CCE
2009

PROGRAM AND ABSTRACT BOOK

2009 6th INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING, COMPUTING SCIENCE AND AUTOMATIC CONTROL

CENTRO DE INVESTIGACIÓN Y DE ESTUDIOS AVANZADOS DEL INSTITUTO POLITÉCNICO NACIONAL. DEPARTAMENTOS: INGENIERÍA ELÉCTRICA, CONTROL AUTOMÁTICO Y COMPUTACIÓN
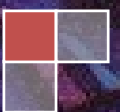
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Toluca, Mexico
November 10-13, 2009

Contents

Message from the Podium

Editorial.

This year we are celebrating the 6th International Conference, and the second 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 211 submissions from 13 countries (including Mexico), from which 121 were accepted for oral presentation. We received submissions from countries such as the USA, Spain, China, Iran, Colombia, Cuba, Brazil, United Kingdom, and Vietnam, among others, reflecting the international character of this conference.

As Presidents of CCE 2009, we wish to thank the Organizing Committee, the anonymous referees and the supporting personnel for their valuable time and efforts for they make possible to hold a successful 2009 6th International Conference on Electrical Engineering, Computing Science and Automatic Control (CCE). We also wish to give special thanks to the Universidad Autónoma del Estado de México, in Toluca, for hosting this conference and for all their 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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Facultad de Ingeniería de UAEMEX

Consejo Mexiquense de Ciencia y Tecnología

General Information

The Conference will be held in Toluca City at premises of **Facultad de Ingeniería** of the   **Universidad Autónoma del Estado de México**   (Mexico State Autonomous University) an important educational center.

Address: Cerro de Coatepec s/n, Ciudad universitari, Toluca, Estado de México, México)

The Mexico State Autonomous University has its roots in the Literary Institute, later named the Scientific and Literary Institute, which was founded in 1827. It has been a prestigious institution and educated figures such as **José María Heredia**, **Ignacio Ramírez**, **Felipe Sánchez Solís**, **Ignacio Manuel Altamirano** and **Adolfo López Mateos**. The Institute became an autonomous university in 1956. The original building, situated downtown near Benito Juárez street, has been remodeled and houses the dean's offices. The university has installations in various parts of the city, but the "Ciudad Universitaria" (lit. "university city") built around the Cerro (Hill) de Coatepec is the most noticeable, with its bust of López Mateos prominently displayed at the top of the hill.

Toluca, formally: Toluca de Lerdo is the state capital of **Mexico State** as well as the seat of the Municipality of Toluca. It is the center of a rapidly growing urban area, now the fifth largest in Mexico. It is located 63 kilometers (39 mi) west-southwest of **Mexico City** and only about 45 minutes by car to the western edge of the **Distrito Federal**. According to the 2005 census, the city of Toluca has a population of 467,713, with 747,512 as the total municipal population. The city is the eighth largest in **Mexico** in population. The municipality of Toluca, along with twelve other municipalities make up the metropolitan population of 1,610,786 as of 2005, making it the fifth most populous metropolitan area in Mexico and the largest entirely within the State of México.

When Toluca was founded by the Matlazincas, its original name was Nepintahihui (land of corn, tierra del maíz). The current name is based on the Náhuatl name for the area when it was renamed by the **Aztecs** in 1473. The name has its origin in the word tollocan that comes from the name of the god, Tolo, plus the locative suffix, can, to denote "place of Tolo". It is also referred to in a number of **Aztec codices** as Tolutépetl, meaning hill of the god, Tolo, an allusion to the nearby **volcano**. The name Toluca de Lerdo was adopted in 1861 in honor of **President Sebastián Lerdo de Tejada**.

 http://en.wikipedia.org/wiki/Toluca#cite_note-StateofMexico-2

An opening ceremony for the CCE'09 held by the University will take place at the "Aula Magna" (great lecture theater) in the "Rectoría" building located in downtown Toluca. To get there, assuming that you depart from the conference venue (Facultad de Ingeniería), you can either choose to walk all the way there or simply avoid any inconvenience and take a taxi. If you decide to walk, it will take you about 30-35 minutes to cover the distance marked in the map shown below. If you prefer to take a taxi, ask the driver to take you to the "Rectoría" building on Instituto Literario street. It is a very well knowplace, so you should be there in no more than 15-20 minutes and the trip should cost you no more than30 pesos. Make sure you agree the fee with the driver in advance. We recommend you to use one of thetaxis usually parked accross the road as you leave the conference venue. If you find difficult to clearly tell the taxi driver where you are going to, you can show him this message, point to the words Rectoría" and "Instituto literario" street and that should do.

Programa

TUTORIAL COURSES
NOVEMBER 9-10, 2009

Monday November 9, 2009 **TUTORIAL COURSES**			
	Room1	**Room2**	**Room3**
9:00-10:00	Tutorial Registration		
10:00-11:30	TUT1	---------	
11:30-12:00	Break		
12:00-13:30	TUT1	---------	
13:30-15.30	Lunch		
15:30-17:00	TUT1	---------	
17:00-17:30	Break		
17:30-18:30	TUT1	---------	

CONFERENCE CCE 2009
NOVEMBER 10-13, 2009

Tuesday November 10, 2009 **CCE AND TUTORIAL COURSES**				
	Room1	**Room2**	**Room3**	**Room4**
10:00-11:00	Opening Ceremony			
11:00-11:30	*Welcome Cocktail*			
11:30-13:30	ROUND TABLE1	---------	---------	---------
13:30-16:00	*Lunch*			
15:00-16:00	Tutorial Registration			
16:00-17:00	TUT2			
17:00-17:20	Break			
17:20-18:00	TUT2			
16:00-18:00				

Wednesday November 11, 2009 **CCE**				
	Room1	**Room2**	**Room3**	**Room4**
9:00-12:00 15:00-17:00	Registration			
10:00-11:00	PLE1	---------	------	-----
11:00-12:00	PLE2	---------	---------	-----
12:00-12:30	Break			
12:30-13:30	COM1	BIO1	SSM1	MEC1
13:30-15:00	*Lunch*			
15:00-17:00	COM2	BIO2	CS1	AC1
17:00-17:20	Break			
17:20-18:40	AC2	AC3	AC4	AC5
9:00				

Thursday November 12, 2009 **CCE**				
	Room1	**Room2**	**Room3**	**Room4**
9:00-12:00 15:00-17:00	Registration			
10:00-11:00	SSM2	AC6	MEC2	SSM4
11:0-12:00	PLE3	---------	---------	---------
12:00-12:30	Break			
12:30-13:30	PLE4	---------	---------	---------
13:30-15:00	*Lunch*			
15:00-17:00	SSM3	MEC3	CS2	AC7
17:00-17:20	Break			
17:20-18:20	AC8	MEC4	CS3	AC9

Friday November 13, 2009 **CCE**				
	Room1	**Room2**	**Room3**	**Room4**
9:00-10:00	Registration			
10:00-11:00	SSM5	MEC5	AC10	AC11
11:00-12:00	PLE5	---------	---------	---------
12:00-12:30	Break			
12:30-13:30	PLE6	---------	---------	---------
13:30-14:30	AC12	AC13	AC14	AC15
14:30	Closing ceremony, Recognition Best Paper, Closing Cocktail			

Opening Ceremony, Welcome Cocktail and Round Table in:

Aula Magna Universidad Autónoma del Estado de México
Instituto Literario No. 100, Colonia Centro,
Toluca, Estado de México,
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Sessions, Plenary talks, Closing ceremony, Closing Cocktail in:

Facultad de Ingeniería , Universidad autónoma del Estado de México
Cerro de Coatepec s/n, Ciudad universitaria,
Toluca, Estado de México, México)

Plenary Conferences Abstracts

Vladimir Rasvan

Department of Automatic Control

University of Craiova

Romania

Plenary Talk: Delays. Propagation. Conservation laws.

November 11, 2009

Abstract:

Since the very First paper of J. Bernoulli in 1728, a connection exists between initial boundary value problems for hyperbolic Partial Diferential Equations (PDE) in the plane (with a single space coordinate accounting for wave propagation) and some associated Functional Equations (FE). From the point of view of dynamics and control (to be specific, of dynamics for control) both type of equations generate dynamical and controlled dynamical systems. The functional equations may be difference equations (in continuous time), delay-differential (mostly of neutral type) or even integral/integro-differential. It is possible to discuss dynamics and control either for PDE or FE since both may be viewed as self contained mathematical objects. The choice is more or less matter of taste.

It is interesting however to point out that FE (diference, delay diferential) with lumped (pointwise, "pure") time delays are the reflex of the so-called lossless and/or distortionless propagation associated to linear or quasi-linear PDE. In these cases all achievements and results of the theory of F(D)E may be used and this is what control theory is accomplishing for the last half century.

A more recent topic is control of systems displaying conservation laws. Conservation laws are described by nonlinear hyperbolic PDE belonging to the class "lossless" (conservative); their dynamics and control theory is well served by the associated energy integral. It is however not without interest to discuss association of some FE. Lossless implies usually distortionless propagation hence one would expect here also lumped time delays. This association of some FE would allow application of various traditional tools of Control Theory besides the Liapunov like approach of the energy function.

The paper contains some illustrating applications from various fields: nuclear reactors with circulating fuel, canal flows control, overhead crane. In all cases, specific features of the control models are discussed in connection with the control approach.

Prof. Dr. Michael Dellnitz

Paderborn Institute for Scientific Computation,

University of Paderborn, Germany

Plenary Talk : **Multiobjective Optimization via Set Oriented Numerical Methods**

November 11, 2009

Abstract:

Over the last years so-called set oriented numerical methods have been developed in the context of the numerical treatment of dynamical systems. The basic idea is to cover the objects of interest — for instance invariant manifolds or invariant measures — by outer approximations which are created via adaptive multilevel subdivision techniques. These schemes allow for an extremely memory and time efficient discretization of the phase space and have the flexibility to be applied to several problem types.

In this talk we will show that set oriented techniques can particularly be useful for the solution of multiobjective optimization problems. In these problems several objective functions have to be optimized at the same time. For instance, in the production of a technical device one wants to simultaneously minimize cost and maximize quality. As indicated by this example the different objectives typically contradict each other and therefore certainly do not have identical optima. Thus, the question arises how to approximate the "optimal compromises" which, in mathematical terms, define the so-called Pareto set. In order to make our set oriented numerical methods applicable we will first construct a dynamical system which possesses the Pareto set as an attractor.

In a second step we will develop appropriate step size strategies.

The corresponding techniques are applied to several real world applications.

As an extension we will also show how to use these techniques for the identification of control strategies for the guidance of rail-bound vehicles. Here we will essentially illustrate how multiobjective optimization can be utilized in the context of model predictive control.

Dr. Vicente Feliu Batlle

Department of Electrical Engineering, Electronics and Automatic

University of Castilla-La Mancha

Spain

Plenary Talk: Impact control of mobile flexible structures. Applications in robotics

November 12, 2009

Abstract:

The purpose of this lecture is to introduce the basic principles of impact control of mobile flexible structures. This research pursues: a) the real time detection of the instant and location of an impact produced on a flexible structure, b) active motion control in order to minimize the effects of the collision of the structure with some object and to remove structural vibrations, c) force control of a flexible structure under constrained motion. Some applications in the robotics area will also be developed in the lecture. This conference will be organized in three main parts.

The first part is devoted to define the dynamic models to be used in the study. It begins with an introduction to the subject, where some basic concepts are presented, and its interest is motivated. Then the dynamics of flexible beams under free motion is presented, both using lumped masses models and distributed mass models. After, the previous models are extended to the case of flexible beams under constrained motions. Finally the dynamics of impacts and the interaction between the beam tip and the contact surface are studied.

The second part is devoted to develop efficient control schemes in order to reduce the effects of impacts, and allowing a precise force control. It begins with a quick overview of the allowable control techniques for fast motion of flexible beams while quickly cancelling structural vibrations. After some schemes for force control of flexible beams under constrained motions are proposed. Finally, efficient collision detection algorithms are developed for the case of flexible structures.

The third part is devoted to present some applications of the previous results, focused in the field of robotics. First some experiments on collision detection and real time force control using a three-degrees-of-freedom flexible arm are presented. Second an application to object recognition using a flexible sensing antenna is shown. Third a specially designed gripper with flexible fingers combined with the proposed controllers is used for delicate objects handling.

Finally some conclusions are outlined.

Dr. Francisco. J. García Sánchez

Professor Emeritus

Solid State Electronics Laboratory

Simón Bolívar University

Venezuela

Plenary Talk: Electron Device and IC Evolution: Present Challenges and Tendencies

November 12, 2009

Abstract

There seems to be a broad consensus about the fact that for the first time since 1965 Moore's Law, as we understood it up to now, is finally approaching its end. The realization of extremely small geometry transistors needed for the very large scale integrated circuits demanded by today´s growing and diversifying markets is beginning to experience serious difficulties.

The main impediments to continue aggressively shrinking the conventional transistor, such as feature size physical limitations, maximum speed, power consumption, fabrication complexity, yield, reliability and cost of manufacturing technology are discussed. Several tendencies that aim to find possible future solutions to the expected problems are considered.

The conclusion is that for the time being, the miniaturization of conventional technology transistors will continue until it reaches its natural limit in a decade or so. Nevertheless, this last gasp of the conventional knowhow requires redoubled development and investment in new materials, 3D structures, the use of advanced printing processes, novel operation concepts, and aggressive integration architectures, among other critical aspects. Some discussion is also devoted to the development of the so-called 'beyond CMOS' futuristic unconventional devices, most probably not based on the massive flow of electrons, and wishfully fabricated "bottom-up" by self-assembly.

Dr. Wagner Coelho A. Pereira

Biomedical Engineering Poogram - COPPE

Federal University of Rio de Janeiro = UFRJ

Brasil

Plenary Talk: Image Processing of Breast Ultrasound

November 13, 2009

Abstract

Breast cancer is the most common form of cancer in women in the western world, excluding non-melanoma skin cancers, and it is the second leading cause of cancer deaths. Mammography has been recommended as the most adequate screening exam to early detection, which increases therapy efficacy, and diminishes mortality. Its accuracy, however, depends on the composition of mammary tissue and lesion characteristics, as a dense parenchyma can reduce the mammographic sensitivity. In addition, a considerable number of suspicious solid masses are recommended to surgical biopsy although only 10% - 30% of them are malignant. Therefore, ultrasound (US) breast image have been used, in addition to mammography, to improve diagnosis and reduce the number of avoidable biopsies for patients with palpable mass and inconclusive mammograms.

Morphological and texture characteristics are used by radiologists aiming at establishing the diagnostic hypothesis on breast US images, which presents values of accuracy, sensitivity, and specificity ranging from 81.3% to 96.6%, 75.3% to 85.1% and 78.5% to 96.8%, respectively. Morphological characteristics of malignancy include spiculation, microlobulation, angular margin, as malignant tumors usually infiltrate adjacent tissues, while benign tumors generally present regular and well-defined contours. As contour analysis from breast solid tumors using US images has potential to aid in biopsies reduction of benign tumors, quantitative analysis of morphological characteristics has been widely investigated.

In this study, we investigate the potentiality of some morphological parameters in assessing breast tumor on US images. Two of them are new: the normalized residual value (nrv) and the morphological-closing ratio (mshape). The potential of these parameters to take part in a Computer-Aided Diagnostic System (CAD) is presented and discussed.

Prof. Dr. Michael Dellnitz Paderborn

Institute for Scientific Computation,

University of Paderborn, Germany

Tutorial: Set Oriented Numerics

Course Code: T002

Abstract:

In several real world problems it is desirable to identify and approximate an entire set of solutions which is of relevance for the behavior of the corresponding system. For example,- in a dynamical systems context one would like to compute invariant sets rather than just single orbits contained in these sets,- in a control theoretic framework reachability sets are of interest, or - in multiobjective optimzation one would like to identify the entire Pareto set rather than single optimal solutions obtained, for instance, by an a priori weighting of the objective functions. Typically these sets cannot be computed analytically and therefore one has to use corresponding numerical tools for their approximation.

In this tutorial I will give an introduction to the area of set oriented numerics. The basic set oriented algorithms will be described, including their underlying mathematical foundation. In this context all the three themes mentioned above - Dynamical Systems, Control and Multiobjective Optimization - will be addressed. It will also be shown how to apply these algorithms in concrete applications, such as the approximation of transport phenomena in the ocean, or the identification of energy efficient trajectories for spacecraft

Round Table Session

Una Carrera Científica: Cómo y porqué elegirla

Pablo Rudomín Zevnovaty

Pablo Rudomin Zevnovaty, PhD (born 1934 in Mexico City) is a Mexican neuroscientist.

Born to Russian parents he is a graduate of the biology program of the National School of Biological Sciences of the National Polytechnic Institute (IPN). He has been the director of the program of bioph neuroscience at the CINVESTAV (Center for Research and Advanced Studies) of the IPN since 1984. At the neuroscience program, his research has focused on the analysis of the central control mechanisms for the information that is transmitted by nerve fibers originating in the skin and muscles to the spinal cord.
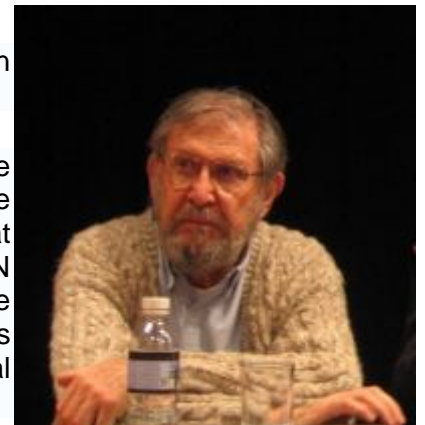
He has also been a guest researcher at the following centers:

- Rockefeller Institute for Medical Research – New York City, US (1959–1960)
- Institute of Medical Pathology – Siena, Italy (1960–1961)
- Marine Biology Laboratory – Woods Hole, Massachusetts, US (1960)
- National Institutes of Health – Bethesda, Maryland, US (1968–1969, 1984–1986 and 1990–1991)
- Gö teborg University –Gö teborg Sweden (1983)

He has also held the honorary positions:

- President of the Mexican Academy of Sciences
- Vice-president of the Mexican Society of Physiological Sciences
- General coordinator of the Presidential Science Advisory Council.
- Counseling member of the CONACYT.

