Realization

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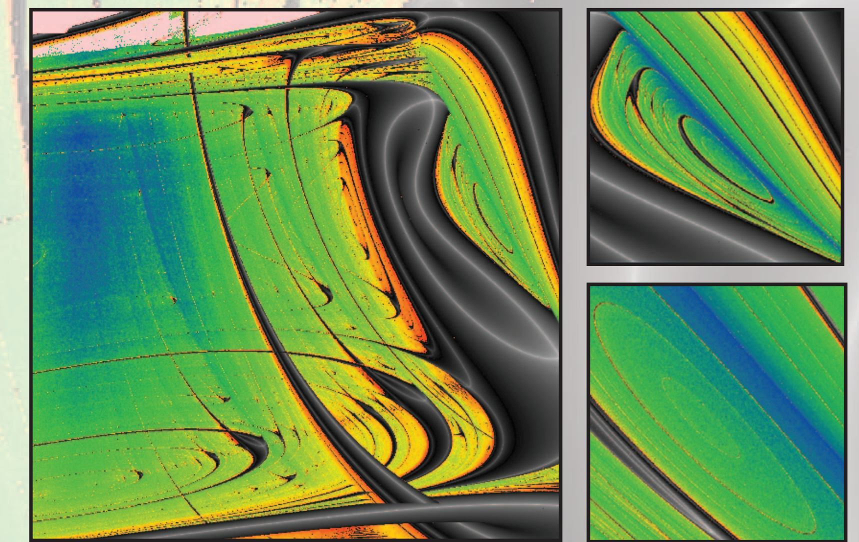


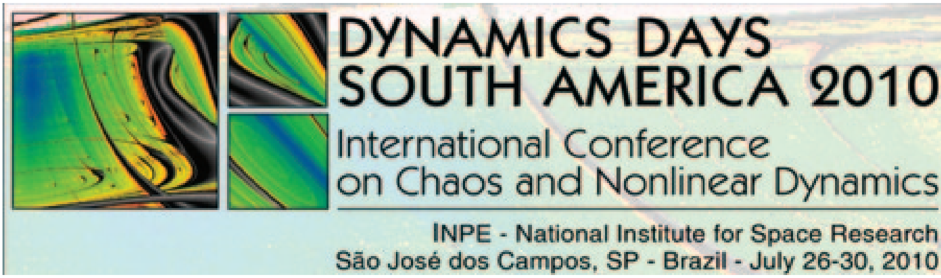
DYNAMICS DAYS SOUTH AMERICA 2010

International Conference on Chaos and Nonlinear Dynamics

INPE - National Institute for Space Research
São José dos Campos, SP - Brazil - July 26-30, 2010

Book of Abstracts and Program

http://www.lac.inpe.br/ddays/



Dynamics Days South America 2010

July 26 – 30, 2010
São José dos Campos, São Paulo, Brazil

The "Dynamics Days South America 2010" logo: The figure shows a Lyapunov phase diagram for a chemical oscillator governed by the mass action law of chemical kinetics. The regions in colors depict chaos (positive exponents), while darker shadings indicate domains of periodicity. This oscillator displays an intricate network of periodicity hubs. (more details can be found in Intern. J. of Bifurcation and Chaos 20, 197-211 (2010) – courtesy Jason Gallas).

Graphical Designer and Production: Beatriz Fontenelle, Carlos Vieira e Pepito

Forewords and Welcome Message

The Dynamics Days was founded in 1980 and is now the longest standing and most respected international series of meetings devoted to the field of dynamics and nonlinearity. It has been held regularly in Europe since 1980, in the US since 1982, in the Asia-Pacific region since 1999. Over the time, these meetings have been served as a forum to promote regional as well as international scientific exchange and collaborations. Traditionally they have been bringing together researchers from a wide range of backgrounds including physics, biology, engineering, chemistry and mathematics for interdisciplinary research in nonlinear science.

From now on, the South America Region starts to periodically set a stage to receive this respectable and prominent meeting. As so, on behalf of the Organizing Committee, we would like to welcome you in São José dos Campos, Brazil, for the “Dynamics Days South America 2010”. Also, we would like to express our profound gratitude for your keen interest and very enthusiastic support shown for this conference. Thanks to you, to your work and collaboration, we can already say that our Dynamics Days in South America region is a success and will be kept as so for the years to come.

In this first edition, the number of submissions overpasses all the most optimistic forecast. In the same way, the amount of financial support that we have received from Brazil and abroad was over the expectance. Based on that, we can assert that all the community in our region are receiving here with joy, hope and enthusiasm the Dynamics Days.

Finally, we would like to thank everybody who joint us in the organization of this conference. It includes all the sponsors for their technical and financial support; all the participants for their contributions; all the committee members for their work and follow-through. We also expect that you have the opportunity to make friends, exchange scientific knowledge and establish collaborations that allow the development of the field of dynamics and nonlinearity in our region.

For the Organizing Committee,
Elbert E. N. Macau

Table of Contents

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- **Rita Aparecida da Costa**
- **Rodolfo Maduro Almeida**
- **Thais Cristina Santos**

Conference Information

Registration

Registration for the conference Will be open at the following times, in the LIT / Fernando de Mendonça Auditory atrium:

Monday, July 26th	8:00 AM – 5:00 PM
Tuesday, July 27th	8:00 AM – 2:00 PM
Wednesday, July 28th	8:00 AM – 2:00 PM
Thursday, July 29th	8:00 AM – 2:00 PM
Frieday, July 30th	8:00 AM – 11:00 PM

Internet

Wireless internet access is available in the LIT building. The network available is LIT_ VISITANTES which password is lit*wl2010.

Lunch breaks

The lunch will be served in the main hall of INPE's recreation center (see map), all days, from 12:30 PM to 2:20 PM. It will cost 15,00 BRL per kilo. Nearby this area, there is also a cafeteria, which offers coffee, drinks and snacks during all day.

Poster Sessions **– Wednesday and Thursday, July 28, 29, 6:30 PM – 8:30 PM**

During the poster sssions there will be snacks, cakes and drinks in the LIT / Fernando de Mendonça Auditory atrium.

