interaction of Space Charge Waves in GaN Films

Angel de Jesus Castro Romero, Institution: Polytechnic University of Pachuca
Abel Garcia Barrientos, Institution: Polytechnic University of Pachuca
Francisco Rafael Trejo Macotela, Institution: Polytechnic University of Pachuca

The nonlinear interaction of space charge waves including amplification and conversion to high frequencies in n-GaN semiconductor films, possessing the negative differential conductance phenomenon, is presented. The simulation results suggest amplification and frequency multiplication for input signals with frequencies f < 220 GHz using the balance equations model.

30.3 HW-CVD deposited Microcrystalline-Silicon on Crystalline-Silicon Solar Cell with Inverted Heterojunction Structure

Yasuhiro Matsumoto, Institution: CINVESTAV
Mauricio Ortega, Institution: CINVESTAV
Frank Wünsch, Institution: Helmholtz Zentrum Berlin für Materialien und Energie Lise Meitner

p-microcrystalline-silicon / n-crystalline-silicon hetero-junction solar cell has been prepared by means of hotwire chemical vapor deposition (HW-CVD) technique. The solar cell structure was illuminated on the opposite side of the normally-formed heterojunction. With this inverted structure, the photovoltaic cell has the design potential increasing the light-incident surface texturing and it avoids the use of transparent conducting oxide (TCO).
The HW-CVD has employed for the deposition of a very thin intrinsic hydrogenated amorphous silicon (i-a-Si) as a bufferlayer, and boron-doped hydrogenated microcrystalline silicon (p-μc-Si) 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-μc-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 obtained I-V characteristics under simulated solar radiation at 100mW/cm2 are: Jsc =26.1 mA/cm2; Voc = 545 mV; Jm = 21.4 mA/cm2; Vm = 410 mV; FF = 61.7%, with total area efficiency of η = 8.8%

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31. SSD2: Solid-State Materials, Electron Devices and integrated Circuits

Thursday (17:40 – 19:00) Room 3
Session Chair: Dr. Ruben Herrera Galicia

31.1 An analytical expression for Early Voltage factor useful for hand calculations

Juan Luis del Valle, Institution: CINVESTAV-IPN. Unidad Guadalajara
Raymundo Carranza, Institution: CINVESTAV-IPN. Unidad Guadalajara
Juan Medina, Institution: CINVESTAV-IPN. Unidad Guadalajara

The maximum voltage gain of a MOSFET transistor's is limited by its output conductance (gds), which depends on gate and drain-source voltage bias and drain current and channel length (L). In this work, it is demonstrated that output conductance, extracted from SPICE simulations using EKV 2.6 model parameters, can be expressed as the product of two potential functions; the first one being a function of channel length; the second one, depending on inversion level (if). This expression can be used for hand calculations of either output conductance as a function of channel length and inversion level, or the Early voltage factor (VE) as a function of the inversion level.

31.2 Light-Controlled Transducer with Pulse Width Modulated Output based on Non-Equilibrium Metal Oxide Semiconductor Capacitors

Oleksandr Malik, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
Francisco Javier De la Hidalga Wade, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)

A novel conception of practical applications of non-equilibrium processes in illuminated metal-oxide-semiconductor capacitors is presented. It is shown that the time dependent variations of the displacement current in such capacitors, biased in strong inversion condition by a functional voltage generator, is the basis of the new transducers. Triangular or sawtooth voltage waveforms supplied by a generator together with a dc voltage bias are used in the processing circuit containing a semiconductor capacitor as the sensitive optical transducer. The main advantages of these proposed low-cost transducers is the direct pulse width modulated (PWM) output electric signal, with a duty that can change from 2 to 98% under microwatts' variations of the incident light intensity. This transducer does not need an A/D converter, which may be important for several applications, such as automatic control, robotic, feedback electronic systems, and non-contact optical position sensing for nulling and centering measurements. The operating principles, mathematical modeling and experimental results of this novel transducer are considered in detail in this work.