He has been a professor since 1961 and since 1993 he has been a member of El Colegio Nacional.

Awards

- National Alfonso Caso Science Award from the Mexican Academy of Sciences
- National Science Award;
- Award for the Best Paper of the Mexican Academy of Sciences;
- Prince of Asturias Award;
- Luis Elizondo Award of the ITESM
- Lázaro Cárdenas Award.
- Dr Honoris Causa, University of Puebla, Mexico

Nació en la Ciudad de México en 1934. Estudió Biología en la Escuela Nacional de Ciencias Biológicas del Instituto Politécnico Nacional. Es maestro en Ciencias, especialidad en Fisiología, del Cinvestav, donde es director del Programa de Neurociencias e Investigador Emérito. Es también Investigador Nacional Emérito del SNI.

Su investigación se ha enfocado en la caracterización de los patrones de activación y de las conexiones sinápticas de interneuronas en la médula espinal. Desarrolla métodos computacionales para determinar conexiones de interneuronas espinales con fibras aferentes y con motoneuronas. Estudia las influencias supraespinales sobre la efectividad sináptica de fibras aferentes musculares y cutáneas.

Ha sido investigador visitante en el Instituto Rockefeller; en el Instituto de Patología Médica de Siena, Italia; en el laboratorio de Biología Marina de Woods Hole; en el laboratorio de neurofisiología de los Institutos Nacionales de Salud, en Bethesda, Maryland; en la Universidad de Gö teborg, en Suecia; en John Curtin Medical School de Canberra, en Australia.

Fue presidente de la Academia de la Investigación Científica, vicepresidente de la Sociedad Mexicana de Ciencias Fisiológicas; asesor del Conacyt. Pertenece a El Colegio Nacional.

En su gestión como coordinador general del Consejo Consultivo de Ciencias de la Presidencia de la República, se ampliaron las actividades con la exención del pago de impuestos a la importación de equipos e insumos para la investigación y se impulsó la Ley para el Fomento de la Investigación Científica y el Desarrollo Tecnológico.

Se ha hecho acreedor al premio Príncipe de Asturias de Investigación Científica y Técnica; al Premio Nacional de Ciencias "Alfonso Caso", de la Academia de la Investigación Científica; Premio Nacional de Ciencias y Artes; premio "Luis Elizondo" en el ITESM; y a la Presea Lázaro Cárdenas del IPN.

Cuenta con 108 publicaciones científicas, 11 de divulgación, 75 comunicaciones a congresos nacionales y 60 a congresos internacionales.

http://www.fisio.cinvestav.mx/academicos/rudomin/index.html

http://en.wikipedia.org/wiki/Pablo_Rudom%C3%ADn_Zevnovaty

http://www.ccc.gob.mx/semblanzas/445-pablo-rudomin-zevnovaty

http://www.colegionacional.org.mx/Rudomin0.htm

Adolfo Martínez Palomo

Adolfo Martínez Palomo was born in Mexico City in 1941. He is a surgeon and received his doctorate degree in medical sciences from the Facultad de Medicina Faculty of Medicine of the Universidad Nacional Autónoma de México (UNAM) [National Autonomous University of Mexico] , and a Masters of Science degree from Queen's University in Kingston, Canada. Dr. Martínez Palomo was associate researcher at the Cancer Research Institute of Paris, and research physician at the Instituto Nacional de Cardiología [National Institute of Cardiology] in Mexico. He has also been a member of scientific committees at the Consejo Nacional de Ciencia y Tecnología (Conacyt) [National Council of Science and Technology] , the US National Academy of Sciences, the Rockefeller Foundation, Harvard University, the International Vaccine Institute of Seoul, and the Centers for Disease Control and Prevention of Atlanta, Georgia.
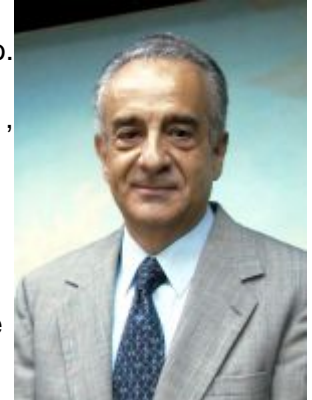
Dr. Martínez Palomo's specialty is molecular biology. He has studied the biology of neoplasic cells and of the cells of the heart' s conduction system as well as the host-parasite interaction in amoebiasis, giardiasis, trichomoniasis and onchocercosis. His laboratory is committed to the study of protozoa parasites infecting humans, especially Entamoeba histolytic, Entamoeba dispar, Giardia lamblia, and Trichomonas vaginalis.   .

He is a former director of the Programa Mexicano para el Estudio de las Enfermedades Parasitarias [Mexican Program for the Study of Parasitic Diseases] of the Rockefeller and MacArthur Foundations and a former president of the Academia de la Investigación Científica [Academy of Scientific Research] and of the Academia Nacional de Medicina [National Academy of Medicine] . He was head of the Departamento de Patología Experimental [Experimental Pathology Department] of the Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav) [Center for Research and Advanced Studies of the National Polytechnic Institute] , an institution for which he was appointed Director General for the period 1995-2002. Currently he is Professor Emeritus at Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav) [Center for Research and Advanced Studies of the National Polytechnic Institute] , President of UNESCO's International Bioethics Committee (Paris) and member of the Global Forum for Health Research (Geneva) and of the Experts Committee Parasitic Diseases of the World Health Organization (Geneva). He is a member of El Colegio Nacional [The National College] since 1985. He is Coordinator General of the Consejo Consultivo de Ciencias de la Presidencia de la República (CCC) [Science Consulting Council of the President's Office] .   .
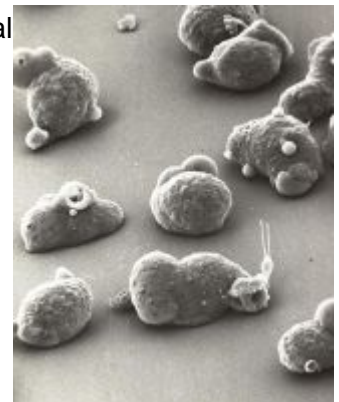
Dr. Martínez Palomo was awarded in Switzerland, the Karger Prize; in Italy, the TWAS Prize; and in Mexico, the Premio de la Academia de la Investigación Científica [Prize of the Academy of Scientific Research), the Premio Nacional de Ciencias y Artes [National Award for Science and Arts] , the Premio " Luis Elizondo" [" Luis Elizondo" Prize] awarded by the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) [Monterrey Institute of Technology and Higher Learning] , and the Medalla " Eduardo Liceaga" de la Secretaría de Salud [" Eduardo Liceaga" Medal of the Health Ministry] . .

Dr. Adolfo Martínez Palomo has written many books, including five of the most important texts found in the amoebiasis literature, and more than 200 scientific papers published in refereed journals. He has received invitations to lecture in 22 different countries.

Adolfo Martínez Palomo nació en la ciudad de México el 15 de marzo de 1941. Hizo estudios de médico cirujano en la UNAM de 1958 a 1964, y en 1971 obtuvo el doctorado en ciencias médicas, también en la Universidad Nacional Autónoma de México. Obtuvo la maestría en ciencias de la Universidad Queen´s, en Canadá. Fue investigador asociado en el Instituto de Investigaciones sobre el Cáncer, en Villejuif, Francia.

Entre los principales cargos que ha desempeñado en México podemos mencionar el de jefe del Laboratorio de Microscopía Electrónica en el Instituto Nacional de Cardiología, director del Programa Mexicano para el Estudio de Enfermedades Parasitarias de las fundaciones Rockefeller y MacArthur, presidente de la Academia de la Investigación Científica y de la Academia Nacional de Medicina, así como jefe del Departamento de Patología Experimental del Centro de Investigación y de Estudios Avanzados (Cinvestav) del IPN, del cual fue director de 1995 a 2002.
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Ha estudiado la biología de las células neoplásicas, del sistema de conducción del corazón y de la interacción huésped-parásito en la amibiasis, la giardiasis y la oncocercosis. Ha escrito cinco libros sobre amibiasis y otros temas médicos, y más de 150 artículos científicos. Es miembro de comités científicos del Conacyt, la OMS, la Academia de Ciencias de EUA, la Fundación Rockefeller y la Universidad de Harvard, además de haber sido invitado como conferencista en más de 20 países.
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Ha sido miembro de diversas organizaciones nacionales, regionales e internacionales dedicadas a la promoción de la investigación en salud, entre ellas del Comité de Expertos en Enfermedades Parasitarias, de la OMS; del Consejo Directivo del Instituto Internacional de Vacunas, dependiente de la ONU, y del Comité Global de Investigación en Salud con sede en Ginebra. Ha sido, además, asesor científico del Center for Diseases Control and Prevention, en Atlanta, EUA, entre otros organismos e instituciones. Ha recibido numerosos premios y distinciones: en Suiza recibió el Premio Karger; en Italia el Premio *TWAS* y, en México, el Premio de la Academia de la Investigación Científica, el Premio Nacional de Ciencias, el Premio Luis Elizondo y la Medalla Eduardo Liceaga.
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El doctor Adolfo Martínez Palomo es miembro de El Colegio Nacional desde el 6 junio de 1985. Su conferencia inaugural, " Ciencia y subdesarrollo" , fue contestado por el doctor Guillermo Soberón.

http://www.cinvestav.mx/Departamentos/Infect%C3%B3micayPatog%C3%A_9nesisMolecular/PersonalAcad%C3%A_9mico/Mart%C3%ADnezPalomoAdolfo /tabid/951/language/es-MX/Default.aspx

http://www.colegionacional.org.mx/SACSCMS/XStatic/colegionacional/docs/espanol/martinez_palomo.pdf

http://www.ccc.gob.mx/counselors/363-adolfo-martinez-palomo

http://www.colegionacional.org.mx/SACSCMS/XStatic/colegionacional/template/content.aspx? se=vida&te=detallemi embro&mi=128

Eusebio Juaristi

Eusebio Juaristi nació en la ciudad de Querétaro el 21 de diciembre de 1950. Obtuvo el título de Licenciado en Ciencias Químicas (1974) del Instituto Tecnológico y de Estudios Superiores de Monterrey y de Doctor en Ciencias Químicas (Ph.D., 1977) de la Universidad de Carolina del Norte en Chapel Hill, NC, E.U.A. Trabajó como investigador posdoctoral en la Universidad de California, en Berkeley (1977-1978), y como investigador asociado en la División de Diagnósticos de Syntex en Palo Alto, California (1978-1979), antes de volver a México, donde actualmente es Profesor Titular e Investigador en el Departamento de Química del CINVESTAV-IPN. Fue Profesor Visitante del Politécnico (E.T.H.) de Zurich durante (1985-1986 y 1992-1993), y de la Universidad de California en Berkeley (1999-2000).

El Dr. Juaristi ha sido el iniciador en México de la investigación en el área de la fisicoquímica orgánica, con énfasis en el análisis conformacional y la estereoquímica, constituyéndose en líder mundial del estudio del efecto anomérico. También ha destacado en el área de la síntesis asimétrica, campo en el que, junto con su grupo de investigación, ha desarrollado nuevos métodos para la síntesis enantioselectiva de ß-aminoácidos. Otras áreas de investigación en las que Juaristi ha tenido una influencia notable son: estructura y reactividad de los carbaniones; análisis conformacional, y aplicaciones de la química computacional.   .

A la fecha, el Dr. Juaristi es autor o coautor de 260 publicaciones en el área de la química, incluyendo 152 trabajos de investigación original, 24 capítulos en libros, 11 libros, 18 artículos de revisión, 18 artículos de docencia y 32 artículos de difusión. El impacto de estas publicaciones se puede medir por el número de citas bibliográficas registradas a la fecha (más de 5300), lo que le ha llevado a convertirse en uno de los químicos latinoamericanos más citados de todos los tiempos. Ha contribuido, además, a formar un número importante de estudiantes a nivel de doctorado (29) maestría (23) y licenciatura (52). Muchos de estos graduados son actualmente investigadores independientes que dirigen trabajos de investigación a nivel licenciatura y/o posgrado en instituciones académicas del área metropolitana y del interior de la República. Finalmente, el Dr. Juaristi ha impartido un gran número de cursos y conferencias en casi todos los estados de la república, así como en varios países de América, Europa y Asia .

El Dr. Juaristi ha ocupado diversos puestos en la Academia Mexicana de Ciencias, y ha sido miembro de los consejos editoriales de varias revistas de química nacionales e internacionales. Ha recibido también importantes premios y reconocimientos: el Premio de la Academia de la Investigación Científica (1988); el Premio Manuel Noriega, de la OEA (1990); el Premio Nacional de Química "Andrés Manuel del Río" (1994) y el Premio Nacional de Ciencias y Artes (1998).   .

El Dr. Eusebio Juaristi y Cosío ingresó en El Colegio Nacional el 13 de febrero de 2006. Su discurso de ingreso, dividido en dos partes: " Un camino marcado porla curiosidad, la obstinación y la casualidad" , y " La química en México: retos en su enseñanza, en investigación científica y en desarrollo tecnológico" , fue contestado por el Dr. Leopoldo García-Colín Scherer.

http://www.cinvestav.mx/Departamentos/Quimica/DirectorioQu%C3%ADmica/In vestigadores/DrEusebioJuaristiyCosi o.aspx

http://www.colegionacional.org.mx/SACSCMS/XStatic/colegionacional/template/content.aspx? mi=123&se=vida&te= detallemiembro

http://www.relaq.mx/RLQ/EusebioJuaristi_vitae.htm

http://www.ccc.gob.mx/semblanzas/439-eusebio-juaristi-y-cosio

Onésimo Hernandez-Lerma

He was born in Ciudad Obregon, Sonora, in 1946. He earned a bachelor' s degree at the Escuela Superior de Física y Matemáticas [Upper School of Physics and Mathematics] of the Instituto Politécnico Nacional (IPN) [National Polytechnic Institute] and obtained master' s and doctorate degrees at Brown University. He is a researcher and professor in the mathematics department of the Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav) [Center for Research and Advanced Studies of the National Polytechnic Institute] , where he holds the highest academic category; he is an Investigador Nacional, nivel III [National Researcher, Level III] .

His research has been conducted in the areas of optimum control of stochastic systems, stochastic games theory, infinite linear programming, and Markov processes. He has made significant contributions to all of these areas, but his work is most prominent in the area of stochastic control.

His work established a strong base for a subject matter known as "Adaptive control" of stochastic systems, and the large number and impact of his papers have earned him international recognition as creator of the "Mexican school of stochastic control" .

He was head of the departamento de matemáticas [department of mathematics] of the Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav) [Center for Research and Advanced Studies of the National Polytechnic Institute] . Professor of Ciencia Básicas e Ingeniería [Basic Sciences and Engineering] of the Universidad Autónoma Metropolitana (UAM) [Autonomous Metropolitan University] . Professor at the Sección de Graduados [Graduate Section] of the Escuela Superior de Ingeniería Mecánica y Eléctrica (ESIME) [Upper School of Mechanical and Electrical Engineering] of the Instituto Politécnico Nacional (IPN) [National Polytechnic Institute] . He is a member of the Consejo Consultivo de Ciencias de la Presidencia de la República (CCC) [Science Consulting Council of the President's Office] .   .

He has received the Premio Nacional de Ciencias y Artes [National Award for Science and Arts] and was conferred a PhD Honoris Causa by the University of Sonora.   .

He has published over 100 research papers and 12 books and monographs. Dr. Hernández-Lerma is one of Mexico's mathematicians with a very high number of citations of their work (some 800).

He has tutored 12 doctoral students (7 from the Centro de Investigación y de Estudios Avanzados

del Instituto Politécnico Nacional (Cinvestav) [Center for Research and Advanced Studies of the National Polytechnic Institute] , 3 from the Facultad de Ciencias [Faculty of Sciences] of the Universidad Nacional Autónoma de México (UNAM) [National Autonomous University of Mexico] and 2 from the Universidad Autónoma Metropolitana (UAM) [Autonomous Metropolitan University]). He has also supervised 28 masters and 3 undergraduate theses.

Nació en Ciudad Obregón, Sonora, en 1946. Obtuvo el título de licenciatura en la Escuela Superior de Física y Matemáticas del Instituto Politécnico Nacional, la maestría y el doctorado en Brown University. Es investigador y profesor del departamento de Matemáticas del Cinvestav, donde tiene la máxima categoría académica, y es Investigador Nacional nivel III.

Sus áreas de investigación son el control óptimo de sistemas estocásticos, la teoría de juegos estocásticos, la programación lineal infinita, y los procesos de Markov. En cada una de estas especialidades ha hecho importantes contribuciones, pero donde más ha destacado es el área de control estocástico.

Sus trabajos establecieron sobre una base sólida el tema conocido como "control adaptable" de sistemas estocásticos, y el gran número e impacto de sus publicaciones le han valido el reconocimiento internacional de creador de "la escuela mexicana de control estocástico".