Banquet – Tuesday, July 27, 7:00 PM

Churrascaria Vale Sul - http://wikimapia.org/7202080/pt/Vale-Sul-Grill

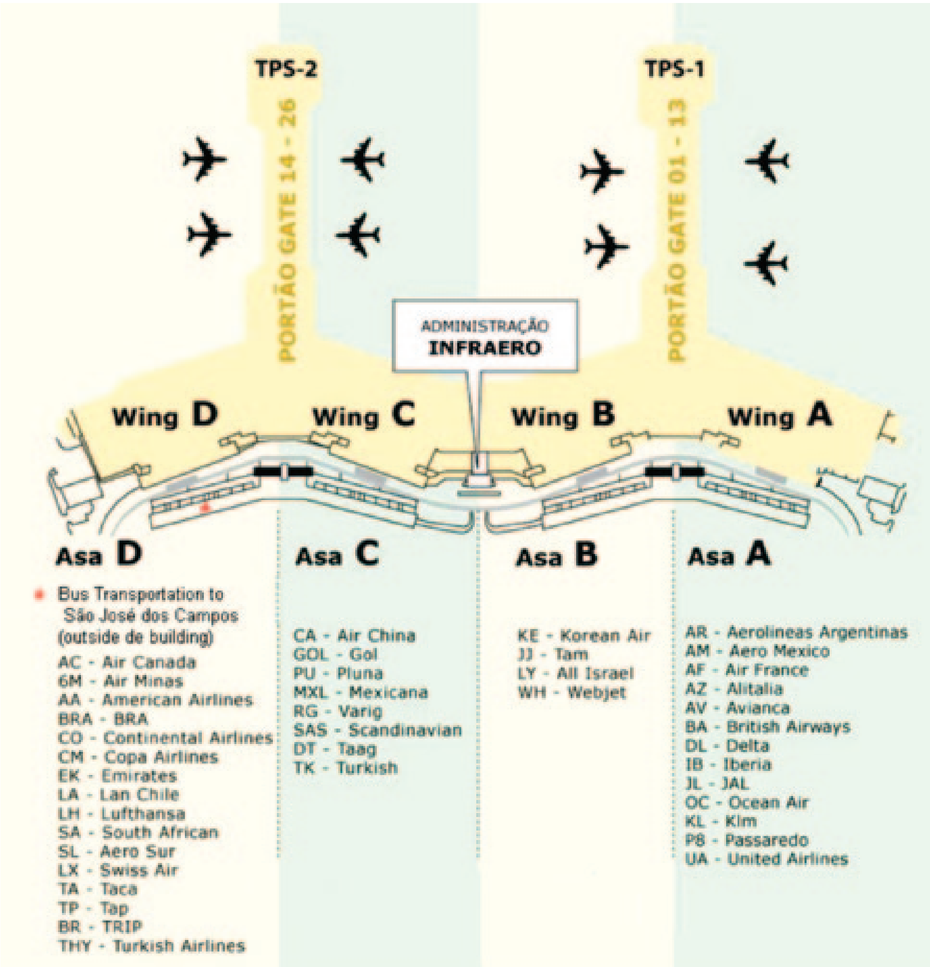
The banquet will take place in a very nice barbecue restaurant. There is a large buffet with salads, cheese and vegetables. The main attraction of the place is the Brazilian barbecue served in an all-you-can-eat basis. They alsoserved grilled chicken and sea food. The following drinks are included: water, soft drinks, juices and beer, and one dessert of your choice.

The banquet is included in the full registration fee. Additional tickets (for accompanying persons or for the ones who did nor pay full registration fee) can be purchased at the registration desk.

Coffee-Breaks

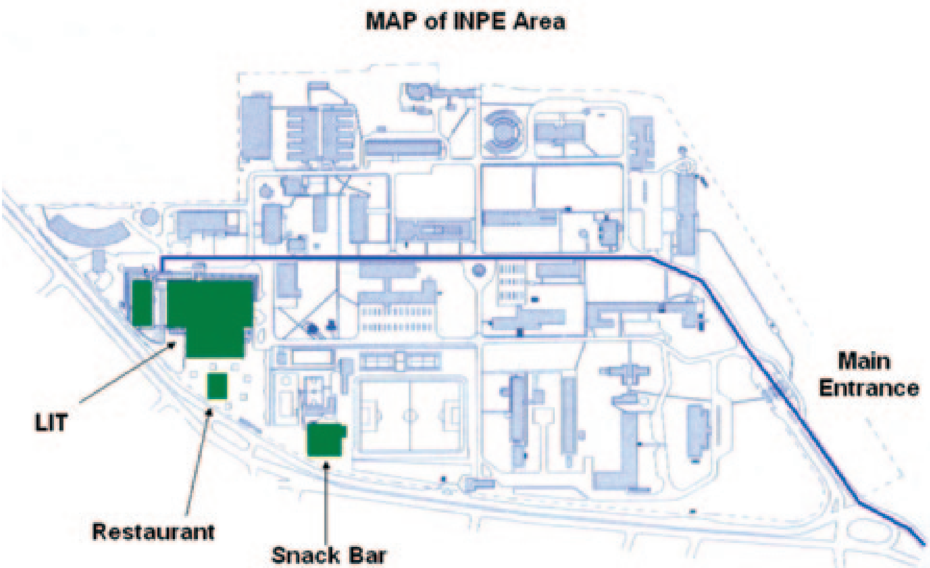
All coffee-breaks will be served in in the LIT / Fernando de Mendonça Auditory atrium.

Ground transportation for São Paulo / Guarulhos International Airport to São José dos Campos Main Bus Termnal:

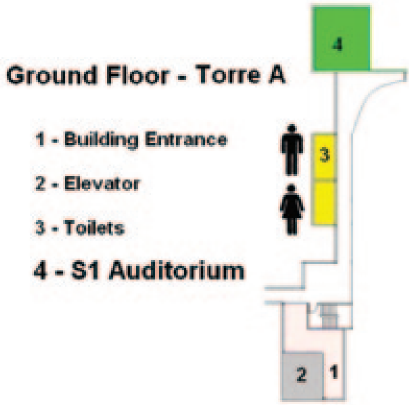


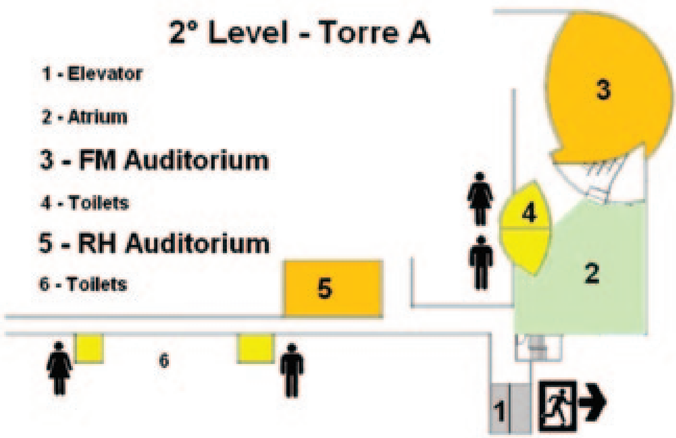
How to get INPE from Rio de Janeiro or São Paulo