31.3 Optical characterization of integrated P+/N-Well/P-substrate and N-Well/P-substrate photo-device structures on CMOS technology

Gelacio Castillo-Cabrera, Institution: CINVESTAV-IPN
M. Alfredo Reyes Barranca, Institution: CINVESTAV-IPN
Jair García Lamont, Institution: Universidad Autónoma del Estado de Hidalgo. Instituto de Ciencias Básicas e Ingeniería. Centro de Investigación en Tecnologías de Información y Sistemas.
J. Antonio Moreno Cadenas, Institution: CINVESTAV
Arturo Escobosa Echavarría, Institution: CINVESTAV-IPN

Here, a characterization methodology for integrated silicon-based photo-devices is presented. Devices are phototransistors ("P+/N-Well/P-substrate") and photodiodes ("N-Well/P-substrate") with similar sizes, (9μmx9μm). They were integrated in a 1.5μm CMOS technology through MOSIS. Through these characterizations it is possible also to find out in general, the performance advantages and disadvantages, comparing measurements made on these kinds of structures. It was found that phototransistors have a better performance compared with photodiodes. The contribution from substrate leakage current in N-Well/P-substrate structures is high, as well as from carriers generated in the neighborhood of the pixel circuit. It is shown that crosstalk is the phenomenon that deviates the measured photo-response from the ideal model of photo-devices.

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32. SSM2: Solid-State Materials, Electron Devices and integrated Circuits

Thursday (16:40 – 17:40) Room 4
Session Chair: M. Alfredo Reyes Barranca

32.1 Structural, Photoluminescence and electrical properties of MW-CBD CdZnS thin films

Vidhya Bhojan, Institution: CINVESTAV
Velumani Subramaniam, Institution: CINVESTAV
Jesus Arenas Alatorre, Institution: Institute of Physics, UNAM
Victor Sanchez Resendiz, Institution: CINVESTAV
J.A.Chavez Carvayar, Institution: UNAM
Rene Asomoza, Institution: CINVESTAV
Yuiry Kudriavtsev, Institution: CINVESTAV

Thin films of CdZnS have found extensive applications in various optical, electrical and optoelectronic devices. A simple method of microwave assisted chemical bath deposition (MW-CBD) was adopted to fabricate CdZnS (Cadmium Zinc Sulphide) thin films. The bath solution is composed of Cadmium Sulphate, Zinc Sulphate, thiourea, ammonium Sulphate and ammonia. The concentration of bath solution is varied as Y=0.1, 0.3 and 0.5 where Y= [ZnSO4]/ {[CdSO4] + [ZnSO4]}. Deposition has been carried out for 120s microwave irradiation time. X-ray

diffraction (XRD) indicates the hexagonal structure (002) peak at 2θ =26.59° for the as-deposited CdZnS thin films. Grain size, dislocation density and strain in the deposited films have been determined. High resolution scanning electron microscopy (HRSEM) image gives the morphology, size and shape of particles in the deposited CdZnS thin films. High resolution transmission electron microscopy (HRTEM) analysis is used to determine the particle size which is around 12nm. Secondary ion mass spectrometry (SIMS) results show that composition is uniform throughout the entire film thickness. Band gap of deposited films as determined by photoluminescence (PL) studies is found to increase from 2.40 eV to 2.47eV with the increase in Y from 0.1 to 0.5. Ohmic conduction and space charge limited conduction (SCLC) has been observed in the deposited films.

32.2 Characterization of Polymeric thin films from Isopropanol by PECVD

Oscar García Serrano, Institution: CINVESTAV-IPN
Oscar García Serrano, Institution: CINVESTAV-IPN
Ramón Peña Sierra, Institution: CINVESTAV-IPN
Gabriel Romero Paredes Rubio, Institution: CINVESTAV-IPN
Alejandro Ávila García, Institution: CINVESTAV-IPN

Polymerized organic thin films were synthesized on a variety of substrates by Plasma Enhanced Chemical Vapor Deposition (PECVD) technique using isopropanol as precursor. Hydrogen peroxide, ammonium hydroxide, and iodine dissolved in isopropanol were used as precursor's dopants and chlorobenzene as copolymerization precursor. The structural, optical and electrical properties of the films were studied as functions of the dopant type and concentration.
The growth rate, refractive index, optical bandgap, chemical structure and resistivity of the films, strongly depend on the concentration and type of added dopant. The AFM microphotographs showed smooth surfaces with RMS roughness less than 10 nm. The optical band-gap values of the films were in the range of 2.6 to 3.26 eV, the resistivity was in the order of 103 – 104 ohm-cm. The photoluminescence response of the polymerized films was obtained in the visible region, by exciting with a UV laser.