Fue jefe del departamento de Matemáticas del Cinvestav. Profesor de Ciencias Básicas e Ingeniería de la Universidad Autónoma Metropolitana. Profesor de la sección de Graduados de la Escuela Superior de Ingeniería Mecánica y Eléctrica del Instituto Politécnico Nacional. Es miembro del Consejo Consultivo de Ciencias de la Presidencia de la República.

Ha recibido el Premio Nacional de Ciencias y Artes; es doctor Honoris Causa de la Universidad de Sonora.

Ha publicado más de 100 artículos de investigación y 12 libros y monografías. Es uno de los matemáticos mexicanos con mayor número de citas a sus trabajos (alrededor de 800).

Ha supervisado 12 estudiantes de doctorado (7 del Cinvestav, 3 de la Facultad de Ciencias de la UNAM, 2 de la UAM-I), 28 de maestría y 3 de licenciatura.

http://www.math.cinvestav.mx/~ohernand/

http://www.ccc.gob.mx/semblanzas/430-onesimo-hernandez-lerma

http://www.ccc.gob.mx/counselors/345-onesimo-hernandez-lerma

De 1998 a 2000 fue investigador titular en el Laboratorio Nacional de Informática Avanzada, en Xalapa, Veracruz. Desde 2001 es investigador titular (actualmente es Investigador CINVESTAV **3-D**) en el Departamento de Computación del CINVESTAV-IPN, donde estableció el "*Evolutionary Computation Group*".

El Dr. Coello ha impartido ponencias magistrales, pláticas invitadas y tutoriales en Estados Unidos, Canadá, Brasil, España, Uruguay, Inglaterra, Suiza, Colombia, Chile, Argentina, Singapur, India y México. Actualmente es Miembro del Sistema Nacional de Investigadores (como Investigador Nacional Nivel **3**), del Consejo Consultivo de Ciencia y Tecnología del CONACyT, de la Academia Mexicana de Ciencias y de la *Association for Computing Machinery* (ACM). También es *senior member* de la *IEEE Computational Intelligence Society* (donde funge como "chair" de la "*task force on evolutionary multiobjective optimization*").

El Dr. Coello ha impartido diversos cursos a nivel licenciatura y posgrado desde hace 17 años. En el CINVESTAV-IPN, ha impartido cursos de optimización (con técnicas de programación matemática), computación evolutiva y optimización evolutiva multiobjetivo. A lo largo de sus 11 años como investigador, ha dirigido 7 tesis doctorales, 21 tesis de maestría y 4 de licenciatura. Ha sido miembro de los comités científicos de más de 50 congresos internacionales (incluyendo las conferencias más importantes de computación evolutiva) y revisor técnico . para más de 40 revistas internacionales. Es Editor Asociado de la revistas *IEEE Transactions on Evolutionary Computation* (IEEE Press), *Evolutionary Computation* (MIT Press), *Computational Optimization and Applications* (Springer), *Pattern Analysis and Applications* (Springer) y *Journal of Heuristics* (Springer). También pertenece a los comités editoriales de las revistas *Soft Computing* (Springer), *Engineering Optimization* (Taylor & Francis) y el *International Journal of Computational Intelligence Research* (The International Computational Intelligence Society).
Es autor de más de 180 artículos publicados en revistas y congresos internacionales con arbitraje estricto, así como 20 capítulos para libros publicados en inglés por editoriales de prestigio. También es autor del libro *Evolutionary Algorithms for Solving Multi-Objective Problems* (Kluwer Academic Publishers, 2002), del cual recientemente se publicó la segunda edición (Springer, 2007). También fue editor del libro *Applications of Multi-Objective Evolutionary Algorithms* (World Scientific, 2004) y es autor del libro de divulgación titulado *Breve Historia de la Computación y sus Pioneros* (Fondo de Cultura Económica, 2003).
Varios de los trabajos del Dr. Coello han recibido el " best paper award" en congresos internacionales, y 3 de las tesis doctorales que ha dirigido han recibido el Premio a Mejor Tesis Doctoral en el Certamen Anual de la Asociación Nacional de Instituciones de Educación en Informática (ANIEI).
Sus publicaciones reportan más de 1040 citas en el *ISI Citation Index*, además de tener documentadas unas 1000 citas adicionales en otras fuentes, que incluyen más de 20 libros monográficos (en inglés), congresos, y tesis doctorales de diversas partes del mundo. Dos de sus artículos han estado en la lista de artículos más citados en los últimos 10 años del *ISI Citation Index*.

http://delta.cs.cinvestav.mx/~ ccoello/
http://delta.cs.cinvestav.mx/~ ccoello/vitae/vitae.html
http://tequila.matem.unam.mx/capitulos/conferenciantes-distinguidos/dr.-carlos-a.-coello-coello
http://201.116.18.153/amc/cvpremios/Carlos_Coello_Coello.pdf

Abstract Book

1. AC1: Nonlinear systems
Wednesday (15:00-17:00) Room 4
Session Chair: Dr Jorge Dávila
Co-chair: Dr Bernardino Castillo

1.1 Tracking through singularities using a robust differentiator
B. Castillo-Toledo, A. López Cuevas
Institution: Centro de Investigación y de Estudios Avanzados del IPN, Unidad Guadalajara
In this work, an alternative solution to the tracking problem for a SISOnonlinear dynamical system exhibiting points of singularity is given. An inversion-based controller is synthesized using the Flies generalized observability canonical form (GOCF) associated to the system. This form depends on the input and his derivatives. For this purpose, a robust exact differentiator is used for estimate control derivatives signals with the objective of define a control law depending on such derivatives estimates of the control and on the states of the system. This control law is such that when is applied to the system it guarantees bounded tracking error near the singularities.

1.2 On the Robust Control Design for a Class of Nonlinear Affine Control Systems: Invariant Ellipsoid Approach
Omar González González, Alexander S. Poznyak Gorbatch, Vadim Azhmyakov
Institution: CINVESTAV-IPN
This paper is devoted to the problem of robust design for a class of continuous-time control systems with bounded uncertainties. We study a family of nonlinearly affine dynamical system and apply a modified invariant ellipsoid technique. This makes it possible to obtain practically stable closed-loop controllable models. The design of the stabilizing feedback control strategy is based on the conventional Lyapunov approach to invariant sets of dynamical systems. We propose a computational scheme for a constructive treatment a feedback control law such that the region of the

practical stability of the resulting system is minimized. The corresponding solution procedure contains an auxiliary LMI-constrained optimization problem. The effectiveness of the elaborated invariant ellipsoid based method is ilustrated by a numerical example.

1.3 A Linear Framework for the Robust Stability Analysis of a Generalized Super-Twisting Algorithm
Jaime A. Moreno
Institution: Instituto de Ingeniería, Universidad Nacional Autónoma de México
In this paper a linear framework is proposed for the analysis and design of stable and robust stable Generalized Super-Twisting Algorithms (GSTA). The GSTA includes a linear version of the algorithm, the standard STA and a STA with extra linear correction terms, that provide more robustness and convergence velocity. This linear framework allows to construct strong Lyapunov functions of quadratic-like type for the GSTA by means of Algebraic Lyapunov Equations (ALE), in exactly the same form for the linear STA and for the GSTA. When nonlinear perturbations are present this framework leads to the construction of robust Lyapunov functions by solving Algebraic Riccati Inequalities (ARI) or Linear Matrix Inequalities (LMI), that are identical for the linear and the nonlinear versions of the GSTA. The corresponding frequency domain interpretations are also identical for the whole class of GSTA.

1.4 Sliding Modes Parameter adjustment in the presence of fast actuators using invariant ellipsoids method
Jorge Davila, Alex Poznyak
Institution: Automatic Control Department, Centro de Investigación y Estudios Avanzados (CINVESTAV-IPN)
In this article a methodology for the design of the sliding surface and controller gain for standard sliding modes in the presence of fast actuators is presented. The technique of invariant ellipsoid and

Linear Matrix Inequalities (LMI) are used to solve the problem.

1.5 On the stabilization of the ball and beam system using a direct Lyapunov method

Carlos Aguilar-Ibañez
Institution: Centro de Investigación en Computación del IPN

I presents the stabilization of the ball on the actuated beam, whether the damping force acts or not in the non-actuated coordinate. The control law is based on the application of the traditional Lyapunov method. The balance strategy consists of shaping a convenient energy function that allow us to derive the required asymptotic stabilizing controller. To this end, we subtle introduce an auxiliary control variable in order to algebraically obtain the kinetic metric and the potential energy of the whole system. The formed positive energy function in conjunction with the proposed feedback controller assures that the whole system be a dissipative one.

Keywords: Lyapunov direct method, Lyapunov stability, Euler-Lagrange equations, Under-actuated mechanical systems.

1.6 Robust Control for a Class of Continuous-Time Dynamical Systems with Sample-Data Outputs

Manuel Mera, Alex Poznyak, Vadim Azhmyakov, Emilia Fridman
Institution: Departamento de Control Automático, CINVESTAV,

This paper addresses the problem of robust control for a class of nonlinear dynamical systems in the discrete-continuous time domain. We deal with nonlinear controllable models described by ordinary differential equations in the presence of bounded uncertainties. The full model of the control system under consideration is completed by linear sampling-type outputs. The linear feedback control design proposed in this manuscript is created by application of an extended version of the conventional invariant ellipsoid method. Moreover, we also apply some specific Lyapunov-based "descriptor techniques" from the stability theory of delayed systems. The above combination of the modified invariant ellipsoid approach and descriptor method make it possible to obtain the robustness of the designed control and to establish some well stability properties of dynamical systems under consideration. Finally, the applicability of the proposed method is illustrated by a computational example. A brief discussion on the main implementation issue is also included.

2. AC2: Stochastic Systems

Wednesday (17:20-18:40) Room 1
Session Chair:
Co-chair:

2.1 Optimal Risk-Sensitive Controller for First Degree Stochastic Polynomial Systems

María Aracelia Alcorta García, Michael V. Basin, Sonia Guadalupe Anguiano Rostro, Mauricio Torres Torres
Institution: Universidad Autónoma de Nuevo León

This paper presents the optimal risk-sensitive controller problem for first degree polynomial stochastic systems with a scaling intensity parameter, multiplying the diffusion term in the state and observations equations and exponential-quadratic cost function to be minimized. The optimal risk-sensitive controller equations are obtained based on the optimal risk-sensitive filtering and control equations for first degree polynomial systems and the separation principle. In the example, the risk-sensitive controller equations are compared to the conventional linear-quadratic controller equations for first degree polynomial systems. The simulation results reveal significant advantages in the criterion values in favor of the designed risk-sensitive controller, in particular, for large values of the scaling parameter.

2.2 Output Linear Feedback Tracking for Dicrete-Time Stochastic Model Using Robust Attractive Ellipsoid Method with LMI Application

Hussain Alazki, Alex Poznyak
Institution: Dept. Automatic Control, Centro de Investigación y de Estudios Avanzados del IPN,
We study the behavior of stochastic discrete-time models controlled by an output linear feedback during a tracking process. 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 "inaverage". 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. The suggested approach is illustrated by designing of a robust tracking controller for a benchmark example in the presence of stochastic noises in the state dynamics as well as in the output observations.

2.3 Mean-Square Joint State and Noise Intensity Estimation for Linear Stochastic Systems

Michael Basin, Alexander Georgievich Loukianov, Miguel Hernández González
Institution: Centro de Investigación y Estudios Avanzados del IPN
This paper presents the mean-square joint state and diffusion coefficient (noise intensity) estimator for linear stochastic systems with unknown noise intensity over linear observations, where unknown parameters are considered Wiener processes. The original problem is reduced to the filtering problem for an extended state vector that incorporates parameters as additional states. Since the noise intensities cannot be observable in the original linear system, the new quadratic vector variable formed by the diagonal of the matrix square of the system state is introduced. The obtained mean-square filter for the extended state vector also serves as the optimal identifier for the unknown parameters. Performance of the de-

signed mean-square state filter and parameter identifier is verified in an illustrative example.

2.4 Mean-Square State Filtering and Parameter Identification for Uncertain Linear Stochastic Systems

Michael Basin, Alexander Georgievich Loukianov, Miguel Hernández González
Institution: Centro de Investigación y Estudios Avanzados del IPN
This paper presents the mean-square joint state filtering and parameter identification problem for uncertain linear stochastic systems with unknown parameters in both state and observation equations, where the unknown parameters are considered Wiener processes. The original problem is reduced to the filtering problem for an extended state vector that incorporates parameters as additional states. The resulting filtering system is polynomial in state and linear in observations. The obtained mean-square filter for the extended state vector also serves as the mean-square identifier for the unknown parameters. Performance of the designed mean-square state filter and parameter identifier is verified for both, positive and negative, parameter values.

3. AC3: Identification and State Estimation

Wednesday (17:20-18:40) Room 2
Session Chair: Jean-Claude Carmona
Co-chair:

3.1 L1-L2 Robust Estimation in Prediction Error System Identification

Christophe Corbier, Jean-Claude Carmona, Víctor Alvarado
Institution: Laboratoire des Sciences de l´ Information et des Systémes, UMR CNRS, ENSAM.
The problem of robust system identification with corrupted data remains a difficulty. In this paper we shall put ourselves in the prediction error framework. We shall present a mixed estimator based on a parameterized objective function leading to

an alternative solution fighting against the outliers, based on the well-known Huber's M-estimate. A simple physical insight on the main noise characteristics of the data leads to a convenient choice of the scaling factor which automatically determines the balance between and contributions in the estimation procedure. Moreover, a general formalism leads to concise expressions of the gradient and the Hessian of the objective function which facilitate the estimation algorithm's synthesis. These expressions are established in the classical case of linear models. A new decision tool, namely the - contribution function of the residuals is proposed, which helps the user to determine the convenient model. Finally, some results on the frequency response of the best estimate are given for a semi finite acoustic duct used as an experimental set-up.

3.2 A New Asymptotic Polynomial Observer to Synchronization Problem

Juan Luis Mata, Rafael Martínez-Guerra, Ricardo Aguilar
Institution: CINVESTAV-IPN
In this paper, we consider the synchronization problem via nonlinear observer design. A new asymptotic polynomial observer for a class of nonlinear oscillators is proposed, which is robust against output noises. A sufficient condition for synchronization is derived analytically with the help of Lyapunov stability theory. The proposed technique has been applied to synchronize chaotic systems (Lorenz and Rössler systems) by numerical simulation.

3.3 A Bounded Error Observer for Synchronization of Chaotic Systems

Juan Luis Mata, Rafael Martínez Guerra, Ricardo Aguilar
Institution: CINVESTAV-IPN
In this paper, we propose a bounded error observer of reduced order for a class of chaotic systems. The state variables are estimated by means of output system, which is supposed to be exactly known. The estimation methodology is based on a suitable change of variable which allows gener-

ating artificial variables to infer the remaining states constructing a differential-algebraic structure. The proposed methodology is applied to a class of Lipschitz nonlinear systems with success. Some remarks about the convergence characteristics of the proposed estimator are given and numerical simulations illustrate the effectiveness of the suggested approach.

3.4 Nonlinear observer for Real-time attitude estimation

W. Fermín Guerrero Sánchez, José Fermi Guerrero Castellanos, Rigoberto Juárez Salazar, Benito Bernardino Salmerón Quiroz
Institution: Facultad de Ciencias Físico-Matemáticas, Benemérita Universidad Autónoma de Puebla (BUAP)
This paper deals with the attitude estimation of a rigid body equipped with a module of GAM sensors (rate gyros, accelerometers and magnetometers). 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 error dynamics can break up into two passive subsystems connected in "feedback". This property is a first and crucial result that could be 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. The effectiveness of the observer is confirmed in a real-time application.

4.   AC4: Optimization and Computational Methods
Wednesday (17:20-18:40) Room 3
Session Chair:
Co-chair:

4.1 A priori error estimates of mixed methods for quadratic convex optimal control problem governed by nonlinear parabolic equations
Institution: Institute for Computational and Applied Mathematics

In this paper we investigate a priori error estimates of quadratic convex optimal control problem governed by nonlinear linear parabolic equations using mixed finite element methods. The state and co-state are approximated by the lowest order Raviart-Thomas mixed finite element spaces and the control is approximated by piecewise constant functions. By applying some error estimates results of mixed finite element methods for partial differential equations, we derive a priori error estimates of optimal order both for the coupled state and the control approximation of the optimal control problem.

4.2 Constraints Analysis, Determination Twists inside Singularity and Parametrical Optimization of Parallel Mechanisms by means the Theory of Screws

Thanh Nguyen Minh, Quoc Le Hoai, Victor Glazunov
Institution: Manufacturing Automation Department, Hochiminh City University of Transport, Vietnam
This paper addresses the constraint analysis and determination of the twists inside singularity of parallel mechanisms to rely on the theory of screws. Moreover, modeling of working space and parametrical optimization of parallel mechanism are considered.

4.3 An Approach to Optimization of Linear Networked Systems based on the Hybrid LQ Methodology

Rosalba Galván Guerra, Vadim Azhmyakov, Juan Eduardo Velázquez Velázquez, Alexander Poznyak Gorbatch
Institution: Cinvestav Zacatenco
This paper deals with an optimal design of linear networked control systems. We study a class of delayed dynamical systems in the continuous time-domain and propose an optimization approach based on the newly elaborated hybrid LQ-type techniques.
Moreover, we develop an explicit connection between the given networked control processes and auxiliary hybrid models. The optimal feedback control strategy for the networked systems is obtained as a consequence of the Riccati-formalism for the associated hybrid LQ problems. We also consider some alternative optimization techniques and discuss stability properties of the optimal trajectories.