INPE Campus



LIT Auditoriums





General Program – Sessions

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08:30 – 08:45	Registration	P9 (L. Pecora)	P18 (A. Motter)	P27 (J. Kurths)	P36 (Ying-Cheng Lai)
08:45 – 09:05	Open				
09:05 - 09:35	P1 (E. Ott)	P10 (A. Ozorio)	P19 (S. Cannas)	P28 (M. Baptista)	P37 (R. Stoop)
09:35 - 10:05	P2 (E. Rosa)	P11 (P. Cincotta)	P20 (M. Chevrollier)	P29 (P. Morrison)	PT_3
10:05 - 10:35	P3 (L. Torres)	P12 (C. Giordano)	P21 (C. Otto)	P30 (P. McClintock)	
10:35 - 11:00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:00 – 12:40	S1 S2 S3 S4	S5 S6 S7 S8	S9 S10 S11 S12	S13 S14 S15 S16	S17 S18 S19 S20
12:40 - 14:30	Lunch	Lunch	Lunch	Lunch	Lunch
14:30 - 15:05	P4 (A. Colman_Lerner)	P13 (R. Meucci)	P22 (H. Weber)	P31 (L. Mariconi)	P38 (M. Parrilo)
15:05 - 15:35	P5 (G. Mindlin)	P14 (F. Barra)	P23 (R. Egydio)	P32 (I. Jánosi)	S21 C17 C18
15:35 - 16:05	P6 (F. Ghezzi)	P15 (J. Castaño)	P24 (K. Krisher)	P33 (C. Masoller)	
16:05 - 16:25	Coffee break	Coffee break	Coffee break	Coffee break	16:40 Coffee break
16:25 - 17:25	C1 C2 C3 C4	C5 C6 C7 C8	C9 C10 C11 C12	C13 C14 C15 C16	17:00 Closing Section
17:25 – 18:00	P7 (S. Sinha)	P16 (C. Salazar)	P25 (C. Anteneodo)	P34 (M. Aguiar)	
18:00 - 18:30	P8 (J. Tredicce)	P17 (M. Copelli)	P26 (P. Mendes)	P35 (M. Clerc)	
18:30 – 20:30			PT_1	PT_2	

P: Plenary talk; S: Minisymposium; C: Contributive talk; PT: Poster Session

Monday - July, 26th

Morning

8:30 - 8:45 **Registration**

8:45 - 9:05 **Open Ceremony**

9:05 - 10:35 **Plenary Sessions**
Auditorium FM
Chair: Jason Gallas

9:05 - 9:35 **P_01: Edward Ott**
Emergent Behavior in Large Systems of Coupled Phase Oscillators

9:35 - 10:05 **P_02: Epaminondas Rosa**
Alternating Synchronization in Coupled Chaotic Oscillators

10:05 - 10:35 **P_03: Leonardo A. B. Torres**
Energy Based Analysis of Dynamical Systems Synchronization

10:35 - 11:00 **Coffee-Break**

11:00 - 12:40 **Parallel Sessions / Mini-Symposia**

S01 - The Brain and its Functioning
Auditorium S1
Organizers: Antonio Roque da Silva Filho, Hilda A. Cerdeira and Koichi Sameshima
Speakers: Mauro Copelli, Koichi Sameshima, Roland Köberle

S02 - The Structure and Dynamics of Networks
Auditorium FM
Organizer: Francisco Aparecido Rodrigues
Speakers: Francisco Aparecido Rodrigues, Paulino Ribeiro Villas Boas, Gonzalo Travieso, Luiz Felipe R. Turci

S03 - Synchronization and Collective Behavior in Network
Auditorium RH
Organizer: Mario G. Cosenza
Speakers: O. Alvarez-Llamoza, Juan A. Muniz, Marcus Werner Beims,

S04 - Nonlinear Aeroelasticity
Auditorium SC
Organizer: Roberto Barroso Ramos
Speakers: Roberto Ramos, Cayo Prado Fernandes Francisco, André Fenili, Kleber A. L. Castão,

12:40 - 2:30 PM - Lunch

Afternoon

2:30 PM - 4:05 PM Plenary Sessions

Auditorium FM

Chair: Silvina P. Dawson

2:30 PM - 3:05 PM **P_04: Alejandro Colman-Lerner**
Signal propagation, information transmission and cell to cell variation during the activation of the S. cerevisiae pheromone response pathway,

3:05 PM - 3:35 PM **P_05: Gabriel B. Mindlin**
Physiology and dynamics of birdsong production,

3:35 PM - 4:05 PM **P_06: Flavio Ghezzi**
Loops, mesostructures and fractals

4:05 PM - 4:25 PM Coffee Break

4:25 PM - 5:25 PM Parallel Sessions / Contributive Talks

4:25 PM - 5:25 PM **C_01 Neuronal Dynamics**
Chair: Hilda Cerdeira
Auditorium: RH
Fabio Schittler - "Computation by heteroclinic switching"
Everton Agnes - "Model architecture for pattern recognition and discrimination in a neural network of spiking neurons"
Jaime Cisternas - "Bifurcations of smooth and lurching waves in a thalamic neuronal network"

Fabiano Ferrari - "The Skew Tent Map Entropy Production"

4:25 PM - 5:25 PM **C_02 Complex Network**
Chair: Tiago Pereira
Auditorium: FM
Tiago Pereira - "Hub Synchronization in Large Scale-Free Networks"
Luiz Felipe R. Turci - "Adaptive Node-to-Node Pinning Control of Complex Networks"
Rodrigo Pereira - "Effective dynamics for chaos synchronization in networks with time-varying topologies"

Vadas Gintautas - "Identification of functional information subgraphs in complex networks"

4:25 PM - 5:25 PM **C_03 Population and Dynamics**
Chair: Marcus Aguiar
Auditorium: SC
Marcus de Aguiar - "Neutral Speciation in Spatially Distributed Populations"
Evaldo de Oliveira - "Solving the Levins' paradox in the logistic map of population growth"
Juliana Kodaira - "The basic reproduction number in SI staged progression model: a probabilistic approach"

Fabiola Angulo - "Sustainable Development Through Complex Networks"

4:25 PM - 5:25 PM **C_04 Applications in Nonlinear Sciences** ( )
Chair: Murilo Baptista
Auditorium S1
Carlos Pando - "Isolas of periodic orbits in a molecular model of a laser with a saturable absorber"
Carrera - "Influence of damping in the long term behavior of a cardanically suspended body"
Bruno Batista - "The effect of poisoning species on the oscillatory dynamics of a surface catalyzed reaction"

Gerard Gomes - "A note on the dynamics of ferroelectric liquid crystals"

5:25 PM - 6:30 PM Plenary Sessions
Auditorium FM
Chair: Hilda Cerdeira

5:25 PM - 6:00 PM **P_07: Sudeshna Sinha**
Logical Stochastic Resonance

6:00 PM - 6:30 PM **P_08: Jorge Tredicce**
From Vortices to Localized Structures in Optics

Tuesday - July, 27th

Morning

8:30 - 10:35 Plenary Sessions
Auditorium FM
Chair: Carlos L. P. Lambruschini

8:30 - 9:05 P_09: Lou Pecora
Regularization of Tunneling Rates with Chaos.