32.3 Properties of CuInGaSe Thin Films Prepared by Chemical Spray Pyrolysis

Jagadeesh Babu Bellam, Institution: Department of Electrical Engineering, CINVESTAV-IPN, México D.F.
Velumani Subramaniam, Institution: Department of Electrical Engineering, CINVESTAV-IPN, México D.F.
Arturo Morales Acevedo, Institution: Department of Electrical Engineering, CINVESTAV-IPN, México D.F
Asomoza Rene, Institution: Department of Electrical Engineering, CINVESTAV-IPN, México D.F.

Polycrystalline films of semiconducting Cu(In1-xGax)Se2 (CIGS) quaternary alloy, one of the promising materials for photovoltaic applications, have been prepared by means of chemical spray pyrolysis (CSP). Copper, Indium and Gallium metal chlorides and Selenourea are used as constituent elements to prepare spray solution. Single phase CIGS films with chalcopyrite structure have been successfully grown on glass substrate at 350°C. The films have been characterized by X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Raman Spectroscopy and optical absorption in terms of deposition time from 5 minutes to 25 minutes. Hall studies were carried out to determine resistivity, mobility and carrier concentration in the film. All the deposited films were polycrystalline and showed single phase chalcopyrite structure with a preferred (112) orientation. Average grain size of 12.8 nm calculated from XRD spectra indicated that the films had a nanocrystalline structure. Chemical constituents present in the deposited CIGS films were identified using energy dispersive X-ray (EDX) analysis. The distinct peak in Raman spectra near 170 cm-1 indicated the presence of CIGS. All the films exhibit direct band gap structure and their band gap values are found to be 1.40 to 1.64 eV. Optical absorption coefficients of the films are found to be over 107cm-1. Resistivity of the films varied from 0.4 Ohm-cm to 4×10-2 Ohm-cm with increase in thickness of the films.

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33. ICD2: Solid-State Materials, Electron Devices and integrated Circuits

Thursday (17:40 – 19:00) Room 4
Session Chair: Dr. Mauricio Ortega López

33.1 Micro-hot plate temperature control circuit design for a MEMS gas sensor, by interfacing multiphysics and multidomain software.

Salvador Mendoza Acevedo, Institution: CINVESTAV
Mario Alfredo Reyes Barranca, Institution: CINVESTAV
Edgar Norman Vázquez Acosta, Institution: CINVESTAV
Luis Martín Flores Nava, Institution: CINVESTAV
Alejandro Ávila García Institution: CINVESTAV

It is well known that software is a powerful tool for circuit simulation and analysis, conceived to verify electronic systems. However, some kind of analyses may not be completed with only one software suit, due to the nature of the system under test. In this work, a technique is presented to overcome some limitations that are present, in particular, when a simulation has to be done with a system having electro-thermal interaction among its components. The system here presented is

used in a gas sensor having elements that modify their physical properties upon the operating conditions of the system, mainly biasing and temperature. This existing electro-thermal coupling complicates the simulation of the complete system if only one software suite is used. We propose an analysis method that integrates the capacities of the involved programs. Results show that a proposed temperature control circuit operates correctly and this is validated when a complete simulation with two software suites is done, with the system including both, the temperature control circuit and the gas sensor structure. As this structure is very important to the system's performance, the behavior obtained from the integral simulation can determine possible adjustments in the design of the gas sensor system, so fabrication of a prototype through a silicon foundry can proceed

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33.2 Simplified modeling and simulation for physical systems circuit design on a multiphysics software exportable to a multi-domain

Edgar Norman Vázquez, Institution: CINVESTAV Mario Alfredo Reyes, Institution: CINVESTAV Salvador Mendoza, José Luis González Institution: CINVESTAV

Simulation software is a fundamental tool that should be used when designing systems dealing with electro-thermal interaction, for instance. Nevertheless, there exist some inconveniences that limit and make specific software hard to use in this task. On one side, it may require a large processing hardware capacity, and on the other, simulation time increases substantially if the model complexity and accuracy required is high [1]. This work presents the procedure for modeling and simulating a micro-electro-mechanical system (MEMS) operating with an electro-thermal interaction and implemented with the help of a multi-domain design and simulation platform based on dynamic systems (Simulink® of Matlab®), using the results obtained after several simulations made with a finite elements analysis and engineering software environment, in particular, for simulation and modeling the physical behavior of the system's elements (COMSOL Mutiphysics®). The main goal of this study is to show a highly convenient alternative from which simulation time can be shortened with reduced hardware requirements, allowing at the same time the outline of possible electronic temperature control blocks, so it can be integrated on a silicon chip.