4.4 A computational method for the determination of attraction regions

Guerrero Sánchez W. Fermín, Guerrero Castellanos J. Fermi, Vladimir Alexandrov K.
Institution: Benemérita Universidad Autónoma de Puebla
The region of attraction of nonlinear dynamical system can be considered using an analytical R-function that can be written like an infinite series where each term of the series has the homogeneous form of degree $n \geq 2$ this function allows to determine and to come near to the region of attraction of a nonlinear system around the point of equilibrium located in the
origin. The analytical function and the sequence of this Taylor polynomials are constructed by a recurrence formula using the coefficients of the power series expansion of f at 0 [10].This paper describes a novel computational method using the Software MATHEMATICA for obtaining a solution to this problem, which was proposed by the Russian mathematician, V. I. Zubov. In order to evaluate the method, two examples are treated in which the exact attraction region is found in analytic closed form. Since the construction procedure requires the solution of a linear partial differential equation, there are many cases for which an exact analytic solution is not possible. In some of these cases, however, it is possible to construct an approximate series solution which is always at least as good approximation of the usual quadratic form of Lyapunov functions.The "trajectory reversing method" is presented as a powerful numerical technique for low order systems. Then an analytical procedure based on the same topological approach is developed, and a comparison is made with the classical Zubov method.

5.   AC5: Modern Applied Control I
Wednesday (17:20-18:40) Room 4
Session Chair:
Co-chair:

5.1 Optimal delayed control for an overhead crane
Carlos Vázquez, Joaquín Collado
Institution: CINVESTAV
This note studies a delayed control approach (open and closed loop)in order to attenuate the oscillations of a three degrees of freedom (3DOF) overhead crane system. The proposed control schemes have the capability of attenuate the oscillations during the travel phase and eliminated them at the end point. Both control schemes give us simple expressions for the optimal control parameters. We compared our results with numerical simulations and performed experiments over a laboratory overhead crane.

5.2 Two-Rotor VTOL miniUAV: Design, Modeling and Control
Escareno Juan, Salazar Sergio, Rondon Eduardo, Lozano Rogelio
Institution: Laboratorio "Franco-Mexicano de Informática y Automática" and "Laboratoire Heudiasyc, UMR CNRS 6599, Université de Technology
In this paper we present the design, modeling and control of a two-rotor vertical take-off and landing (VTOL) miniUAV.
The detailed dynamic model of the vehicle is deduced via the Euler-Lagrange formulation. We address the stabilization of the attitude and position of the vehicle to perform autonomous flight. For this purpose, we have proposed a nonlinear inner-outer loop controller, based on the timescale separation between the position(slow dynamics) and attitude (fast dynamics) stabilization. A visual-based position measurement system is used to estimate the aircraft's linear position. Experimental autonomous flight was successfully achieved, validating the proposed vehicle as well as the embedded control system.

5.3 Real-time Stereo Visual Servoing Control of an UAV having Eight-Rotors
Hugo Romero Trejo, Sergio Salazar Cruz, Rogelio Lozano, José Gómez
Institution: Universidad Autónoma del Estado de Hidalgo
This paper presents a visual feedback control of a small UAV using image-based visual servoing with stereo vision. In order to control the orientation and the position of flying robot with respect to an object or target well defined, we propose to use a navigation system based on binocular vision system combined with inertial sensors. This combination of sensors, allows us to get a complete characterization of the state of aerial vehicle. It means, using the stereo vision system we are able to estimate the UAV 3D position, while from the inertial sensors we can obtain the orientation of rotorcraft. Real time experiences are developed to validate the performance of navigation system proposed.

5.4 Oscillation attenuation in an overhead crane: comparison of some approaches
Carlos Vázquez, Joaquín Collado
Institution: CINVESTAV
This paper presents a second-order sliding mode (SOSM) control for oscillation attenuation in a five degrees of freedom (5DOF) overhead crane. Furthermore the paper illustrates how the prefilter can be advantageously combined with the SOSM controller to obtain a better performance in the oscillation attenuation problem. Additionally, we present a comparison with the well known proportional-derivative (PD) controller. The performance of the controllers is simulated in a nonlinear model and tested experimentally on a scale model of 5DOF overhead crane.

6.   AC6: Time delayed systems
Thursday (10:00-11:00) Room 2
Session Chair: Dra Sabine Mondié Cuzange
Cochair:

6.1 Reducing Stick-Slip Oscillations in Oilwell Drillstrings

Martha Belem Saldivar Márquez, Jean Jacques Loiseau, Sabine Mondié Cuzange
Institution: Department of Atomatic Control, CINVESTAV-IPN.

Torsional drillstring vibrations, also known as "stick-slip" oscillations appearing in oillwell drillstrings are a source of failures which reduce penetration rates and increase drilling operation costs. An important problem to solve is the determination of control laws that reduce stick-slip phenomenon. A distributed model for the drilling system is given, this model is reduced to a neutral type retarded model through two different approaches: the d'Alembert transformation and Laplace transforms techniques.

Some experience-based control strategies are evaluated in order to reduce stick-slip oscillations. The use of the angular velocity at the drillstring upper part, the torque on the bit and the weight on the bit is shown to have a key effect in the reduction of drillstring torsional vibrations.

6.2 Proportional retarded control of a second order system

Raúl Villafuerte, Sabine Mondié, Carlos Vázquez, Joaquín Collado
Institution: Department of Automatic Control CINVESTAV-IPN

A strategy for the tuning of a second order system in closed loop with a proportional retarded control law, based on the root location analysis of the system, is proposed. It is validated by achieving a significant reduction of the oscillatory behavior of a cart pendulum experimental setup.

6.3 Lyapunov matrix of linear systems with delays: a polynomial approximation

Erick Eduardo Huesca Lazcano, Sabine Mondié
Institution: CINVESTAV

A polynomial approximation of the Lyapunov matrix appearing in the complete type Lyapunov Krasovskii functionals associated to time delay systems of retarded type with multiple arbitrary delays is proposed. Two measures of the quality of the approximation are provided: the first one is an estimate of the error in the derivative and the second one is based on the symmetric property.

7.   AC7: Power Systems and Induction Motor Control I

Thursday (15:00-17:00) Room 4
Session Chair: Dr Juan M. Ramírez
Co-chair:

7.1 Third-Order Quasi-Continuo Control of Induction Motor

José Manuel Cañedo Castañeda, Leonid Moiseevich Fridman, Alexander Georgievich Loukianov, Fredy Alberto Valenzuela Murillo
Institution: Centro de Investigación y de Estudios Avanzados del IPN Unidad Guadalajara

This paper presents the robust control design for the angular speed and the flux module in three-phase induction motors based in the canonical form technique using the third-order quasi-continuo control algorithm. The proposed controller incorporates an observer with discontinuous input and super-twisting control algorithm which gives an estimate of the unknown variables. A robust differentiator is employed for estimate the second derivative of the sliding manifold. The performance and robustness of the proposed controller are verified by means of the digital simulation.

7.2 Second Order Sliding Mode Sensorless Torque Control of Induction Motor

Marcos Israel Galicia Cueva, Alexander Georgievich Loukianov, Edgar Nelson Sánchez Camperos
Institution: Centro de Investigación y de Estudios Avanzados del I. P. N. Unidad Guadalajara

In this paper the torque and the square of the rotor flux magnitude control using second order sliding mode controller for an induction motor, is proposed. Designed super-twisting controller permits

to reduce chattering that is inherent in standard sliding mode control and to improve accuracy. To estimate the rotor flux and speed, an adaptive observer is proposed. The effectiveness of the designed control scheme is confirmed via simulation.

7.3 Multi-Swing Trajectory Analysis using Time-Varying One-Machine Infinite Bus Equivalents

Juárez-Toledo Carlos, Martínez-Carrillo Irma, Nancy Jacqueline Pacheco-Martínez
Institution: Department of Electrical Engineering, UNAM, Mexico D.F

In this paper a method for identifying the multi-swing stability is presented. The method is based in finite-differences of the time-varying One-machine Infinite-Bus (OMIB) equivalents. Conventionally the problem of transient stability has been studied by means integration methods being limited to the analysis of first oscillation. The key of this article to expand the conventional methodology to study the stability multi-oscillations by means of the analysis of a criterion based on the derived of the angle OMIB. The proposed method establishes the multi-swing stability on the power system using the second derivate test criterion based on the gradient OMIB.

The effectiveness of the proposed technique is tested on a realistic 45-machine power system model representing parts of the Mexican interconnected system.

7.4 A passive speed observer for induction motor

Ricardo Alvarez Salas, Marco Antonio Gallegos Lara
Institution: CIEP Facultad de Ingeniería Universidad Autónoma de San Luis Potosí

In this paper, the observer design problem for sensorless motors is approached by means of an estimation technique which exploits some properties of the error dynamic that make feasible to express this system as a feedback interconnection, subject to a disturbance signal, of two sub-

systems that can be rendered passive via a proper choice of the output injection terms. Then, a semiglobal convergent low order observer, which simultaneously estimates rotor fluxes and motor speed in presence of unknown constant load torque, is proposed. Passive speed observer performance is experimentally evaluated and compared with results obtained under the same conditions for an observer based on a model reference adaptive system.

7.5 Adaptive Voltage Regulator for Secondary Reactive Power Control in a Power Station

Ruben Tapia, Juan M Ramirez, Felipe Coyotl
Institution: Universidad Politécnica de Tulancingo

This paper is aimed to present the performance of a B-spline neural network controller to regulate the reactive power provision from synchronous machines. Due to the fact that power systems possess non-stationary parameters and changing settings, adaptive control schemes are preferred. Control technology must ensure its performance in terms of power system's practical operation to address the diversity of loads connected to maximize the available resources. The B-spline neural network is a convenient tool to implement the adaptive voltage regulator, with the possibility of carrying out this task on-line considering the systems' non-linearities. The reactive power contribution is based on the premise that each machine must provide an amount according to its nominal operating capacity. The applicability of the proposal is demonstrated by simulation of a multi-machine power system.

7.6 DVR's control based on instantaneous power

Pedro García Vite, Juan M Ramírez, Johnny Posada
Institution: Cinvestav - Unidad Guadalajara

This paper is aimed to present the control of the dynamic voltage restorer (DVR), which allows takes into account both balanced and unbalanced disturbances. The controllers are based on the Clarke transformation and the instantaneous power theory. The main mathematical relation-

ships are detailed. Through simulation the proposition applicability is exhibited.

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8. AC8: Power Systems and Induction Motor Control II

Thursday (17:20-18:20) Room 1
Session Chair: Dr Victor M. Cárdenas Galindo
Co-chair: Janeth A. Alcalá Rodríguez

8.1 Application Issues of Four Step Technique Used in Harmonic Voltage Compensator Based in a Single-Phase Matrix Converter

Tonatiuh Echegoyen Arellano, Víctor Manuel Cárdenas Galindo, Jesús Reyes Malanche
Institution: Universidad Autónoma de San Luis Potosí

This paper presents some practical issues to be considered in the PWM control system of a single-phase matrix converter used in a series active filter, avoiding short circuit conditions. The matrix converter is controlled using the four-step strategy, which is built digitally in a FPGA system. The harmonic compensator control is generated by using the single-phase dq theory and it is programmed in a DSpace system. The proposed strategies are verified by means of simulation and experimental results in a 3.6 kW, 127 V, 60 Hz prototype.

8.2 Linear Operating Region of a Single - Phase BTB Converter to Bidirectional Power Transfer

Janeth A. Alcalá Rodríguez, Víctor Manuel Cárdenas Galindo, Emanuel Rosas Hernández, Nancy Visairo Cruz, Ricardo Sierra Rivera
Institution: Universidad Autónoma de San Luis Potosí

Single phase Back to Back (SPBTB) converter is widely used for power transfer in order to increase the performance of electrical power systems; however to take advantage of a SPBTB response it is necessary to avoid over-modulation conditions. This paper deals with an analytical procedure to obtain a SPBTB operating region to guarantee

power transfer of each one of the converters of a SPBTB without over-modulation. On the other hand, it is required to know the capacity of the energy store element; in this work, considering a dc link voltage ripple, a capacitor value is calculated in order to allow the adequate power management. Graphics and simulations are presented to demonstrate the analysis validity.

8.3 Active and Reactive Current Decoupled Control Strategy Applied to a Single-Phase BTB Converter

Emanuel Rosas Hernández, Víctor Manuel Cárdenas Galindo, Janeth A. Alcalá Rodríguez, Ciro Alberto Núñez Gutiérrez
Institution: Universidad Autónoma de San Luis Potosí

This paper presents a comparison of two control strategies applied to a Single-Phase Back to Back converter. Both techniques use two loops: one inner current loop and an outer voltage loop. The first control strategy is based on a classical PI control. The second one uses a control scheme to decouple the active and reactive component of the input current, obtaining a better steady state and dynamic response of the system. The performance is verified with simulation and experimental results.

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9. AC9: Neural, Fuzzy and Petri Net Control I

Thursday (17:20-18:20) Room 4
Session Chair: Fernando Ornelas Téllez
Co-chair: Dr Alejandro Malo

9.1 Petri Net Tool for the Construction of Street Networks

Alejandro Justo Malo Tamayo
Institution: Centro de Investigación y de Estudios Avanzados del I.P.N.

The street network of a city is a dynamic entity in continuous change. Sometimes change can be seen as 'permanent', sometimes as 'temporary.' New streets or changes to existing streets can be

seen as permanent. Signal malfunctions, potholes, accidents change the capacity of the network can be seen as a temporary change. The dynamic nature of the network requires a tool to model and analyse it; while allowing constants updates. This work proposes a Petri net tool that allows the user to flexibly model, modify and analyze in a progressive fashion a street network. An example of its use is included. The work is restricted to the definition of the network.

9.2 Reduced Neural Observers for a Class of MIMO discrete-time nonlinear system

Alma Y. Alanís, Edgar N. Sánchez, Esteban A. Hernández
Institution: Universidad de Guadalajara

A nonlinear discrete-time reduced order neural observer for the state estimation of a discrete-time unknown nonlinear system, in presence of external and internal uncertainties is presented. The observer is based on a discrete-time recurrent high order neural network (RHONN) trained with an extended Kalman filter (EKF)-based algorithm. This observer estimates the state of the unknown discrete-time nonlinear system, using a parallel configuration. The paper also includes the stability proof on the basis of the Lyapunov approach. To illustrate the applicability simulation results are included.

9.3 Non-blocking Step State-feedback Supervisory Control of Discrete Event Systems using Interpreted Petri Nets

Alejandra Santoyo Sánchez, Luis Isidro Aguirre Salas, Celia B Villanueva Novelo, Carlos De Jesús Velásquez
Institution: Universidad de Guadalajara Depto. de Computación CUCEI

This paper deals with supervisory control of Discrete Event Systems (DES) by state feedback in order to avoid uncontrollable specifications and blocking. Based on separation between the model representing what the system can do, the model of what the system should do (the specification) and the model of what the system does (the controlled process). In this approach, the specifica-

tion and the system model are described by IPN, and the specification describes a state subset that the specification must reach. It also captures the order, in which these states must be reached. The method to translate the specification language in term of the system language includes structural information of both IPN (system and specification) to define trace equivalence, which to avoid blocking and uncontrollability. Moreover, this work presents a technique to modify trace equivalence based on the inclusion of uncontrollable events to guarantee controllability (compute of the infimal controllable language). All algorithms herein purposed have being implemented in MAPLE.

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10.   AC10: Feedback and Fequency Domain Analysis
Thursday (10:00-11:00) Room 3
Session Chair:
Co-chair

10.1 New results on the state feedback realizability of full column rank precompensators

Eduardo Castañeda, Javier Ruiz
Institution: CINVESTAV-IPN, Unidad Guadalajara

In this paper, new results on the structural properties related to the static state feedback realizability of full column rank precompensators for linear multivariable systems are presented. Necessary structural conditions for a given full column rank precompensator to be state feedback realizable are stated in terms of the zeros of the compensator, the modes of the system, the zero-pole structure of the compensated system and the controllability indices of the system.

10.2 Frequency-Change Analysis of Nonlinear System Using Spectrum (Fast Fourier Transform) Theory

Javier García-Guzmán, Carlos Castillo-López, Carlos Juárez-Toledo
Institution: Department of Electrical Engineering, UNAM, Mexico D.F

The study of nonlinear behavior near an equilibrum point is of considerable importance in power system. In this paper, some systematic procedures based on normal form (NF) theory are proposed for studying the influence of high order terms arising from the Taylor series expansion of the system model on power system dynamic behavior. Using this method, a third-order model of the power system is proposed in which weak system nonlinearities are explicitly represented. Analytical expressions are then developed that provide To check the validity of the Frequency-Change method, experiments were obtained using single-machine infinite-bus system using a classical representation. The purpose of these experiments is to find the phase difference between the classical model and the nonlinear equivalents.

10.3 Structural Controllability of Composite Systems in Frequency Domain
Liu GuanMin, Lu KaiSheng
Institution: Department of Marine Automation, Wuhan University of Technology
This paper studies the structural controllability of the parallel and the tandem connection of two structural controllable and observable linear time-invariant subsystems in the representations of the transfer function matrices. The structural rank criterions are stated in terms of the co-primeness rank criterions and two properties of linear systems over F(z) to simplify the structural controllability estimation of composite system.

11.   AC11: Power Systems and Induction Motor Control III
Friday (10:00-11:00) Room 4
Session Chair: Dr Daniel U. Campos-Delgado
Co-chair: Dr José M. Cañedo

11.1   Discrete-Time Adaptive Neural Backstepping Control for a Double Fed Induction Generator
Riemann Ruíz Cruz, Edgar Nelson Sánchez Camperos, Alexander Georgievich Loukianov

Institution: CINVESTAV-IPN Campus Guadalajara
This paper presents a discrete-time adaptive neural backstepping control for a double fed induction generator connected to an infinity bus, based on a discrete-time high order neural network (HONN), which is trained with an extended Kalman filter (EFK) algorithm. The discrete-time adaptive neural backstepping control performance is illustrated via simulations.