9:05 - 9:35 P_10: Alfredo Ozorio
Threshold for generating quantum interferences in open chaotic systems.

9:35 - 10:05 P_11: Pablo Cincotta
Chaotic diffusion in multidimensional Hamiltonian systems.

10:05 - 10:35 P_12: Claudia M. Giordano
Chaotic diffusion in multidimensional conservative systems.

10:35 - 11:00 Coffee-Break

11:00 - 12:40 Parallel Sessions / Mini-Symposia

S05 - Chaos and Transport in Hamiltonian Systems
Auditorium S1
Organizer: Pablo Miguel Cincotta
Speakers: Francisco Salazar; Maffione, Nicolás; Darriba, L.A. ,

S06 - Neuronal Dynamics
Auditorium FM
Organizers: Thiago Pereira, Rafael Dias Viela
Speakers: Rafael Dias Vilela, Vladimir R. V. Assis, Markus Dahlem
Tiago Pereira

S07 - Bifurcations of Non-Smooth Systems
Auditorium S1
Organizer: Gerard Olivar Tost
Speakers: Carlos M. Escobar, Johan M. Redondo, Gustavo A. Osorio,

S08 - Clock Distribution Systems
Auditorium SC
Organizer: José Roberto Castilho Piqueira
Speakers: J. R. C Piqueira, R. Carareto, F. M. Orsatti

12:40 - 2:30 PM - Lunch

Afternoon

2:30 PM - 4:05 PM Plenary Sessions

Auditorium FM
Chair: Edson Denis Leonel

2:30 PM - 3:05 PM **P_13: Riccardo Meucci**
Chaotic dynamics in class B-lasers past and future perspectives.

3:05 PM - 3:35 PM **P_14: Felipe Barra**
Propagating Modes in a Diffusive Periodic Waveguide.

3:35 PM - 4:05 PM **P_15: Jose Daniel Muñoz Castaño**
Modeling with Cellular Automata and Lattice Boltzmann.

4:05 PM - 4:25 PM Coffee Break

4:25 PM - 5:25 PM Parallel Sessions / Contributive Talks

4:25 PM - 5:25 PM **C_05 Synchronization**
Chair: Luiz Felipe R. Turci
Auditorium: FM

Gonzalo Marcelo Ramírez Ávila - “Transients and Arnold tongues for synchronized electronic fireflies”.

Hassan El-Nashar - “The role of periodic boundary conditions on the synchronization of coupled oscillators in a ring”.

Armando Ticona - “Synchronization conditions in two coupled pendulums”.

Josue Fonseca - “Instabilities in coupled Huygens pendula”.

4:25 PM - 5:25 PM **C_06 Bifuraction Thoery and Applications**
Chair: Iberê Caldas
Auditorium: RH

Eulo Balvedi Jr. - “Bifurcation Analysis of a Typical Section with Control Surface Freeplay”.

Gerard Olivar - “A Novel Non-Smooth Bifurcation in a Chemical Process DAEs System”.

Caroline Martins - “Robust Tori in a Double-Waved Hamiltonian Model”.

**Ian Ford - ** “Entropy generation (and reduction) in a thermomechnically driven simple harmonic oscillaotr”.

4:25 PM - 5:25 PM **C_07 Hamiltonian Systems and Billards**
Chair: Ricardo Egydio de Carvalho
Auditorium: SC
Alexander Loskutov - “Superdiffusion in time-dependent open horizon billiards”.
Edson Denis Leonel - “Suppressing Fermi acceleration in oval like driven billiards”.
Jose Salas - “Dividing surfaces and reaction rates in the H+H2 -> H_2+H chemical reaction”.
Turgay Uzer - “Intense-Laser Double Ionization: Insights from Nonlinear Dynamics”.

4:25 PM - 5:25 PM **C_08 Time Series Analisis**
Chair: Reinaldo Roberto Rosa
Auditorium S1
Marcus Silva - “Decentralized observer for a class of nonlinear norm bounded systems”.
Lucas Uzal - “Optimal irregular delay embeddings”.
Sebastián Quiroga Lombard - “A simple conceptual model to interpret the 100000 years dynamics of paleo-climate records”.

5:25 PM - 6:30 PM **Plenary Sessions**
Auditorium: FM
Chair: Luiz de Siqueira Martins

5:30 PM - 6:00 PM **P_16: Carlos Enrique Mejia**
Stable coefficient identificaion by mollification.

6:00 PM - 6:30 PM **P_17: Mauro Copelli**
Physics of Psychophysics: contributions from Statistical Mechanics to Neuroscience.

Wednesday - July, 28th

Morning

8:30 - 10:35 Plenary Sessions
Auditorium FM
Chair: Iberê Luiz Caldas

8:30 - 9:05 P_18: Adilson E. Motter
Network Compensatory Perturbations: The Key to Rescue and Control the Dynamics of Complex Systems.

9:05 - 9:35 P_19: Sergio Alejandro Cannas
Emergent complexity in natural networks out of stability selection pressure.

9:35 - 10:05 P_20: Martine Chevrollier
Radiation trapping and Lévy flights of photons in atomic vapors.

10:05 - 10:35 P_21: Christian Otto
Complex Dynamics of Semiconductor Quantum-Dot Lasers subjected to.