33.3 Multiscroll Oscillator based on Floating Gate CMOS Inverter

Rodolfo Trejo Guerra, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
Esteban Tlelo Cuautle, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
José Mariano Jiménez Fuentes, Institution: National Institute for Astrophysics, Optics and Electronics (INAOE)
Carlos Sánchez López, Institution: Autonomous University of Tlaxcala

The design of a multiscroll chaotic oscillator based on the realization of a sawtooth function by using floating gate MOSFETs (FGMOS), is introduced. Basically, we propose the implementation of a FGMOS inverter to generate the nonlinear functions which are responsible of the equilibrium points of a continuous chaotic dynamical system, allowing the generation of multiple scroll attractors. Spice simulations show the behavior of the nonlinear cell, along with the generation of multiscroll chaotic attractors.

33.4 Hybrid Adders for High-Speed Arithmetic Circuits: A Comparison

Monico Linares Aranda, Institution: Nacional de Astrofísica, Óptica y Electrónica
Ramón Báez, Institution: Nacional de Astrofísica, Óptica y Electrónica
Oscar González Díaz Institution: Nacional de Astrofísica, Óptica y Electrónica

In this paper the most interesting topologies of one-bit hybrid full adders, are analyzed and compared for speed, power consumption, and power-delay product. The investigation has been carried out with properly defined simulation set up and input pattern on a Mentor Graphics environment using a TSMC 180 nm CMOS process. Performance has been also compared for different supply voltage values. The simulation results show that the Chang adder is the best in terms of PDP figure of merit; however the Aguirre adder is the best in terms of driving capability even at low power supply.

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34. SSM3: Solid-State Materials, Electron Devices and integrated Circuits

Friday (9:00 – 10:00) Room 3

Session Chair: Dr. Héctor Hernández de Léon

34.1 Electrical Behavior of Au/IrO2/Si heterostructures

Alejandro Ávila García, Institution: Departamento de Ingeniería Eléctrica, CINVESTAV-IPN
Alejandro Meza Serrano, Institution: Departamento de Ingeniería Eléctrica, CINVESTAV-IPN
Gabriel Romero Paredes Rubio Institution: Departamento de Ingeniería Eléctrica, CINVESTAV-IPN

Au/IrO2/Si heterostructures were built. Their DC current versus temperature characteristics were

experimentally obtained to get the corresponding Richardson plots. From these plots, the Richardson constant was estimated for these devices. Then, from the current-voltage plots at room temperature the series resistance, ideality factor and barrier height were obtained by applying the method proposed by Cheung for parameter extraction from the thermionic theory. The model is found to fit reasonably the electrical behavior of the heterostructures for voltages higher than □B.

34.2 Electrical Characterization of Pd-PdO nanocomposites and PdO thin films prepared by thermal oxidation of Pd

Oscar García Serrano, Institution: CINVESTAV-IPN
Oscar García Serrano, Institution: CINVESTAV-IPN
Ramón Peña Sierra, Institution: CINVESTAV-IPN
Gabriel Romero Paredes Rubio, Institution: CINVESTAV-IPN

Electrical characterization of nanometric PdO films produced by thermal oxidation of Pd films in air at atmospheric pressure is reported. The PdO films were characterized using the van der Pauw-Hall method to establish the effects of oxidation degree of Pd thin films. The measured carrier mobility is directly related to the oxidation rate and film thickness. The produced films are n-type with carrier concentration of 1017 to 1020 cm-3 and electron mobility of 22-38 and 20-28 cm2/Vs for complete and partially oxidized films, respectively. XRD studies were used as a tool to determine the complete oxidation of the Pd film considering the volume change in the unit cells of Pd and PdO

34.3 Amplification of Space Charge Waves in n-InP Films

Abel Garcia Barrientos, Institution: Polytechnic University of Pachuca (UPP)
Vassil Palankovski, Institution: Advanced Materials and Device Analysis Group, Inst. for Microelectronics, TU Wien, Vienna, Austria

The non-linear interaction of space charge waves including the amplification in microwave and millimeter wave range in n-InP films, possessing the negative differential conductance phenomenon, is investigated theoretically. Both the amplified signal and the generation of harmonics of the input signal are demonstrated, which are due to non-linear effect of the negative differential resistance. It is possible to observe an amplification of the space charge waves in n-InP films of submicron thicknesses at essentially higher frequencies f < 70 GHz, when compared with n-GaAs films f < 44 GHz. The increment observed in the gain is due to the larger dynamic range in n-InP than in n-GaAs films.