11.2 Direct Electromagnetic Torque Controller of a Wound Rotor Induction Generator via Second Order Sliding Modes
Onofre Morfin, José Cañedo, Alexander Loukianov
Institution: CINVESTAV-IPN, Unidad Guadalajara
In this paper, we propose a robust non-linear controller based on a second order sliding mode technique named super-twisting method. The control scheme is proposed to control, in direct form, the electromagnetic torque and stator reactive power of a wound rotor induction generator 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.

11.3 Parameters Identification in Induction Motors Following Hyperplanes Optimization
Daniel U. Campos-Delgado, Diego R. Espinoza-Trejo, Edgar Arce-Santana
Institution: Universidad Autónoma de San Luis Potosí
In this work, it is proposed a simple off-line identification algorithm for an induction motor (IM) based on a novel optimization scheme, called hyperplanes optimization. The main idea of the identification scheme is to convert the problem of parameters characterization to a finite dimensional optimization problem over a bounded set. The proposed approach relies on the information of a hard or soft startup of the motor, in order to identify all 7 IM parameters: stator and rotor leakage inductances, stator and rotor resistances, mutual inductance, mechanical inertia and friction coefficient. Finally, the hyperplanes optimization is extended using
an iterative approximation to the optimal param-

eters, and compared to an stochastic search algorithm. Experimental results in 1 HP and 3 HP IM test-rigs show an accurate characterization with the proposed identification scheme, and validate the approach illustrated in this work.

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12.   AC12: Modern Applied Control II
Friday (13:30-14:30) Room 1
Session Chair:
Co-chair:

12.1 Design Considerations for Monolithic Integration of a Micro Hotplate Temperature Controller of a MEMS Gas Sensor.
Salvador Mendoza Acevedo, Mario Alfredo Reyes Barranca,Luis Martín Flores Nava, Alejandro Ávila García, José Luis González Vidal
Institution: CINVESTAV-IPN
A control system to regulate the temperature of the micro hotplate of a MEMS gas sensor is presented. The heating element, called micro hotplate, is comprised of a micro heater and a temperature sensor, both made with polysilicon, located near each other. This material has a Temperature Coefficient of Resistance (TCR) that is the base for the design of the temperature controller of the gas sensor system. A high temperature between 250 and 400 °C is necessary to produce a chemical reaction between the gas and the sensing film and a good temperature control for the micro hotplate is desired. Objectives as thermal insulation of the circuitry from the heating element, having a monolithic sensor system, and low power consumption, are the main specifications for the system. This is obtained by means of a micro pit realized with MEMS micromachining processes. The analysis of the circuit proposed to comply with these characteristics is presented, for the future integration with a standard CMOS technology. A trade off is observed between the sensor structure parameters and the circuit design.

12.2 A Maneuver Control Strategy for Optical Tweezers
Carlos Aguilar-Ibañez, Miguel S. Suárez-Castañón, Luis I. Rosas-Soriano
Institution: Centro de investigación del Instituto Politécnico Nacional
A control strategy for changing the position of an immersed micro particle in a viscous medium and trapped by optical tweezers is presented. The feedback controller was designed under the consideration that the mass of the micro particle is sufficiently enough so it can be discarded from the equations of motion. In practice it is true, since the inertial force produced by the motion of a micron-scaled trapped particle is completely dominated by the medium viscous drag force. To carried out the stability analysis of the controlled system the standard Lyapunov stability theory was used. Numerical simulations were performed to show the robustness of the obtained closed-loop system in the presence of random thermal noise.

12.3 On the approximated control of Optical tweezers via flatness based approach
Carlos Aguilar I., Hebertt Sira-Ramírez, Luis I. Rosas-Soriano
Institution: Centro de Investigación en computación del IPN
A flatness based control strategy for the manipulation of a microscopical particle is presented in this paper. The strategy was possible due to the fact the Optical Tweezers (OT) is a flat system, with flat outputs given by the horizontal and vertical position coordinates of the geometric center of the laser beam. The controller was designed under the consideration that the particle is suspended in a frictionless medium. Therefore the stability analysis was relatively simple. The effectiveness of the control strategy was tested by numerical simulations, where the system tracked a straight line, an elliptic curve, and carry out the rest-to-rest transfer maneuver task by using a smooth trajectory.

13.   AC13: Neural, Fuzzy and Petri Net Control II
Friday (13:30:00-14:30) Room 2
Session Chair:
Co-chair:

13.1 Discrete Time Inverse Optimal Neural Control: Application for a Planar Robot
Fernando Ornelas, Edgar Nelson Sánchez, Alexander Georgievich Loukianov
Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional - Unidad Guadalajara
This paper presents an inverse optimal neural controller, which is constituted by the combination of two well known techniques: a) inverse optimal control to avoid solving the Hamilton Jacobi Bellman (HJB) equation associated to nonlinear system optimal control, and b) an on-line neural identifier, which uses a recurrent neural network, trained with the extended Kalman filter (EKF), in order to build a model of an assumed unknown nonlinear system. The applicability of the proposed approach is illustrated via simulation by the control of a planar robot.

13.2 Neural Network Identi-cation of Uncertain 2D Partial Differential Equations
Isaac Chairez, Rita Fuentes, Alexander Poznyak, Tatyana Poznyak, Marisol Escudero, Laura Viana
Institution: UPIBI-IPN
There are many examples in science and engineering which are reduced to a set of partial differential equations (PDE's) through a process of mathematical modeling. Nevertheless there exist many sources of uncertainties around the aforementioned mathematical representation. It is well known that neural networks can approximate a large set of continuous functions defined on a compact set to an arbitrary accuracy. In this paper a strategy based on DNN for the non parametric identi-cation of a mathematical model described by a class of two dimensional (2D) partial differential equations is proposed. The adaptive laws for weights ensure the "practical stability" of the DNN trajectories to the parabolic 2D-PDE states. To verify the qualitative behavior of the suggested methodology, here a non parametric modeling problem for a distributed parameter plant is analyzed.

13.3 Fuzzy Control with Time Delay estimation for Networked Control Systems
Paul Erick Mendez Monroy, Héctor Benítez Pérez
Institution: PI-UNAM
This paper presents a fuzzy control strategy with estimated Round Trip Time delay for linear Networked Control Systems, the fuzzy model is designed from a continuous linear model, and the fuzzy control is designed by Linear Quadratic Regulation a stability analysis is present. A Magnetic Levitation system is using as case study to shows the effectiveness of control and robustness to traffic.

14.   AC14: Optimization and Computational Methods II
Friday (13:30-14:30) Room 3
Session Chair:
Co-chair:

14.1 Time-Optimal Arriving Control of Material Point in Multidimensional Space
Jesús Alberto Meda Campaña, Valery R. Nosov, Julio César Gómez Mancilla
Institution: National Polytechnic Institute
In this paper, the problem of taking a material point from arbitrary initial conditions to the origin, in the minimum possible time, is addressed. It is considered that the motion of the material point is defined on a multidimensional region. Under this assumption, it is shown that for controllable systems there exists an infinity of time-optimal controls, which have sufficiently strange forms.

14.2 An algebraic denoising scheme
John Alexander Cortés-Romero, Carlos García

Rodríguez, Alberto Luviano Juárez, Rogelio Portillo Vélez, Hebertt Sira Ramírez
Institution: Universidad Nacional de Colombia CINVESTAV

In this paper, the noise filtering problem ("denoising" problem) is approached via a suitable modification of the traditional Luenberger observer approach, also known as the "high gain observer" approach (HGO). The HGO observer is, fundamentally, a Luenberger observer with large stable eigenvalues of the output estimation error dynamics. HGO and some of its modifications have been particularly useful in the linear based control of perturbed linear and nonlinear systems. HGO are, however, inappropriate to deal with noisy injection signals and noisy plants. To overcome this fact, the structure of the Luenberger state estimator reconstructing the time derivatives of the given signal is enhanced against the effects of noise by means of an algebraic filtering scheme. The algebraic filtering consists in a suitable modification of the recently introduced algebraic parameter identification methodology. The proposed approach is capable of attenuating the noise effects significantly. The proposed strategy is illustrated via numerical simulations.

14.3 Hybrid Differential Algebraic Equations Approach for Modeling Interconnected Power Networks

María Fernanda Mejía Pinzón, Sylvain Claude Leirens
Institution: Universidad de Los Andes

In this paper a Hybrid Differential Algebraic Equations (HDAEs) approach is developed for modeling interconnected power networks. After some theoretical aspects, the Differential Algebraic Equations (DAEs) that describe the dynamics of a 4-Bus power network is obtained. Then a HDAEs model is proposed to simulate the hybrid behavior when the line tripping of one of the network lines occurs, making the system to operate in two different modes.

15.   AC15: Chaotics Systems

Friday (13:30-14:30) Room 4
Session Chair: Dr Joaquín Collado
Co-chair:

15.1 Chaos synchronization of hyperchaos Lorenz system via nonlinear control

Saleh Sayyad Delshad, Arash Golabi, Mohammad Taghi Hamidi Beheshti
Institution: Tarbiat Modares University

In this paper, chaos synchronization of hyperchaos Lorenz system [Xingyuan Wang, Mingjun Wang, "A hyperchaos generated from Lorenz system," J. Physica A, pp. 3751-3758, 2008] is investigated. Based on the Lyapunov stability theory, a novel nonlinear controller is designed that guarantees the global and exponential asymptotical stability of the origin of considered system. Finally, numerical simulations are provided to show the effectiveness of proposed nonlinear controller.

15.2 Reshaping Arnold tongues

Luis Moreno-Ahedo, Joaquín Collado
Institution: Automatic control deparment, CINVESTAV-IPN

We shall present some results about shaping the Arnold´s tongues.

15.3 PI Controller with Dynamic Gains calculation to comply with Time Specs in presence of Parametric Disturbances

Marco Antonio Paz Ramos, Suselle Cristal Garibo Esquivel, Carlos Alejandro De Luna Ortega, José Iván Orlando Rodríguez Martínez
Institution: Universidad Politécnica de Aguascalientes

In this paper we introduce an adaptive structure that dynamically calculates the gains of a PI controller, in presence of parametric disturbances in the controlled process approach, with the purpose of maintaining a desired pole assignment in closed loop, besides fulfilling a specified time closed loop performance. The designing procedure presented in this work is useful when the process to be con-

trolled can be satisfactorily accomplished with a first or second order transfer function.

16.   BIO1: Biomedical Engineering
Wednesday (12:30-13:30) Room 2
Session Chair: Dr. Carlos Alvarado Serrano

16.1 On a Wireless Power Transmission System for an Implantable Prosthesis Telemetry Unit

Aidee Huerta Lecona, José de Jesús Gutiérrez Cortés, Octavio Rodríguez Torres, Marco Pedro Ramírez Tachiquin
Institution: Escuela de Ingeniería de la Universidad La Salle

We propose a wireless electrical power transmission system, for energizing a stress monitoring arrangement on the surface of a Titanium based-alloy prosthesis implant. Applying standard methods for characterizing cylindric coils, we find a frequency range that warrants the maximum power transmission, and we propose an electronic circuit for transmitting the sensed values by virtue of radio waves. We also mention some unexpected phenomena of power transference at very low frequencies.

16.2 Actuator Fault Tolerant Control for an Artificial Pancreas

Octavio Vega-Hernández, Daniel U. Campos-Delgado, Diego R. Espinoza-Trejo
Institution: Universidad Autónoma de San Luis Potosí

With recent advances in continuous glucose sensors and portable insulin pumps, the concept of an artificial pancreas is now feasible. However, due to continuous operation, the actuator in this system could fail in some degree. In this sense, this paper addresses model-based fault diagnosis using a glucose-insulin model developed by Hovorka et al. (2004), and extended with an interstitial compartment to reproduce subcutaneous glucose measurements. First, a nominal feedback controller is designed following a pole-placement technique and internal model principle. In addition, a feedforward action is included to compensate fast glucose excursions due to meals. For fault diagnosis purposes, meals are considered as partially known perturbations in the system, so their information is appended into the glucose-insulin model as an exosystem with nominal initial conditions. A nonlinear PI observer is then designed using the extended glucose-insulin model to generate a dedicated residual for fault diagnosis. After fault detection and identification, the controller gain is modified in order to compensate the effect of the fault. These ideas are validated in simulation under a closed-loop configuration, and fault conditions of sub and over-dosing in the insulin pump.

16.3 Insect Control by Radio-Frequency High-Strength Electric Fields

Iryna Ponomaryova, Alejandro López Torrecillas, Nefi Alejandro Barron Herrera, Ana Dulce Ibarra Velázquez
Institution: ESIME-Culhuacán, IPN

Insect control with radio-frequency electric fields of high strength is reported here. The experiments were accomplished at frequencies 47.5, 900 and 2,450 MHz for both the pulse modulated and the continuous wave RF radiation. The coaxial type chamber experiments on Sitophilus granarius L. (granary weevil) at voltages U = 5.5-10.5 kV, frequency 47.5 MHz, electric fields 180-350 kV/m and exposures 5-60 s give 40-90% of mortality that mainly depends on voltage increase. The irradiation chamber with plane capacitor experiments are pulse modulated at the frequency 47.5 MHz and fields 350-2,000 kV/m. 100% of mortality is reached at the exposures 1-30 s and field 2,000 kV/m. The RF radiation of granary weevil in the coaxial irradiation chamber in stationary mode reaches 100% mortality at major exposure times and frequencies 900 and 2,450 MHz. Stationary mode permits 21-97% fungi control at voltage U = 10.5 kV, frequencies 900 and 2,450 MHz and exposures 120-180 s

17.   BIO2: Biomedical Engineering
Wednesday (15:00-17:00) Room 2
Session Chair: Dr. Arturo Vera Hernández

17.1 New Exact Solutions for the Three-Dimensional Electrical Impedance Equation applying Quaternionic Analysis and Pseudoanalytic Funtion Theory

Marco Pedro Ramírez Tachiquin, Octavio Rodríguez Torres, José de Jesús Gutiérrez Cortés
Institution: Escuela de Ingeniería de la Universidad La Salle
We introduce a set of linearly independent solutions for the three-dimensional quaternionic Electrical Impedance Equation, when the conductivity is a two-dimensional separable-variables function, and using a generalization of the Beltrami equation, we study two particular cases when the Electrical Impedance Equation turns into a p-analytic system. Then we express analytically its general solution in terms of Taylor series in formal powers. This allows us to introduce a new class of exact solutions for the three-dimensional Electrical Impedance Equation.

17.2 Electrical Stimulation to Vagina Muscle cells and Rabbit bladder Muscle and Epithelial cells In-Vitro to change Growth Factor

Ernesto Paredes Martínez
Institution: National Polytechnic Institute of Mexico, ESIME-UPC (IPN)
We stimulated electrically (In-Vitro) Vagina muscle cells and Rabbit bladder muscle and Epithelial cells, in order to see the effects on growth rate in the cultures. In two medium cultures "A" (control) and "B" (stimulated) we obtained a significant difference cell growth stimulating with a bipolar wavelet with 400 mVpp and 200 Hz of frequency applied on vagina muscle cells in passing 3, and a 150 mVpp wavelet (with 3.33 Hz, and 10 Hz) on rabbit bladder muscle and epithelial cells for primary culture, passing 2 and 3 [A][B]. We present the results generated by stimulating on muscle and epithelial cells cultures to obtain different viability and proliferation in comparison to control

cells. These results (and future ones) will be used to find an optimal wavelet to control the growth factor in cells to improve the quality of neo-tissues in human bladder.

17.3 Performance simulation of retinal partial operations in ON- and OFF-Centers

Gelacio Castillo-Cabrera, M. Alfredo Reyes Barranca, Jair García Lamont
Institution: CINVESTAV-IPN
The object the present work is to present a model for a retinal prosthesis. The translation of an algorithm on the standard technology of silicon sets a trade off between accurate of model and feasibility to implementation. That is, a high accurately of the model, normally results in more complexity, and therefore minus feasibly its implementation in hardware. To develop the model was necessary to review the receptive field concept, its classification and retinal architecture. The model consists in to reproduce the signal in a ganglion cell. This model has the advantage that is very simple with a high feasibly to implement on standard technology silicon. The mathematical representation comprises sustained and transient response which is the classification of the receptive fields. A second contribution of this work is the interpretation of the response of ganglion cell which will be analyzed along the developmental of this work. Simulations results are presented using the mathematical representation.

17.4 Analysis of simulated electrogastrogram signals using parameters associated with correlation for detection of phase shift between signals

Juan M. Ramírez, Kathy M. Carmona, Laura Ivoone Garay
Institution: Unidad Profesional Interdisciplinaria de Ingeniería y Tecnologías Avanzadas, IPN
This paper presents a parameter obtained from the difference in the correlation of simultaneously recorded signals along abdominal wall, as a possible guideline for the determination of abnormal phase shift associated with stomach pathologies. A database of simulated signals, with 105 ran-

domly selected pacemaker frequency, in three possible cases (namely bradygastria, typical gastric frequency and tachygastria), seven different phase shifts and five levels of white noise were used in testing the suggested parameter. The auto-correlation of the first signal and the cross-correlation of both signals were computed and plotted together; vectors from origin to peaks of each signal, average of differences in magnitude between signals peaks and standard deviation of all of them were obtained. These values were compared with previous associated ranges obtained from one half of the database, and a detection of 100 % cases of 8 randomly selected test signals from the remaining available data were achieved. This new parameter, along with the pacemaker frequency are considered as possible inputs in a neural network for automatic identification of normal phase shift in future research.