10:35 - 11:00 Coffee-Break

11:00 - 12:40 Parallel Sessions / Mini-Symposia

S09 - Chalenges in Autonomous Learning
Auditorium S1
Organizer: Roseli A. F. Romero
Speakers: Paulo Martins Engel, Luiz Chaimowiz, Silvia Botelho, Caurin, G. A. P, Anna Helena Reali Costa, Roseli A. F. Romero

S10 - Astrodynamics - Part I
Auditorium FM
Organizers: Othon Cabo Winter, Antonio F.B.A.Prado
Speakers: Anderson O. Ribeiro, Valerio Carruba
Décio C. Mourão, D. Foryta,

S11 - Dynamics Suspensions Part I - Coagulation and Trapping
Auditorium S1
Organizers: Rafael Dias Viela, Michael Wikinson, Jean-Regis Angilella
Speakers: Ian J. Ford, Jean-Régis Angilella, Rafael D. Vilela,

S12 - Nonlinear Vibrations Elastic Structures
Auditorium SC
Organizers: Marcio José Horta Dantas, José Manoel Balthazar, Paulo Batista Gonçalves
Speakers: Márcio José Horta Dantas, Heitor Miranda Bottura, Berenice Camargo Damasceno, André Fenili

12:40 - 2:30 PM - Lunch

Afternoon

2:30 PM - 4:05 PM **Plenary Sessions**
Auditorium FM
Chair: Hamilton Varela

2:30 PM - 3:05 PM **P_22: Hans Ingo Weber**
Nonlinaer Dynamics and Multibodies Rotating in Space.

3:05 PM - 3:35 PM **P_23: Ricardo Egydio**
Dynamical Transport Barries.

3:35 PM - 4:05 PM **P_24: Katharina Krischer**
Globally coupled oscillators: An experimental approach towards an associative memory device.

4:05 PM - 4:25 PM Coffee Break

4:25 PM - 5:25 PM Parallel Sessions / Contributive Talks

4:25 PM - 5:25 PM **C_09 Control**
Chair: Luiz Felipe R. Turci
Auditorium: FM
Benjamin Toledo - "Optimal Control in Noisy Chaotic Systems".
Viviana Csota - "Stabilizing equilibrium by linear feedback for controlling chaos in Chen system".
Antonio Endler - "The controlling role of envelope mismatches in intense inhomogeneous charged beams".

Wolfgang Hanke - "Control of the Belousov-Zhabotinsky reaction by small external forces, especially gravity".

4:25 PM - 5:25 PM **C_10 Celestial Mechanics**
Chair: Vivian M. Gomes
Auditorium: RH
Ashok Mittal - "Intriguing structures in iterative maps motivated by N-body problem".
Maria Espindola - "Direct Hamiltonization - The Generalization of the Alternative Hamiltonization".
Gustavo Correa - "Homoclinic Chaos in Axisymmetric Bianchi-IX cosmological models with an ``ad hoc'' quantum potential".

4:25 PM - 5:25 PM **C_11 Self-organization and Collective Phenomena**
Chair: Juan Valdivia
Auditorium: SC
Juan Valdivia - "Chaos and criticality in city traffic under resonant conditions".
Nelson Lammoglia - "Description of realistic wealth distributions by kinetic trading models".
Priscila Favero - "The role of dipole surface at CdS nanoparticle self organization".
Rosse Quiroz - "Phase transition liquid-gas simulation in a bi-dimensional net".

4:25 PM - 5:25 PM **C_12 Fulid Dynamics and Turbulence**
Chair: Abraham Chian
Auditorium S1
Rodrigo Miranda - "Amplitude-phase synchronization in intermittent turbulence and spatiotemporal chaos".
Abraham Chian - "Edge of chaos in the GOY shell model of fully-developed turbulence".
Giseli Lima - "Two upwinding schemes for nonlinear problems in fluid dynamics".
Breno Silva - "Turbulence and Cascades on Geodynamo",

5:25 PM - 6:30 PM Plenary Sessions
Auditorium FM
Chair: Mario Consenza

5:30 PM - 6:00 PM **P_25: Celia Anteneodo**
Lyapunov exponents of many particle systems.

6:00 PM - 6:30 PM **P_26: Paulo R. de Souza Mendes**
A Novel Approach For Modeling the Thixotropic Elastoviscoplastic.

6:30 PM - 20:30 PM Poster Session (PT_1)

Chair: Rodolfo Maduro Almeida
Atrium

PT1: Francisco Marcus

Nonlinear Bidimensional Sloshing Suppressor Model.

PT2: Leonardo Santos

Heat stress estimation as an inverse problem: variational approach..

PT3: Clóves Rodrigues

Nonlinear electronic transport behavior in Indium Nitride.

PT4: Claudio Cesar Silva Freitas

Using Matlab as a Tool for the Teaching of Nonlinear Systems in Engineering: The Case of the Inverted Pendulum.

PT5: Everton Medeiros

Multistability in Systems with Impacts.

PT6: Everton Medeiros

Weak perturbation to control chaos in an impact oscillator.

PT7: Pedro Curto-Risso

Mono and multifractal analysis of simulated heat release fluctuations in a spark ignition heat engine.

PT8: Leandro Neves

Fractal Dimension as a Marker of Cellular Rejection in Myocardial Biopsies from Patients Submitted to Heart Transplantation.

PT9: Leandro Neves

Lacunarity as a Descriptor of Cellular Rejection in Myocardial Biopsies from Patients Submitted to Heart Transplantation.

PT10: Victoria Salazar Herrera

Detection and Alert of muscle fatigue considering surface electromyography chaotic model.

PT11: Noah Levine-Small

Accounting for Complexes of Nodes in a Vulnerability Assessment of Proteins in the Human DNA Damage Response Interaction Network.

PT12: Dionis Teshler

Dynamic Analysis Of Neural Networks.

PT13: Andres Finkelsteyn

Dynamics of comportamental epidemic models with saturated treatment and prophlaxis functions.

PT14: Jorge Ferreira

On a Asymptotic Behaviour of the Solution for a Stochastic Coupled System of Reaction-Difusion of Nonlocal Type.

PT15: Denny Garcia

Multiscale entropy analysis of spontaneous blinking time series.

PT16: Thomas Bartlett

Periodic Quantum Walks.

PT17: Klaus Kramer

Cellular automata with inertia.

PT18: Daniel Escaff

Pattern formation and non-local interaction: continuous versus discrete models.

PT19: Martine Chevrollier

Model for neural signaling leap statistics.

PT20: Diogo Soriano

An evolutionay approach to the search for periodic and chaotic oscillations in Hodgkin-Huxley model.

PT21: Bruno Medeiros

Excitable Electronic Circuit as a Sensory Neuron Model.

PT22: Fernanda Matias

Pseudo-Anticipated Synchronization in a Biologically Plausible Model of a Ubiquitous Neuronal Motif.