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35. SSM4: Solid-State Materials, Electron Devices and integrated Circuits

Friday (9:00 – 10:00) Room 4
Session Chair: Dr. Ruben Herrera Galicia

35.1 Iridium Oxide Films obtained by Thermo-Chemical Transformation

Alejandro Ávila García, Institution: CINVESTAV del I.P.N., Departamento de Ingeniería Eléctrica, Sección de Electrónica del Estado Sólido
Gabriel Romero Paredes Rubio, Institution: CINVESTAV del I.P.N., Departamento de Ingeniería Eléctrica, Sección de Electrónica del Estado Sólido
Ramón Peña Sierra, Institution: CINVESTAV del I.P.N., Departamento de Ingeniería Eléctrica, Sección de Electrónica del Estado Sólido

Films deposited by the dipping method from a 0.005M Iridium chloride solution in iso-propanol and post-annealed at different temperatures (350, 450 and 550 ºC) were characterized. After three dippings, very thin films, with effective thickness less than 10 nm were obtained. Their effective refractive index at 632.8 nm wavelength changed from 2.495 up to 2.727. X-ray diffraction measurements proved that composite films formed by an amorphous fraction, rutile IrO2 phase and metallic Ir particles were obtained. AFM images depict a textured surface, mainly for the highest annealing temperature. The Raman and FTIR spectra confirm the rutile iridium oxide as an important component of the films. A possible path for the films formation is proposed.

35.2 Structural and electrical characterization of thermally oxidized Zn films

Oscar García Serrano, Institution: CINVESTAV-IPN
Oscar García Serrano, Institution: CINVESTAV-IPN
Ramón Peña Sierra, Institution: CINVESTAV-IPN
Marco Antonio Vázquez Agustín, Institution: CINVESTAV-IPN
Gabriel Romero Paredes R., Institution: CINVESTAV-IPN
Oscar Goiz Amaro, Institution: CINVESTAV-IPN

High quality ZnO films were obtained by thermal oxidation of Zn films on the temperature range from 300 to 700 °C. Zn films of 190 nm in thickness were deposited on silicon and glass substrates by the sputtering technique. Thermal oxidation was done at normal environment conditions. The complete oxidation of the Zn films was determined by the ZnO films transparency.
The ZnO films resulted dense with mirror-like surface. The film structural characterization was realized by X-ray diffraction measurements. The electrical characteristics were measured by the van der Pauw method at room temperature. The ZnO films resulted n-type with carrier

concentration of 1016 to 1017cm-3 and mobility values in the range of 1 to 50 cm2/V-s.

35.3 Fabrication of highly luminescent CdS nanocrystal/polyelectrolyte composite from aqueous Solution.

Claudio Davet Gutiérrez Lazos, Institution: Sección de Electrónica del Estado Sólido, Centro de Investigación y de Estudios Avanzados del I. P. N.
Mauricio Ortega López, Institution: Sección de Electrónica del Estado Sólido, Centro de Investigación y de Estudios Avanzados del I. P. N.
Miguel Ángel Meléndez Lira, Institution: Departamento de Física, Centro de Investigación y de Estudios Avanzados del I. P. N.
Román Romano Trujillo, Institution: Centro de Investigación en Dispositivos Semiconductores, BUAP.

CdS/polyelectrolyte nanocomposites were prepared by using thiol-stabilized CdS nanocrystals and poly(diallyldimethylammonium chloride) in aqueous medium. The colloidal solution displayed the typical weak orange emission, which has been attributed to recombination processes at the crystallite surface. When CdS nanocrystals were introduced in a polyelectrolyte matrix, their luminescence was increased. In addition, higher intensity and whitish luminescence was observed in CdS/polyelectrolyte composite, in which a Zn excess was added during the CdS synthesis. The absorbance spectra display a resolved peak around 374 nm, corresponding to CdS electronic transition between conduction and valence band in quantum confined state. Raman spectroscopy show vibrational modes corresponding possibly to low dimensional CdS and ZnS around 600 cm-1 and 575 cm-1, respectively.

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