17.5 Electrocardiography System of Twelve Leads for the Study of the Spatial Variability of Ventricular Repolarization Intervals

Rafael Gómez-Rodríguez, Héctor Rodríguez-Colín, Carlos Alvarado-Serrano
Institution: Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional
This work describes the design and operation of a electrocardiograph capable of acquiring simultaneous recordings of 12-lead for the study of the spatial variability of ventricular repolarization intervals. The electrocardiography system consists of an acquisition module with a dedicated channel for each lead with a circuit for detection of lead failure. Each channel has a gain of 1000, a CMRR of 90 dB and a bandwidth of 0.05 Hz to 150 Hz. It uses a isolated power supply and high isolation amplifiers at the output system. An additional stage of programmable amplification is added for signals conditioning before being acquired by the computer. The communication between these systems is by the USB port using a commercial data acquisition system (ADS) model Ni-USB 6211 with a resolution of 16 bits. The system display the 12-lead with a interface developed in LabVIEW and the data can be stored in ".xls files" for later processing.

17.6 Non-invasive estimation of a non-linear temperature gradient using spectral analysis of multi-echo ultrasonic signals.

Ivonne Bazán Trujillo, Antonio Ramos Fernández, Arturo Vera Hernández, Rubén Posada, Lorenzo Leija Salas
Institution: Instituto Tecnológico de Orizaba
An spectral analysis technique, that establishes a linear relation between the temperature changes in a body and the frequency displacement in the overtone peaks being displayed in the Power Spectral Density (PSD) of ultrasonic echo-signal, has been improved and applied by the paper authors to estimate temperature gradients induced inside a biological phantom by means of ultrasonic therapeutic radiation. In order to evaluate the technique results under controlled conditions, multi-pulse ideal waveforms are properly simulated, considering a non-linear temperature gradient as the thermal distribution induced on this simulated body. The results obtained by means of a very accurate spectral analysis are contrasted, at different depths, with the established increasing-decreasing temperature gradient. The adequacy of the technique to effectively estimate such a realistic temperature spatial distribution, inside a body, is evaluated regarding to selected frequency peaks behavior in comparison with thermal distribution along the central axis of the simulated body, under ultrasonic radiation.

18.   COM1: Communications Systems
Wednesday (12:30-13:30) Room 1
Session Chair: Dr. Fernando Ramos

18.1 Wide-Area Wave Motion Analysis Using Complex Empirical Orthogonal Functions
Pedro Esquivel Prado
Institution: CINVESTAV-IPN, Unidad Guadalajara, Jalisco, Mexico.
In this paper, a method for detection of propagating features in wide-area system measurements through its traveling and standing parts is proposed, where the relationship between complex modes and wave motion is explored. From an ensemble of complex signals, a complex correla-

tion matrix is formed, and its real and complex eigensolutions are the basis of the decomposition. The real and complex eigenvectors contain standing and traveling characteristics. The basic idea is a complex generalization of proper orthogonal decomposition (POD). The method developed is general and could be applied without loss of generality to measured or simulated data. As illustrative case, the method is applied to a synthetic example; additionally, data obtained from global positioning system (GPS)-based multiple phasor measurement units (PMUs) from a real event in power systems are used to study the practical applicability of the method.

18.2 VIKOR Method for Vertical Handoff Decision in Beyond 3G Wireless Networks

Jesús Rubén Gallardo-Medina, Ulises Pineda-Rico, Enrique Stevens-Navarro
Institution: Facultad de Ciencias, Universidad Autónoma de San Luis Potosí

The next generation of wireless networks also known as beyond 3G (B3G) networks is a mixture of heterogeneous wireless access technologies. One of the most important technical challenges in B3G wireless networks is the support of vertical handoff. In this paper, we propose the use of Multiple Attribute Decision Making (MADM) method: VIKOR for vertical handoff decision. The idea of VIKOR for decision making is based on an aggregating function representing closeness to the ideal solution. We execute simulation experiments to compare the performance of VIKOR for vertical handoff decision in B3G networks with other MADM schemes such as SAW and TOPSIS.

18.3 WSN Topology Control Design via Integration of Kalman Filtering and Adaptive Estimation

Zhengmao Ye, Habib Mohamadian
Institution: Southern University

The research field of wireless sensor networks is a challenging area of engineering and science. In contrast to most traditional networks, sensor nets of wireless sensor networks encompass numerous small battery powered autonomous devices which are referred to as the sensor nodes. These devices have data processing and short range radio communication capabilities. Each node relies on the wireless channels for transmitting data and receiving data from other nodes. The deployment of sensor nodes is subject to various types of harsh environments. Wireless sensor networks differ in network densities, from sparse to dense deployments, which requires the adaptive protocols. On the other hand, small scale and low energy wireless devices are needed for communication. The combination of computing, sensing and communication technologies makes it possible. With the dense network deployment, broadcasting by simple flooding will lead to information redundancy. It gives rise to the application of adaptive topology control to the wireless sensor network. The maximum distance of the individual node could communicate with each other is characterized by the communication units on the sensor node. The location performance and energy usage, based on communication distance, can be evaluated by the Kalman filter which exploits the different selection approaches. In this article, topology control of the wireless sensor networks via integration of Kalman filters and adaptive estimation has been proposed for the design of wireless sensor networks.

19.   COM2: Communications Systems
Wednesday (15:00-17:00) Room 1
Session Chair: Dr. Alfredo Tirado

19.1 On the Advances of Electromagnetic Theory for Inhomogenious Media: a Quaternionic Approach

Marco Pedro Ramírez Tachiquin, Jorge Cantarell
Institution: Escuela de Ingeniería de la Universidad La Salle

We analyze a set quaternionic methods for studying the time-dependent Maxwell equations in the presence of sources for inhomogeneous media, the electrical Impedance Equation with a conductivity function depending upon three spatial variables, the Beltrami Fields and the Force-Free Magnetic Fields with non-constant proportionality

factors. For the last three systems, we study some particular cases for which it is possible to obtain new classes of solutions, pointing out their possible application in boundary value problems.

19.2 Design and feasibility analysis of the physical layer for the Academic WDM Ring of Mexico City

Gerardo Nava-Heredia, Sergio Castro-Resines, Azael Fernández-Alcántara, Ramón Gutiérrez-Castrejón
Institution: Instituto de Ingeniería, Universidad Nacional Autónoma de México-UNAM

The design of three optical links that constitute a ring network interconnecting three of the main research institutions of Mexico City is presented. A quantitative analysis proves the feasibility of the networks physical layer deployment in terms of attenuation and dispersion. Six combinations of fiber, wavelength division multiplexing (WDM) technology, and bit rate that follow current standards are considered. The calculations show that attenuation is the most relevant limiting performance factor, mainly due to the large number of connectors and splices required during installation. The optimum deployment scenario is found to consist of 40 channels at 10 Gb/s over standard single-mode fiber following an ITU-T G.694.1 grid on C band. Its extension to include S and L bands is also feasible. The ring put forward here will compose the first and most advanced WDM network in Mexican academia so far.

19.3 On-line Extraction of Modal Characteristics from Power System Measurements based on Hilbert-Huang Analysis

Francisco Román Lezama Zarraga
Institution: CINVESTAV-IPN, Department of Electrical Engineering.

Hilbert-Huang has been used as a systematic approach to analyze and characterize the temporal evolution of nonlinear, time varying process in power systems. In this paper an efficient method for analyzing the local dynamics of transient oscillations using a local empirical mode decompo-

sition (EMD) and the Hilbert transform is presented. Two novel approaches are investigated to characterize non-stationary issues. The first technique is a local implementation of the EMD technique, through a combination of a sliding window of finite length with the sifting process by blocks. The second method is an algorithm to compute the Hilbert transform using variable window filters. Approaches to extending Hilbert-Huang analysis to analyze the local properties of non-stationary signals are explored based on finite-impulse-response (FIR) designed using Kaiser window. Through this proposed methodology is possible to make an on-line analysis technique for measured data using the Hilbert-Huang method. These techniques are tested on time-synchronized phasor measurements collected by PMUs. Off-line technique is used in the analysis of transient phenomena emerged in power systems to compare results.

19.4 A Comparison of Some Audio Watermarking Methods

Elham Kerimi Marnani, Zahra Karami, Ebrahim MolavianJazi
Institution: Department of Electrical and Computer Engineering, Isfahan University of Technology, Isfahan, Iran

The variety of properties of different audio signals crucially affects the selection of suitable watermarking technology for satisfying the various requirements of copyright protection applications. However, comparison of audio watermarking methods has been widely ignored in the literature. In this paper, we compare the performance of three different audio watermarking methods: echo hiding, cepstrum domain, and patchwork algorithms. We investigate the no-attack situations, as well as cases when common signal processing or intentional attacks are imposed on the watermarked signal. By using modified parameters for these methods, we propose better results with respect to some previous research studies.

19.5 Wireless Data Transmission from Inside Electromagnetic Fields

José Ignacio Huertas Cardozo, Roberto Barraza, Julián Mauricio Echeverry Mejía
Institution: Tecnológico de Monterrey
This paper describes analytical and experimental work developed to evaluate the effects of the electromagnetic fields produced by high- voltage lines (400kV) on wireless data transmission at the 900MHz band. In this work the source of the data transmission is located inside the electromagnetic field and the reception station is located at different distances from the power lines. Different atmospheric conditions are considered.

20. CS1: Computer Science and Computer Engineering- Visualization and Optimization

Wednesday (15:00-17:00) Room 3
Session Chair: Luis Gerardo de la Fraga

20.1 Quantitative Effects of Discrete Wavelet Transforms and Wavelet Packets on Aerial Digital Image Denoising

Zhengmao Ye, Habib Mohamadian, Yongmao Ye
Institution: Southern University
The objective of image denoising is to remove the noises and to retain important image features as much as possible. Linear approaches could be effective for some simple cases with slowly varying noises, but not for other slowly varying noise cases and rapidly varying noise cases. As a non-linear wavelet based technique, the wavelet thresholding is effective to denoise blurring aerial images. Either the discrete wavelet transform or wavelet packets technique can be employed using wavelet decomposition. At each level of wavelet decompositions, the digital image is split into four subbands, representing approximation (low frequency feature) and three details (high frequency features) in horizontal, vertical and diagonal directions. The proposed soft thresholding wavelet decomposition at multiple levels is a simple and efficient method for reduction of noises. For multiple level decompositions in terms of both the discrete wavelet transform and wavelet packets techniques, the approximation component will always be decomposed at each level. If the detail components are further decomposed as well similar to that of the approximation, it is the wavelet packet approach, otherwise it is the discrete wavelet transform. On a basis of the proposed thresholding technique at different levels for wavelet denoising, objective metrics can be introduced also to evaluate and compare the denoising effects of the discrete wavelet transform and wavelet packets quantitatively rather than qualitative observation, such as the metrics of the discrete entropy, energy and mutual information.

20.2 Growing Plants for Virtual 3D Environments

Marco Antonio Ramos Corchado, Juan Carlos Sánchez Ruíz, Felix F. Ramos C., José Raymundo Marcial R.
Institution: Universidad Autónoma del Estado de México
In a Virtual Environment, objects of various types may exist. Creating these objects and modeling their behaviour with a high degree of realism is of major interest. Static objects are usually simpler to model than dynamic ones, and perhaps, agents are the most common dynamic objects in a Virtual Environment. Other dynamic components may include Avatars and a wide variety of other living organisms such as plants. In particular, the life cycle of plants takes place entirely within the environment in which they exist, and modeling their natural change represents a challenge hard to deal with. Among the methods proposed to date for plant modeling and simulation, L-systems have been widely used with remarkable results in unrestrictive environments. In this paper we propose a combination of L-systems with a Genetic Algorithm for plants growth emphasizing the incremental natural change of plants. We argue that L-systems on their own encourage inefficient rendering of the growth and change of plants over time. In our model, we also highlight the relationship among plant components (i.e. a plant limb has a parent, children, and occurs at a certain level in the overall structure). We also present preliminary results of a 3D prototype with new rules for the L-system and compare them with those generated by a standard L-System.

20.3 On Network Flow Management in Virtualized Environments

Fernando Rodríguez-Haro, Felix Freitag, Leandro Navarro, Nicandro Farías-Mendoza, Juan Antonio Guerrero-Ibáñez
Institution: Polytechnic University of Catalonia

Virtualization has enabled the use of Virtual Machine (VM) based resource providers to offer computing power as a service. However, one important feature is to have certainty about the planed or expected performance of the applications that run inside the VMs. Therefore, consolidating the work load of web-based applications, with time-varying resource requirements, should be done in an automated way. We present and evaluate a network flow management component for the admission control of HTTP connections. We study this component, in our Local Resource Manager (LRM), by using two types of common web-based applications. The preliminary results shows that we can meet the number of successful served requests and at the same time avoid the degradation in the application's response times.

20.4 Visual Secret Sharing Schemes for Multiple Secret Images Including Shifting Operation of Shares

Angelina Espejel-Trujillo, Mariko Nakano-Miyatake, Mitsugu Iwamoto
Institution: ESIME Culhuacán, Instituto Politécnico Nacional

Visual Cryptography, proposed by Naor-Shamir in 1994, is also called a Visual Secret Sharing (VSS) scheme since it can be regarded as one realization of secret sharing scheme. In VSS schemes, an image is encrypted into a set of images called shares, which look like random noise. In decryption, the secret image is perceived from stacked shares by human visual system, and hence no extra computations and prior knowledge are required. The VSS scheme proposed by Naor-Shamir is a (k, n) or less threshold VSS scheme for binary image, where a secret image is decrypted by stacking arbitrary k out of n shares, but any (k -1) or less shares must not leak out any information of the secret image. In this paper a variant of the VSS Scheme is proposed, where three binary secret images are encrypted into two shares, at the same time these shares looks like innocent image. Furthermore The first secret image is decrypted by a typical stacking process, while the other two secret images are decrypted using the shifting, that is moving one of the shares respect to the other share in a appropriate position.

20.5 Color-based Texture Image Segmentation For Vehicle Detection

Ricardo Mejía Íñigo, María Enriqueta Barilla Pérez, Héctor Alejandro Montes Venegas
Institution: Universidad Autónoma del Estado de México

This paper describes a novel method for detecting vehicles on a highway using two visual features: color and texture. Our method consists of a segmentation process computed on the L*u*v* color space and a texture feature extraction procedure based on Dual-Tree Complex Wavelet Transform. We also apply a denoising process using morphological operations to build a background model and make possible the detection of the vehicles in the scene.

20.6 Non-sorting genetic algorithm in the optimization of unity-gain cells

Ivick Guerra-Gómez, Esteban Tlelo-Cuautle, Carlos Alberto Reyes-García, Gerardo Reyes-Salgado, Luis Gerardo de la Fraga
Institution: INAOE

An optimization system based on the multi-objective evolutionary technique NSGA-II is presented to automatically size unity-gain cells, namely: voltage and current followers, and voltage and current mirrors. These unity-gain cells are optimized in three parameters: gain, bandwidth and offset. The proposed optimization system uses HSPICE as circuit evaluator and includes input and output resistances as constraints, and also by guaranteeing that all transistors are in saturation operation.

21.   CS2: Computer Science and Computer Engineering- Artificial Intelligence
Thursday (15:00-17:00) Room 3
Session Chair: Emmanuel López Neri

21.1 Non-Concurrent Multi-Leak Diagnosis Based on an Accommodation Scheme
José Fernando García Tirado, Blanca Selenia León Rodríguez, Ofelia Begovich Mendoza
Institution: CINVESTAV, Unidad Guadalajara
This paper focuses on the design and testing of a multi-leak diagnosis scheme, outlined in [6] as a feasible scheme to be implemented in real time. As a main contribution it is shown the performance of the designed scheme with one leak and a couple of non-concurrent leaks with acquired real data from a pilot pipeline. The obtained results are the basis for a future real time implementation in a pipeline prototype.

21.2 One-step Forecasting of Seismograms Using Multi-layer Perceptrons
Abraham Bernardo-Torres, Pilar Gómez-Gil
Institution: National Institute of Astrophysics, Optics and Electronics
Research in earthquake forecasting has been growing in recent years. Several techniques have been applied: analysis of satellite images for tectonic faults detection, measurement of electro-telluric variations and radon gas levels, data transformations to audible representations of seismograms, to name a few. Artificial neural networks (ANN) have been used in some of these approaches, but there is scarce research related to their applications as function approximation models of the dynamics involved in earth tremor. This type of modeling is useful in these problems because a suitable function approximator can be used as a one-point predictor. In this work we investigate the capability of multi-layer perceptrons (MLP) to model data from earth tremor, building one-point predictors trained over seismograms taken from the earthquake occurred at Mexico City of September 19, 1985. MLP's were trained using the resilient backpropagation (PROP) and the Levenberg-Marquardt (LV-MQ) algorithms, obtain-

ing in average a MSE= 0.7964 in the first case and 0.7646 for the second case. This results show the ability of MLP's to model this kind of non-linear data for one-point prediction.

21.3 On Automating Component-based Development
Perla Velasco Elizondo
Institution: Centre for Mathematical Research, CIMAT.
A number of approaches to component-based development and tools to automate the associated processes have been proposed. However, most of them focus on a life cycle where component-based systems are generated from scratch rather than on one where they are constructed by composing preexisting components. This has negatively impacted on automating component-based development and as a corollary on its use in practice. In this paper we share our experiences on designing and developing an environment to automate component-based development. We highlight the importance of concepts such as component-based development life cycle, component model and composition theory to achieve the goal of component-based development automation.