PT23: Raymundo Azevedo

Modelling immunisation against cytomegalovirus infection.

PT24: Marcos Amaku

Modelling vaccination against bovine brucellosis.

PT25: Marat Rafikov

Controlling the interaction between sugarcane borer and its parasitoid.

PT26: Luigi Renna

A Discrete SIRS Model with Kicked Infection Probability.

PT27: Leonardo Maia

Evolution and drug resistance: a computational study.

PT28: Marcelo Araujo

Solution for anomalous diffusion equation with source term.

PT29: Diogo Vieira

Dynamical Systems Analysis of a Cortical Neuron Model.

PT30: El-Haffaf Amir

Upper and Lower solutions for fourth nonlinear boundary value problem.

PT31: Hernan Piragua-Ariza

Studying the topological stability of the $\lambda\Phi^4$ kink..

PT32: Eduardo Mazzutti

Mathematical modeling and numerical simulations of a constrained double pendulum.

PT33: Gabriel Slade

Influence of energy changes in breathers.

PT34: Marcus Vinicius Bianchi dos Santos

Comparison between linear and nonlinear control for the double pendulum using the minimum energy criterion.

PT35: Cristiane Stegemann

Periodic, Chaotic, and Hyperchaotic States in Parameter-Spaces of a Four-Dimensional Chuas System.

PT36: Sabrina Camargo

Extreme fractal structures in chaotic mechanical systems: riddled basins of attraction.

PT37: Henrique Carli

Improving the forecasting capabilities in time series analysis.

PT38: Emilson Ribeiro Viana Junior

High Resolution parameter spaces for a forced Chua's Circuit.

PT39: Priscilla Silva

Biparametric Investigation of the Phase Space Structures of the General Standard Map in Dissipative Regime.

PT40: Robson Pessoa

Generalizing the logistic map through the q-product.

PT41: Helaine Furtado

Neural networks for emulation variational method for data assimilation in nonlinear dynamics.

Thursday - July, 29th

Morning

8:30 - 10:35 Plenary Sessions
Auditorium FM
Chair: Edson Denis Leonel

8:30 - 9:05 P_27: Jürgen Kurths
Dynamical System and Complex Networks: Are such Theories Useful for Neuroscience and Geoscience.

9:05 - 9:35 P_28: Murilo Baptista
Communication in complex networks.

9:35 - 10:05 P_29: Philip Morrison
Chaos in Nontwist Hamiltonian Systems.

10:05 - 10:35 P_30: Peter McClintock
Wave Turbulence in Superfluid ^{4}He: Energy Cascades, Rogue Waves \&Kinetic Phenomena in the Laboratory.

10:35 - 11:00 Coffee-Break

11:00 - 12:40 Parallel Sessions / Mini-Symposia

S13 - Communication with Chaos Part I
Auditorium S1
Organizers : Rafael Dias Viela, Michael Wikinson, Jean-Regis Angilella
Speakers: Murilo da Silva Baptista, Renato D. Fanganiello, Luiz Bernardo, Diogo C. Soriano,

S14 - Astrodynamics - Part II
Auditorium FM
Organizers: Othon Cabo Winter, Antonio F.B.A.Prado
Speakers: Rodney S. Gomes, Tadashi Yokoyama, Silvia M. Giuliatti Winter, Hugo Folonier

S15 - Dynamics Suspensions Part II - Turbulence
Auditorium S1
Organizers: Rafael Dias Viela, Michael Wikinson, Jean-Regis Angilella
Speakers: Alain Pumir, M. Wilkinson, B. Mehlig,

S16 - Nonlinear Analysis Simulation Space Physics
Auditorium SC
Organizers: R. R. Rosa, J.D. Simões da Silva
Speakers: Abraham C.-L. Chian, E. Luiz Rempel, M. P. M. A. Baroni, R. R. Rosa

12:40 - 2:30 PM - Lunch

Afternoon

2:30 PM - 4:05 PM Plenary Sessions
Auditorium FM
Chair: Ricardo Luiz Viana

2:30 PM - 3:05 PM P_31: Luca Moriconi
Turbulent Boundary Layer Fluctuations and Horseshoe Vortices.

3:05 PM - 3:35 PM P_32: Imre M. Jánosi
Chaotic advection of passive tracers in the atmosphere: laboratory models and numerical tests with reanalysis wind fields.

3:35 PM - 4:05 PM P_33: Cristina Masoller
Quantifying complexity via information theory measures.

4:05 PM - 4:25 PM Coffee Break

4:25 PM - 5:25 PM Parallel Sessions / Contributive Talks

4:25 PM - 5:25 PM C_13 Control in Complex Systems
Chair: Marcio Dantas
Auditorium: FM
André Steklain - "Stability of a Restricted Three-Body Problem with the Spherical Plummer Potential".
Daniel Cajueiro - "Controlling self-organized criticality in complex networks".
Marcio Dantas - "Stabilization due to Singular Perturbations in a Wind Model".

Adriano Batista - "Squeezing of thermal noise in a parametrically-driven Duffing oscillator".

4:25 PM - 5:25 PM C_14 Communication with chaos and Coding
Chair: Marcio Eisencraft
Auditorium: SC
Larissa Ribeiro - "Digital Modulation using High Period Unstable Periodic Orbits".
Diogo Soriano - "Blind extraction and separation of chaotic sources - results ans perspectives".
Damien Rontani - "Multiplexed Chaos-Based Communications with Semicondutor Lasers".

Daniel Chaves - "Properties of a Aithmetic Code for Geodesic Flows".

4:25 PM - 5:25 PM **C_15 Dynamics of Granular Materials**
Chair: Adriana Tufaile
Auditorium: S1
Ignacio Ortega - "Subharmonic wave transition in a quasi-one-dimensional noise fluidized shallow granular bed".
Laurent Ponson - "Soliton and disorder: wave propagation in elastic spin chains".
Sergio Andres Galindo Torres - "Minkowski Spheropolyhedra for the simulation of Granular Materials".

Orazio Descalzi - "Partial annihilation of counter-propagating pulses".

4:25 PM - 5:25 PM **C_16 Plasma and Turbulence**
Chair: Ricardo Luiz Viana
Auditorium RH
Erico Rempel - "Lagrangian Coherent Structures in a Nonlinear MHD Dynamo".
Luca Moriconi - "Time Dependent Shocks and Forcing Effects in the Velocity Probability Distribution Functions of Burgers Turbulence".

Cayo Francisco - "Dynamics of the Brazil-Malvinas Confluence".

Carlos Breviglieri - "Spatial High Order Numerical Solution for Fluid Dynamics Applications".