21.4 Toward the validation of patient data for clinical practice guidelines
Fernando Pech-May, Iván López-Arévalo, Víctor Sosa-Sosa
Institution: Laboratory of Information Technology, CINVESTAV - Tamaulipas
Clinical Practice Guidelines have been designed to reduce uncertainty in the medical decision making in order to improve medical care and reduce costs. A way to facilitate and formalize this task is by translating it into the computers domain. This paper introduces a validator of patient data for clinical practice guidelines as part of a Decision Support System. So, the clinical staff can introduce patient data for a particular disease, and the system is able to find inconsistencies in the application of clinical practice guideline for such disease

22.3 Dynamic Model of a High Power PEM Fuel Cell System on the basis of Artificial Neural Networks

Abraham Ulises Chávez Ramírez, Roberto Muñoz Guerrero, Sergio Miguel Durán Torres, Luis Gerardo Arriaga Hurtado
Institution: Centro de Investigación y de Estudios Avanzados del IPN (CINVESTAV)

Polymeric Electrolyte Membrane Fuel Cell (PEMFC) systems are potentially promising candidates as alternative energy sources, modeling this kind of system is a difficult task due it is strongly dependent on many physicochemical parameters that cannot be easily measured on the real system. Artificial Neural Network (ANN) has become in a powerful modeling tool for performance prediction of complex systems where internal variable relationships are no well known. In this paper a commercial 5 kW PEMFC system is successfully modeled by training a Multilayer Perceptron Network (MLP) just acquiring small amount of experimental data, this model is able to predict the behavior of the system without any physical equations achieving an acceptable degree of accuracy.

23.   MEC1: Mechatronics
Wednesday (12:30-13:30) Room 4
Session Chair: Dr. Alejandro Rodríguez Ángeles

23.1 Design and Control of a Two Disks Asymmetrical Rotor System Supported by a Suspension with Linear Electromechanical Actuators

Manuel Arias-Montiel, Gerardo Silva-Navarro
Institution: Centro de Investigación y de Estudios Avanzados del I.P.N.

This paper describes the problem of design of an experimental setup for rotordynamic analysis and unbalance control. The rotor system has two disks in an asymmetrical configuration along a steel shaft which is connected to a three phase AC motor by a flexible coupling. A suspension with two linear electromechanical actuators is used to control actively the vibrations caused by unbalance in disks. A LQR scheme with estimated state

feedback is developed based on a reduced order finite element model of rotor system. The controller is applied taking into account the actuators dynamics. Some advances in the construction of the prototype and open loop experimental results are presented. The dynamic behavior of the closed loop system are shown by numerical simulations.

23.2 Positive Position and Acceleration Feedback Control for the Unbalance Response in a Rotor-Bearing System

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

This work describes the problem of the unbalance response compensation in a rotor-bearing system using two control techniques based on measurements of the radial displacements or accelerations directly in a Magnetorheological(MR) bearing suspension. The rotor-bearing system is modeled using Finite Element Methods(FEM) for a Jeffcott-like rotor with one planar and rigid disk, two nonorthotropic supports, one traditional journal bearing and other similar but supported on an arrangement with two MR dampers. The mathematical model consists of two finite elements, with a total of 6 degrees of freedom for each horizontal and vertical direction in three planes (rigid support, disk and MR suspension). For the rotating speed regulation a PID control, based on a sufficiently fast tuning, is applied in order to track a proper speed profile to pass over the first critical speeds (run-up or coast down). Two different control schemes are applied to compensate the unbalance response in the rotor, that is, a Positive Position feedback (PPF), which requires only the measurement of one radial displacements in the MR suspension, and another control scheme based on the measurement of the radial acceleration, well-known as Positive Acceleration Feedback (PAF). Both control schemes require only one sensor (proximitor or accelerometer) for each control input and they demand small control efforts with respect to the power involved in the machine. For simplicity, during the control design and physical implementations, we use the so-called Choi-Lee-Park polynomial model for both

MR dampers, which can adequately describe the highly nonlinear and hysteresis behaviors for this type of actuators. The PPF and PAF controllers are able to reduce the unbalance response in about 70% and 68%, respectively, with respect to the open-loop response. Finally, by means of some numerical simulations is illustrated the dynamic and robust performance of the overall control system.

waves has been used for applications such as synchronicity and navigation with walking mini-robots. Two RDCNN are used for controlling navigation with auto-waves. The first RDCNN emits attractive waves from the objective, meanwhile the second RDCNN emits repulsive waves from the obstacles. In this paper an algorithm driven by activation is proposed, and some simulation results are presented.

23.3 Finite Element and Modal Modeling of a Cantilever Beam with Piezoelectric Patch Actuator for Vibration Absorption

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

This paper is about mechanical vibration absorption in a cantilever beam. This is accomplished by an active control scheme. The experimental set up consists of an aluminum cantilever beam clamped to an electrodynamical shaker. In that the main actuator is a piezoelectric patch and the feedback signal is obtained with a small piezoelectric accelerometer. For control purposes the closed loop is done via a positive feedback controller. In this work the beam is modeled with a four element finite model. The piezoelectric patch model is also presented. Experimental validation of the beam model is presented. And some results in closed loop are shown in numerical simulation as well as in the experimental platform.

24.   MEC2 Mechatronics

Thursday (10:00-11:00) Room 3
Session Chair: Dr. Hebertt J. Sira Ramírez

24.1 An Algorithm based on Autowaves for Navigation Control of a Mobile Robot

José Antonio Medina Hernández, Felipe Gómez Castañeda, José Antonio Moreno Cadenas
Institution: CINVESTAV

Two layers Reaction-Diffusion Cellular Neural Networks (RDCNN) are used for studying the formation of spatial and oscillatory patterns on the plane. In last years, computation based on

24.2 Extended Kalman Filter Tuning in Attitude Estimation from Inertial and Magnetic Field Measurements

José Rodrigo Cordova Alarcón, Hugo Rodríguez Cortés, Esaú Vicente Vivas
Institution: Instituto de Ingeniería, UNAM

The Extended Kalman Filter (EKF) has been the workhorse of real time attitude estimation problems, for several years now. However, an essential and unsolved issue in the practical implementation of the EKF is the selection of the process and measurement noise covariance matrices. In this article, we evaluate experimentally an estimation algorithm that solves a gyro free quaternion formulation of Wahba's problem. This algorithm is based on an EKF and a least squares algorithm sensor fusion procedure. In particular, we address the tuning issues of the covariance matrices in the EKF and the stop criteria and the initial condition in the sensor fusion procedure. Unfortunately, our experimental results show that the algorithm fine tuning is not an easy task and our best results, by the time being, rely on gyroscopic measurements.

25.   MEC3: Mechatronics

Thursday (15:00-17:00) Room 2
Session Chair: Dr. Hebertt J. Sira Ramírez

25.1 Robot   Formation Control using Backstepping and Sliding Mode Techniques

Rafael Castro-Linares, Jaime Álvarez-Gallegos, Jonathan Martínez
Institution: CINVESTAV-Zacatenco

This paper presents a formation control of nonholonomic mobile robots for a leader-follower scheme. The control design is based on a backstepping recursive procedure together with passivity feedback equivalence and sliding mode techniques. In particular, the sliding mode technique allows to get a robust formation control in the sense that it diminishes the effect of model uncertainties. Some simulations are presented to show the performance of the controller.

25.2 Sliding Mode based Differential Flatness Control and State Estimation of Vehicle Active Suspensions
Esteban Chávez Conde Esteban
Institution: Universidad Politécnica de Guanajuato
In this paper the vibration attenuation problem in automotive suspension systems is presented. A robust active vibration control strategy based on sliding mode and differential flatness control techniques is proposed as a solution alternative of this problem. This active vibration control scheme only requires position measurements of the wheel and car body. On-line state algebraic estimation is used to avoid the use of sensors of acceleration and velocity. Simulation results are included to show the dynamic performance and robustness of the proposed active suspension system.

25.3 Robust GPI Observer under noisy measurements
Daniel Librado Martínez-Vazquez, Alejandro Rodríguez-Angeles, Hebertt Sira-Ramírez
Institution: CINVESTAV-IPN
In this paper, a new approach for the Generalized Proportional Integral Observer when only noisy measurements are available is proposed, based in a integral extention of the system and observer model. A comparison of the GPI observer to the new approach is given via an academic simulation example. With this approach, is possible to estimate completely unknown, but bounded, perturbations and the states of the system, such that a perturbation-cancel plus PD compensation control is proposed for trajectory tracking tasks.

25.4 The bifurcation analysis on dynamic voltage stability of different wind power systems
Shanshan Xu, Fangqi Tang, Renjun Zhou
Institution: Electrical and Information Engineering of Changsha University of Science and Technology Institute
In order to obtain the impact which the power injection of wind farm parameter and reactive load parameter respectively and comprehensively on dynamic voltage stability in wind power. For a typical power system, using induction generator based wind farm and doubly-fed generator based wind farm, adding dynamic load model, two kinds of wind power dynamic models are analyzed with single-parameter bifurcation and two-parameter bifurcation. The process indicate that the method by two-parameter bifurcation is superior to that by single-parameter in revealing the influences of system-parameters on voltage stability of wind power system .The results imply that overweight reactive load would enormously reduce system stability margin when power injection continuous increasing, in both of two wind power system under the same structure and parameters; when power injection keeps constant, the variation of reactive load would not affect system stability; the system can reach to the highest efficient operation if avoid the situation that overweight reactive load with power injection continuous increasing by adjusting power injection and reactive load; the stability of doubly-fed generator based wind power system is much better than induction generator based wind power system, and doubly-fed generator based wind power system can obtain much more accurately system stability margin.

25.5 Nonlinear Model Reduction of Power Systems
Antonino López Ríos
Institution: Departemento de Ingeniería Eléctrica CINVESTAV Unidad Guadalajara
The work in this document develops and analyzes a method to generate reduced order nonlinear models from physically-based power systems which are described by differential-algebraic equations (DAEs). The technique combines the Proper

Orthogonal Decomposition (POD) and concepts from balanced realization theory. This combination can be used to obtain linear and nonlinear reduced order models from large-scale system models. Reduced order nonlinear models are then constructed by projection of the equations of motion of the system, which describe the dynamic behavior of interest, onto the space of the most energized POD eigenfunctions. The Reduced-Order Model (ROM) is then used to study system behavior following small and large perturbations. This method enables the reduced model to retain the dynamic behavior of the original system, as well as its passivity and stability. The technique, though developed for power system processes, is general enough to be applied to any process that is described by similar differential-algebraic equations. The proposed methodology is tested on a 16-machine, 68-bus dynamic equivalent of the New England test system.

26.   MEC4: Mechatronics
Thursday (17:20-18:20) Room 2
Session Chair: Dr. Alejandro Rodríguez Ángeles

26.1 Analysis of Nonlinear Modal Interaction in Stressed Power Systems using POD-Galerkin Characterization
Sergio Enrique Vázquez Domínguez, Emilio Barocio Espejo
Institution: CINVESTAV-IPN, Unidad Guadalajara
This paper discusses the application of a nonlinear analysis method based on the proper orthogonal decomposition (POD) method and Galerkin projection to the analysis and characterization of nonlinear modal interaction in stressed power systems. Using Galerkin projections onto bases of eigenfunctions obtained from the POD method, a new model is constructed that determines approximate solutions to the nonlinear power system behavior. The practical use of these methodologies is tested on a two area, 4-generators test system model. The validation is based on comparison with results from transient stability analysis using a commercially available transient stability program.

26.2 Development of a prototype for classification of potato mini-tubers based on Artificial Vision.
Fernández Olvera Yesenia Elizabeth, Sariñana Toledo Aarón, Swenson Durie Rick Leigh
Institution: ITESM Campus Querétaro
This article presents a methodology that was followed for the design and implementation of a new artificial vision system for the grading of potato tubers. This system uses hardware devices and algorithms used in machine vision applications. This work consists of two main stages. The first stage describes the hardware elements used for image acquisition (lighting, camera and optics) and the algorithms for image processing implemented to carry out the potatoes size (diameter) measurements. The second stage describes the mechatronic system used for classifying the potatoes and the user interface developed to run the system. The result of this work is a prototype for measuring and grading with the capability to classify 750 potatoes per hour with an accuracy of 2/10mm.

27.   MEC5: Mechatronics
Friday (10:00-11:00) Room 2
Session Chair: Alejandro Rodríguez Ángeles

27.1 Optimal design of a three dimensional 4 dof COBOT with differential gears
Nicolas Store, Carlos A. Cruz-Villar, Alejandro Rodríguez-Ángeles
Institution: CINVESTAV-IPN
Cobots are passive robots that share their work space with a human. They are safe for whom manipulates them and facilitate the task execution which increase productivity.
Also they take advantage of the human vision, intelligence and dexterity because their goal is to guide the operator who moves the robot. They can execute transport or precision tasks at low cost, reducing the operator training time. This work presents a COBOT which has four rotational degrees

of freedom (DOF) and its work space is a sphere. The design is optimized for one trajectory. The optimal criterion is specialized for COBOTs because the objective is to transmit the biggest blocking force in a forbidden direction. The COBOT possesses CVT which are based on differential gears because they can support high load, they have high efficiency and their assembly to the links is the simplest. The optimization problem needs to model the link's stresses, to solve the direct and inverse kinematic problem and the transmission ratio. Also a trajectory, based on virtual wall, defines the optimal design. The design process is simplified to the minimization problem. Every design criterions are expressed mathematically to be programmed. This method can be reproduced for any system.

27.2 Design of Kokone, a Small Humanoid Robot

Víctor Enrique González Hernández, José Gabriel Ramírez Torres
Institution: Department of Computer Science, CINVESTAV México

In this paper we present the design of Kokone, a small humanoid robot. Kokone ("kid" in náhuatl, a mexican dialect) has 22 degrees of freedom (DoF), with an aluminum structure (1.5 mm thickness). A PC sends control signals to the robot via a serial link. The forward kinematics model is obtained with the Denavit-Hertenberg method. The inverse kinematics problem is solved using a genetic algorithm (GA). The solutions obtained by the GA are then plotted in order to verify their suitability, and show a good performance. Our main objective with this project is to obtain an affordable robotic platform for the development of robotic vision algorithms and navigation strategies.

27.3 Passivity Analysis for a Single Flexible-Link Robot

Juan Fernando Peza-Solis, Gerardo Silva-Navarro, Rafael Castro-Linares
Institution: Centro de Investigación y de Estudios Avanzados del I.P.N., Departamento de Ingeniería Eléctrica, Sección de Mecatrónica

This work describes the controlling of a physical platform and the mathematical model for a single link flexible robot manipulator, whose motion is restricted to an horizontal plane, so that the gravity effects are neglected. The modeling problem is addressed from so-called Euler-Bernoulli beam equation. The design, construction and integration of an experimental set-up developed for this work is also presented. A passivity velocity feedback scheme is then devised for controlling the end tip position of the flexible link. Finally, some experimental results, using this control method, are shown to and illustrate the overall system performance.

28.   SSM1: Electronic materiales I
Wednesday (12:30-13:30) Room 3
Session Chair: María de la Luz Olvera

28.1 Deposition of Nanocrystalline-Silicon by Cat-CVD Method and its Characterization

Srinivas Godavarthi, Yasuhiro Matsumoto, Velumani Subramaniam, P.S. Mallic
Institution: CINVESTAV

Silicon and its related alloys deposited by catalytic chemical vapor deposition (Cat-CVD), takes place upon thermo-catalytic decomposition of the reactant gases, i.e. silane (SiH_4) and hydrogen (H_2), at the surface of a hot filament. Normally, the catalyst is heated at temperatures in the range of 1500-2000ºC. Tungsten (W) is at the present the most used wire material, however, we have used Tantalum (Ta), which resulted with better controllability from amorphous to crystalline-phase transition.

We report the process for depositing nanocrystalline silicon (nc-Si) embedded in hydrogenated amorphous silicon oxide (a-Si:O:H) matrix, as a function of both, Ta catalyst, and substrate temperatures. We also have varied hydrogen flow-ratio to SiH_4 and O_2. Films were deposited on glass and crystalline silicon substrates at different filament and substrate temperatures. The deposited samples were characterized by X-ray diffraction and micro-Raman spectroscopy. Crystalline sizes were determined from XRD spectra applying Sherrer's formula and Raman spectra for

its size-related tendencies. As preliminary results, the range of crystallite formation starts at the catalyst temperature of 1700 ~ 1750 ºC. And as is usual, the crystalline phases are promoted as a function of substrate temperature, as well as hydrogen flow-ratio. We have found that the Tantalum filament promotes crystallization in the controlled way as was compared with the samples prepared using Tungsten catalyst. We will discuss the influence of each nc-Si deposition parameters correlated to the obtained crystalline sizes, as well as the related bonding states.

28.2 Zinc Oxide microspheres grown on Zinc pellet substrate

Oscar Goiz Amaro, Fernando Chávez Ramírez, Carlos Felipe Mendoza, Roberto Baca Arroyo, Nicolás Morales López, Ramón Peña Sierra
Institution: Centro de Investigación y de Estudios Avanzados del IPN

Spherical ZnO microspheres were obtained in a simple system using a short time process, without catalysts, at atmospheric pressure and using water as oxidant agent. Analysis with SEM shows the microstructures have spherical shapes covered with pencil-like structures. XRD spectrum reveals that as-synthesized ZnO products crystallize in the wurtzite phase.