5:25 PM - 6:30 PM Plenary Sessions
Auditorium FM
Chair: Roland Korbele

5:30 PM - 6:00 PM **P_34: Marcus A. M. de Aguiar**
A Neutral Theory of Speciation and Diversity.

6:00 PM - 6:30 PM **P_35: Marcel Clerc**
Liquid–solid-like transition in quasi-one-dimensional driven.

6:30 PM - 20:30 PM Poster Session (PT_2)

Chair: Luiz Felipe Ramos Turci
Atrium

PT42: Denilson Paulo Santos

The Use the Flyby for Optimal Solutions.

PT43: Sheila Assis

Symmetry breaking effects in escape basin analysis.

PT44: Germano Amaral Monerat

Pre-Inflationary Oscillations of FRW Universes: Non-Linear Dynamics about Saddle-Center Points.

PT45: Caroline Martins

Magnetic field line escape: Comparison with mean free path.

PT46: Meirielen Sousa

Fully nonlinear maps and regular acceleration in magnetized relativistic systems.

PT47: Glaucius de Oliveira

Numerically Induced Chaos as a Consequence of Reduced Descriptions of the Nonlinear Schroedinger Equation.

PT48: Itzhack Dana

Kicked Hall Systems: Generic Super-Weak Chaos on a Universal Stochastic Web.

PT49: Diogo Costa

Describing a phase transition in the dynamics of a particle moving in a time-dependent potential.

PT50: Daniel Chave

Properties of a Arithmetic Code for Geodesic Flows.

PT51: Marcelo Silva Custódio

Intrinsic stickiness in open integrable billiards: border effects.

PT52: Adriane Schelin

Ratchet current in the Tokamap with mixed phase space.

PT53: Wilson Luiz Façanha

Chaotic Transport in Plasmas with Magnetic Shear.

PT54: Sandro Pinto

Shadowing of Trajectories in the Standard Map.

PT55: Cesar Manchein

Characterising the common behavior close to stickiness in Hamiltonian systems.

PT56: Júlio Fonseca

Chaotic Dynamics in Fusion Plasmas.

PT57: Adriana Tufaile

Hyperbolic kaleidoscopes and chaos in Hele-Shaw cells.

PT58: Jean Paulo dos S. Carvalho

Frozen orbits around the Europa satellite.

PT59: Fernando Cachucho

Chirikov diffusion in the region of the (3556) Lixiaohua asteroid family.

PT60: Sonia Pinto de Carvalho

Asteroseismology of rapidly rotating stars and optical billiards.

PT61: Saulo Bastos

Dynamic Valid Models for the conservative Hénon-Heiles System.

PT62: Tiago Kroetz

Nontwis Bouncing Ball Mapp.

PT63: Alan Celestino

A Study Via Parameter Spaces of The Tokamap.

PT64: Cesar Manchein

Estimating hyperbolicity of chaotic bidimensional maps.

PT65: Camilo Neto

Scaling in the Helimac Plasma Electrostatic Turbulence.

PT66: Paulo Galuzio

Intermittent onset of turbulence in the damped and forced regularized-long-wave equation.

PT67: Gustavo Zampier

Evidence of Transport Barrier in Tokamak Discharge with High MHD Activity.

PT68: Michael Kholmyansky

Log-Poisson Cascade Description of Turbulent Velocity Gradient Statistics.

PT69: Daniel Freire

Entrainment and mixing in fountains in stratified media.

PT70: Felipe Magalhaes

Defects decay and pattern switching on 1-D Swift-Hohenberg equation.

PT71: Sérgio Lira

Stationary shapes of rotating magnetic fluid droplets.

PT72: Gustavo Zampier

Evidence of self-organized criticality behavior in TCABR plasma edge.

PT73: Pablo Muñoz

Noise-induced intermittency in a mean-field dynamo.

PT74: Dennis Toufen

On the Plasma Turbulence Control in the Texas Helimak.

PT75: Breno Silva

Variations on the geomagnetic field dipole and the fluctuation dissipation theorem.

PT76: Rodolfo Almeida

Percolation model for wildland fire spread dynamics.

PT77: Juliano de Oliveira

A Phase transition in a two dimensional Hamiltonian map.

PT78: Celso Abud

Energy Gain induced by crisis.

PT79: Jose Danilo Szezech Junior

Zonal flow influence in the generation of instability in four wave interaction.

PT80: Rosangela Nascimento

Detrended fluctuation analysis applied to cortical spreading depression: the malnutrition effect.

PT81: Renato Moraes

Detrended fluctuation analysis and parabolicity index in aged rats with status epilepticus elicited by pilocarpine acutely.

PT82: Alexandre Casagrande

Quantification of Chirp-like Structures of EEG Time-Series.

Friday - July, 30th

Morning

8:30 - 10:35 **Plenary Sessions**
Auditorium FM
Chair: Elbert E. N. Macau

8:30 - 9:05 **P_36: Ying-Cheng Lai**
Relativistic quantum scars..

9:05 - 9:35 **P_37: Ruedi Stoop**
Shrimps and their relation to perception.

9:35 - 10:35 **Poster Session (PT_3)**

Chair: Vivian Gomes
Atrium
PT83: David Ciro

A novel cell-coupling leading to nonlocal interactions.

PT84: Diego Ortiz

Community detection in a sociodynamic model of conflict.

PT85: Mauro F. Calabria

Automatic optimization of an experiment in noise-enhanced propagation.

PT86: Renato Fanganiello

Synchronization conditions for a bandlimited discrete-time chaotic system.

PT87: Hazael Serrano

Synchronization in perturbed complex networks with star coupling configuration.

PT88: Raphael Nagao

Empirical Stabilization of Transient Time-Series in an Electrochemical System.

PT89: Cristiane Oliveira

Kinetic instabilities during glycerol electro-oxidation on platinum.

PT90: Fábio A. S. Silva

Spatial patterns in oscillator lattices with non-local coupling: application to an activator-inhibitor auto-catalytic model.

PT91: Edgar Landinez

Supersymmetric Langevin Dynamics To find Reaction Paths.

PT92: Gilberto Corso

Degree Distribution and Nestedness in Bipartide Networks from Community Ecology.

PT93: Claudia Patricia Cruz

Measuring Asymmetry in Insect-plant Networks.

PT94: Ricardo Ferreira

Growth dynamics for protein association network: Comparing Model Simulation and Data.

PT95: Jose Grisi-Filho

Different Methods to generate Scale-Free Networks and their effects on the Network Shape.