28.3 Crystallization mechanism in films along GeTe-SbTe pseudo-binary line

Eduardo Morales Sánchez, Evgene Prokhorov, J. Alfredo Muñoz Salas, Jesús González Hernández, Gerardo Trapaga Martínez
Institution: CICATA-IPN Unidad Querétaro

The aim of this work is to compare the isothermal crystallization kinetic in the films along GeTe-Sb_2Te_3 line with composition $Ge_2Sb_2Te_5$, $Ge_1Sb_2Te_4$ $Ge_1Sb_4Te_7$ and $Ge_4Sb_1Te_5$ using mainly Johnson - Mehl - Avrami-Kolmogorov (JMAK) model. Results obtained have shown different crystallization mechanism in the investigated films. In Ge2Sb2Te5 and Ge1Sb2Te4 films the analysis of the kinetic results (Avrani coefficient) showed that at the beginning of crystalliza-

tion a metastable phase appeared with the Ge1Sb4Te7 composition, this is followed by the nucleation and growth of the stable fcc phase up to full crystallization. In contrast Ge4Sb1Te5 and Ge1Sb4Te7 films show diffusion control growing from small dimension grains with decreasing nucleation rate

29.   SSM2: Semiconductor devices I
Thursday (10:00-11:00) Room 1
Session Chair:

29.1 MOS-like electroluminescent devices using silicon-rich oxide obtained by LPCVD

González Fernández Alfredo Abelardo, Aveces Mijares Mariano, Yu Zhenrui, Morales Sánchez Alfredo, Monfil Leyva Karim
Institution: Instituto Nacional de Astrofísica Óptica y Electrónica

-Silicon Rich Oxide (SRO) is a multiphase material composed by SiO_2, Si and SiO_x.($0<X<2$) SRO characteristics include the photo and cathode emission of visible light. Lastly, big efforts have been devoted to obtain a controllable emission using electroluminescence, but keeping its compatibility with silicon IC's fabrication technology.

In this paper, electroluminescent properties of PolySi/SRO/Si structures were studied. Devices with two different Si excesses were characterized. A full area wideband emission is found on devices with the highest Si excess, the principal emitting bands are centered at 475 and 670 nm. The EL intensity of these bands is modulated by the applied electric field. Different emission colors were observed with the naked eye.

The 670 band present in devices with the highest Si excess is not found in those with the lowest Si excess. A discussion on the probable mechanism of emission is presented.

29.2 Study of Emission Efficiency in ac driven Light Emitter Devices

Roberto Baca Arroyo, Alejandro Esparza García, Gabriel Romero Paredes Rubio, Ramón Peña

Sierra
Institution: CINVESTAV IPN México D.F
A study of the high field emission efficiency in ZnS: Mn is presented. In the high electric field conditions the band bending resulting from space charge effect has not been considered since a space charge density it is low. We demonstrate that ac driven TFEL devices with large insulator capacitance and no space charge effects in the active layer are optimal in terms of providing the energy transfer from sensitizers to luminescent centers. The analysis takes into account the pair-producing mechanism by electron impact with a characteristic electron energy distribution described by the Wolff's distribution functions. From the described model for the studied structure, the emission efficiency behavior could be expressed by the relation between the minimum distances required by a carrier to produce an electron-hole pair and ac drive conditions, respectively

29.3 Influence of a thin intrinsic a-Si:H layer on the I-V characteristics of a-Si:H/c-Si diodes made by hot-wire CVD
Norberto Hernández Como, Arturo Morales Acevedo, Yasuhiro Matsumoto-Kuwabara
Institution: Centro de Investigación y de Estudios Avanzados del IPN
P-type amorphous silicon was deposited on crystalline n-type silicon substrates to obtain heterojunction diodes. Additionally, a thin intrinsic amorphous silicon layer was inserted between both the p-type film and the n-type substrate to study its passivation effect on the c-Si surface. We studied the influence of the quality of the amorphous films upon the performance of the hetero-junction diodes. In particular, the diode ideality factor and the saturation current density were determined by measuring the current-voltage characteristics in dark conditions. The amorphous films were obtained by the hot wire chemical vapor deposition (HWCVD) technique, using a tungsten filament and SiH_4, H_2 and B_2H_6, where the deposition parameters such as gas flow, substrate temperature and filament temperature were varied. It is be shown that the presence of the intrinsic layer is fundamental for making good diodes, since devices made without this film cause the diodes

to have high saturation current density and ideality factor (3×10^{-5} A/cm^2, n > 8) as compared to diodes with a good intrinsic layer (5×10^{-9} A/cm^2, n = 1.4). The results obtained are encouraging, but the quality of the intrinsic films still should be improved for applying them to HIT (Hetero-junction with Intrinsic Thin layer) solar cells.

30.   SSM3: Electronic materials II
Thursday (15:00-17:00) Room 1
Session Chair: Francisco García Sáhchez

30.1 Deposition and Characterization of ZnO:Al Thin Films by Ultrasonic Spray Pyrolysis
Jagadeesh Babu Bellam, A. Maldonado, Velumani Subramaniam
Institution: Department of Electrical Engineering-SEES ,CINVESTAV
Al-doped ZnO (AZO) thin films were prepared using simple, flexible and cost-effective ultrasonic spray pyrolysis (USP) technique at different substrate temperatures. Zinc acetate dehydrate (Zn $(CH_3COO)_2$.2H_2O) and Aluminum acetylacetonate ($C_{15}H_{21}AlO_6$) were used as precursors and the solvent was a mixture of de-ionized water, methanol and acetic acid. Substrate temperatures are varied for 3 at% Al-doped film between 450°C to 500°C. The film's structural, optical and electrical properties were investigated by X- Ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), UV-VIS transmittance spectroscopy, Photoluminescence (PL) and Hall measurements. The obtained films were polycrystalline with a hexagonal wurtzite structure and preferentially oriented in the (002) crystallographic direction. Grain sizes varied from 21.3 to 25.3 nm based on substrate temperature. FESEM images revealed that the film morphology is strongly affected by the substrate temperature. Transmission measurements showed that for visible wavelength (400-700nm), the AZO films have an average transmission of 75%. Optical band gap of AZO films is varied from 3.26 to 3.29 eV with the increase in substrate temperature. PL spectra showed ZnO:Al films with a low density of native defects. Resistivity of the films varied from 0.7 Ohm-cm to 2x10^{-2} Ohm-cm. Minimum electrical

resistivity was obtained for film deposited at 475°C with film thickness of 602nm.

30.2 Photoluminescence from Si nanocrystals obtained by electrochemical methods embedded in a silicon oxide matrix.

Orlando Cortazar Martínez, Mariano Aceves Mijares, Zhenrui Yu, Ragnar Kiebach
Institution: Instituto Nacional de Astrifísica Óptica y Electrónica

Silicon Rich oxide has shown photoemission. However, normally it is required a high temperature annealing in order to get intense emission. On the other hand, Si nanocrystals, nC, obtained by electrochemical methods and poured in a solutions have shown photoemission that depends on their size. Then, Si nC obtained by electrochemical methods are an alternative to obtain emissive silicon rich oxide without high temperature annealing.

In this paper a study about photoluminescence (PL) spectra in silicon nanocrystal layers is presented. Si nc obtained by electrochemical process and suspended in colloidal solutions show photoluminescence. PL spectra show characteristics peaks in ~700nm and ~400nm. After that, the silicon nanocrystals are deposited on silicon substrates by evaporation of the colloidal and covered with a Spin on Glass (SOG) layer. FTIR spectroscopy show an increase of superficial Si-O defects in films after thermal annealing at 1100°C in Nitrogen environment. Finally, the PL spectra from annealed samples shifts toward 550nm, compared to that in colloidal solution. The shift is due to superficial defects in silicon nanocrystals. Analysis of the FTIR data and PL spectra can be correlated to explain this and results are presented.

30.3 ZnO:In Thin Solid Films Deposited By Chemical Spray. Effect Of Deposition Temperature On The Electrical, Optical, Structural And Morphological Properties

Heberto Gómez Pozos, Jose Luís González Vidal, Luis Castellanos, Arturo Maldonado Álvarez, María de la Luz Olvera Amador
Institution: Centro de Investigación en Tecnologías de Información y Sistemas (CITIS), Universidad Autónoma del Estado de Hidalgo

The effect of deposition temperature on the electrical, optical, structural, and morphological properties of indium doped zinc oxide thin films, ZnO:In, deposited by the chemical spray technique have been studied in this work. The starting solution was prepared using zinc pentanedionate and indium chloride as Zn and In precursors, respectively. Ethyl alcohol was utilized as solvent. The films were deposited at a temperature interval between 450 and 525 °C. The X-ray diffraction patterns show that the films are polycrystalline, having a preferential orientation along the [101] direction. The scanning electron micrographs, SEM, clearly show the existence of a textured surface. The lowest electrical resistivity obtained was around 3×10^{-3} Ωcm, and the optical transmittance in the visible region was higher than 75 %.

30.4 Study of Magnesium doped gallium nitride films grown by Low Pressure-Metalorganic Chemical Vapor Deposition

Cesia Guarneros Aguilar, Víctor Sánchez Reséndiz
Institution: Departamento de Ingeniería Eléctrica, Sección de Electrónica del Estado Sólido, CINVESTAV-IPN, México D.F., México

We present results of room temperature and low temperature photoluminescence measurements of GaN:Mg grown by low pressure metalorganic chemical vapor deposition. The effect on these PL measurements with different Mg concentrations was investigated. The luminescence from p-type Mg-doped samples is dominated by shallow-donor-shallow-acceptor pair recombination and by deep blue centers at 3.0 eV. The X-ray pattern shows that the p-GaN layers grow with (0002) preferential orientation. The GaN:Mg layers thermal annealing doesn´t show significant changes in PL and Hall effect measurements.

30.5 Connection between morphology and electrical resistivity in AuAl films

Rubén Domínguez Maldonado, Andrés Iván Oliva

Arias
Institution: Universidad del Mayab
AuAl alloys prepared by thermal diffusion on p-type Silicon (100) substrates were studied. Au/Al bilayers were prepared with 50%:50% as atomic concentration and 100 nm as total thickness. The formed Au/Al/Si systems were annealed from room temperature (RT) to 400°C in a vacuum oven with Argon atmosphere to form the AuAl alloys by thermal diffusion at different times (1, 2, 4 and 6 h). Prepared alloys were characterized with atomic force microscopy (AFM), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), x-ray diffraction (XRD) and collinear four-probe techniques in order to obtain their morphology, stoichiometry, crystalline structure and electrical resistivity, respectively. An increment in the rms-roughness and grain size values was found with diffusion time. AuAl alloys improve their crystalline structure as demonstrated by the XRD technique. The electrical resistivity of AuAl alloys shows a direct connection with the morphology and the annealing time. Small increase in the resistivity value was obtained in alloyed films as compared with the resistivity reported for individual Au and Al in bulk.

30.6 Effect of Thickness on the Structural, Optical and Electrical properties of MW-CBD CdZnS Thin Films
Vidhya Bhojan, Velumani Subramaniam
Institution: Department of Electrical Engineering-SEES,CINVESTAV.
Thin films of CdZnS have found extensive applications in various optical, electrical and optoelectronic devices. In the present work CdZnS (Cadmium Zinc Sulphide) thin films have been deposited by a simple, inexpensive and rapid synthesis route, microwave-assisted chemical bath deposition (MW-CBD).The bath solution is composed of Cadmium Sulphate, Zinc Sulphate, thiourea, ammonium Sulphate and ammonia. The concentration of $ZnSO_4$ is maintained at Y= $[ZnSO_4]$/ $\{[CdSO_4] + [ZnSO_4]\}$ for Y=0.3. The deposition has been carried out for five different radiation time from 60s to 180s, in steps of 30s. X-ray diffraction (XRD) indicates the hexagonal structure (002) peak at 20 =26.59° for the as-deposited CdZnS

thin films. The grain size, dislocation density and strain in the deposited films have been determined. SEM image gives the morphology, size and shape of particles in the deposited CdZnS thin films. EDX results show that the composition of the film is maintained irrespective of radiation time. Optical transmission measurements reveal that the films show good transparency over 80% in the wave-length region of 500-1100nm. The band gap of CdZnS thin films is found to be around 2.6 eV. Sheet resistance of the samples calculated by using Van der Pauw technique is in the order of 10^6 /Sq. Resistivity of the films is in the order of 10^1 to 10^2 Ω-Cm.

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31.   SSM4: Solid state systems
Thursday (10:00-11:00) Room 4
Session Chair: Rodolfo Quintero

31.1 Generalized nth-Power-Law and nth-Root Circuits
Lizeth González Carabarin, Felipe Gómez Castañeda, José Antonio Moreno Cadenas, Lizeth González Carabarin
Institution: CINVESTAV
The aim of this paper is to design analog circuits which develop different computations. This work generalizes the basic idea of the implementation of squaring and square root circuits proposed before to generate nth-power-law circuits and nth-root circuits. The MOSFET´s work on the weak inversion region which allows implementing different kinds of non-linear functions. Fundamental circuit operations were demonstrated and the performance of the circuits using SPICE (simulation program with integrated circuit emphasis) was confirmed. The design was developed for a 0.5µm-technology.

31.2 Magnetic Interaction in Superconducting Systems Modelling
Ana Dulce Ibarra Velázquez, Fidel Agustín Sangínes Lezama, Edgar Isaac Rivas Hernández, Iryna Ponomaryova
Institution: ESIME Culhuacán, IPN

This article describes the effect of "magnetic potential well" (MPW) that is considered to be an exclusion of the classical Earnshow's theorem. Two physical effects are described here: the relationship between the minimum potential energy produced by the magnetic interaction and the stability between the static system and the magnetic interaction. Both the theoretical model and the experimental part confirm that the presence of the zero force of the magnetic interaction gives minimum of potential energy and provides the system stability.

31.3 Design of bulk acoustic wave resonators based on ZnO for filter applications

Gerardo Pérez, Arturo Morales
Institution: Centro de Investigación y de Estudios Avanzados del IPN, Departamento de ingeniería eléctrica

In this study we have employed the one-dimensional Mason's model and the transfer matrix of the transmission line method to obtain the input electric impedance (Z_{in}) for a four layer (metal/piezoelectric/metal/substrate) thin film bulk acoustic wave resonator (FBAR). The input electrical impedance was calculated taking into account the electromechanical properties of the ZnO thin films, the metal used for the contacts and the silicon oxide (SiO_2) supporting layer in order to calculate the electromechanical effective coupling coefficient K^2_{eff} and the quality factor of the device (Q_D). We use a figure of merit (FOM) defined as the product of $K_{eff}^2 \times Q_D$ to optimize both parameters simultaneously for their use in microwave band-pass filters. In this analysis, several metals were employed as electrodes in the FBAR device, and we have found that for gold we obtain a higher value for the FOM than for aluminum, copper or silver. In this case, the optimal metal thickness is around 1.5 micrometers. In addition, the calculated values show that for copper and silver electrodes the FOM is almost the same than for gold electrodes. Then, these electrodes could substitute gold electrodes for achieving low cost filters with good electrical performance.

32. SSM5: Semiconductor devices II

Friday (10:00-11:00) Room 1
Session Chair: Alejandro Ávila

32.1 Transport Mechanisms in Porous Silicon Layer and ZnO/PSL Heterostructures

Marco Antonio Vásquez Agustín, Godofredo García Salgado, Gabriel Romero Paredes, Ramón Peña Sierra
Institution: Departamento de ingeniería eléctrica, SEES del Cinvestav-IPN, México D.F.

The transport mechanisms in both silicon porous layers (PSL) and ZnO/PSL/c-Si heterostructures were identified by Current-Voltage (I-V) measurements. The PSL were made by anodic etching of p-type (100) Silicon (Si) wafers with resistivity of 1-5 $\Omega\text{-Cm}$. The heterostructures were manufactured by depositing a zinc oxide (ZnO) film by DC-sputtering on the previously obtained PSL. The measured electrical resistivity of the ZnO films and the PSL were of 5.3×10^5 and 5.7×10^7 -cm, respectively. The current flow in the PSL is limited by the space-charge regions (SCL), due to the charge trapped in the distinct energy localized states. For the heterostructures similar results were found, where the dominant transport mechanisms are associated to the physical characteristics of the PSL and the ZnO films. Accordingly a bandgap diagram for ZnO/PSL heterostructure is proposed, where the participation of the variety of the defect levels are considered.

32.2 Characterization of PdO films for water vapour sensing

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

The functionality of interdigitated gold/aluminum electrodes on PdO films for water vapor (WV) sensing was studied. The structure (Au/Al/PdO/Al/Au) characterization was done at different temperatures introducing WV pulses in the test chamber under a continuous N_2 flow to produce the desired moisture conditions. PdO films were obtained by thermal oxidation of Pd films at 650ºC in air atmosphere. The Pd films were deposited

by the electroless process on Silicon (Si) substrates. The development of Pd/Si structures is important because it can be integrated with the microelectronic technology. Nanometric and micrometric thickness PdO films were studied. The electrical conduction limiting mechanisms of the Pd and PdO films were also determined. The response time, recovery time, and the sensitivity of structures was characterized in controlled humidity conditions. It was found that the response characteristics depend on the initial humidity condition of the PdO surface. When the structures were stored in environmental conditions the best operating parameters were observed. In contrast, when the structures were stored in dry atmosphere, the response resulted unstable with variations in the signal during extended measurement periods.

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32.3 Inclusion of Direct Tunneling Gate Current in the Symmetric Doped Double Gate MOSFETs Model

Salvador Iván Garduño, Antonio Cerdeira Altuzarra, Magali Estrada del Cueto
Institution: Centro de Investigación y de Estudios Avanzados del IPN

The gate current present in double-gate fully depleted MOSFET's can significantly contribute to the channel current measured in these devices. For this reason, models must take account of this effect in order to represent correctly the behavior of the devices. In this paper, we report a complementation to the Symmetric Doped Double Gate Model for MOSFET's, by including the presence of gate tunneling current. Gate current is expressed in all the operation regions, using only one equation. Agreement observed between modeled and experimental curves in inversion, depletion and accumulation region, as well as for transistors with different geometry was excellent.

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