PT96: Alejandro Carrillo

Self-organization and pattern formation in coupled Lorenz oscillators under a discret symmetric transformation.

PT97: Bilzã Araújo

Identifying abnormal nodes in protein-protein interaction networks.

PT98: Johnatan Aljadeff

Functional Phase Synchronization Structures in Mice Neural Networks.

PT99: Roberto Santos

Estimating Chaos Control Parameters from Time Series.

PT100: Kenzo Sasaki

Analysis of the Ginzburg-Landau equation with non-local coupling.

PT101: Cristhiane Goncalves

Electrical implementation of a complete synchronization dynamic system.

PT102: Cecilia Cabeza

Synchronization of fireflies using a model of Ligth Controlled Oscillators.

PT103: Rero Marques Rubinger

Mutual information and synchronism on a network of four chaotic circuits.

PT104: Ghasem Asadi Cordshooli

Statistical Study Of Nonlinear Return Maps In Regular And Chaotic Conditions.

PT105: Luciano Camargo Martins

The initial inhomogeneity and halo formation in intense charged particle beams.

PT106: Romeu Szmoski

Spatiotemporal Features of a Coupled Map Lattice.

PT107: Nicolas Rubido

Transient dynamics and synchronization regions of pulse-coupled piecewise linear oscillators in T^2..

PT108: André Timpanaro

Study of the attractor structure in an agent-based sociological model.

PT109: Ezequiel Arneodo

An electronics syrinx to explore mechanisms of birdsong production.

PT110: Gabriela Casas

Parameter Modulation in the Hénon Map.

PT111: Marcos Correia

Characterization of hyperchaotic states in parameter-space.

PT112: Julio D'Amore

Lyapunov Exponent Diagram for a Driven Chaotic Oscillator with Complex Variable.

PT113: José Vieira

Numerical Bifurcation Analysis of the Watt Governor System.

PT114: Flavio Prebianca

On The Effect of a Parallel Resistor in The Chua's Circuit.

PT115: Melke Nascimento

High-resolution phase diagrams of a generic electrochemical oscillatior.

PT116: Jose Luevano

The method of separation of variables for the Frobenius-Perron operator for a class of two dimensional chaotic maps.

PT117: Marla Heckler

Transport Properties in an open system.

PT118: Cristhiane Gonçalves

The electronic bouncing ball circuit in a communication system.

PT119: Cleber Oliveira

Cryptography with chaos using Chua's attractor.

PT120: J. Alexis Andrade-Romero

Acoustic signal characterization of a ball milling machine model.

PT121: Roja Norouzie

Statistical Study of logistic Map Orbits In None Chaotic And Chaotic Orbits.

PT122: Enver Ramirez

Asymptotic approach for the nonlinear equatorial long wave interactions.

PT123: André Livorati

Scaling properties for a family of stadium-like billiards with parabolic boundaries.

10:35 - 11:00 Coffee-Break

11:00 - 12:40 Parallel Sessions / Mini-Symposia

S17 - Communication with Chaos Part II
Auditorium S1
Organizer: Marcio Eisencraft
Speakers: José M. V. Grzybowski, Antonio Marcos Batista, Fábio Siqueira Netto, Leonardo Antônio Borges Tôrres

S18 - Astrodynamics - Part III
Auditorium FM
Organizers: Othon Cabo Winter, Antonio F.B.A.Prado,
Speakers: J.I.B. Camargo, Mauro F. Baião, Rodolpho Vilhena de Moraes, Ana Paula Marins Chiaradia

S19 - Turbulence in Fluids and Plasma
Auditorium RH
Organizers: Ricardo Luiz Viana
Speakers: Z. O. Guimarães-Filho, S. R. Lopes, R. L. Viana

S20 - Zero Average Dynamics - ZAD
Auditorium SC
Organizers: Gerard Plivar, Fabiola Angulo,Gustavo Adolfo Osorio
Speakers: Juan G. Muñoz, Simeón Casanova, John A. Taborda, Andrés F. Amador, Daniel A. Burbano

12:40 - 2:30 PM - Lunch

Afternoon

2:30 PM - 3:05 PM Plenary Sessions

Auditorium FM

Chair: Antonio F. Bertachini de Almeida Prado

2:30 PM - 3:05 PM **P_38: Marcelo Barreiro Parrilo**

Climate predictability over South America.

3:05 PM - 4:05 PM Parallel Sessions / Mini-Symposia

S21 - Astrodynamics - Part IV

Auditorium FM

Organizers: Othon Cabo Winter, Antonio F.B.A.Prado

Speakers: Othon C. Winter, R. Vieira Martins, Anderson O. Ribeiro, Gomes, V. M., Érica C. Nogueira

3:05 PM - 4:05 PM Parallel Sessions / Contributive Talks

3:05 PM - 4:05 PM **C_17 Chaotic Dynamics**

Chair: Rene Medrano

Auditorium: SC

Ued Maluf - “Chaos and complexity: a non-ordinary route - II”.

Rene Medrano-T. - “Periodic windows distribution: A quantitative description in the two-parameter space”.

Elinei Santos - “The chaotic Dynamics of Watt regulator generated frommap and differential equations”.

Pablo Muñoz - “Chaotic saddles in a numerical model of Pierce diode”.

Hiroyuki Yoshida - “Chaotic Dynamics in Mathematical Economics: A Duopoly Model”.

3:05 PM - 4:05 PM **C_18 Dynamics of Byosistems and Health Applications**

Chair: Moacir F. de Godoy

Auditorium: RH

Delali Adiamah - “Generic dynamic modeling of metabolic systems”.

Daniel Schultz - “Deciding fate in adverse times: sporulation and competence in Bacillus subtilis”.

Mati Goldberg - “Propagation of calcium pulses in astrocyte networks by nonlinear gap junctions”.

Rennie Machado - “A Minimalist Model Of Calcium-Voltage Coupling In GnRH Cells.”.

Alexander Loskutov - “May suppression of the spatio-temporal chaos in cardiac tissue be a method for controlling the fibrillation phenomenon?”.

4:40 - 11:00 Coffee-Break

5:00 PM Closing Section

ABSTRACTS

Plenary Talks

P_01: Edward Ott

Emergent Behavior in Large Systems of Coupled Phase Oscillatos

Departmanet of Electrical Engineering
University of Maryland
College Park, MD 20742
USA

Large systems consisting of many coupled phase oscillators have been used as models for diverse phenomena. Examples include flashing fire flies, control of animals' circadian rythm by the superchiasmatic nucleus, neuronal dynamics, synchronization of cardiac pace-maker cells, animals that rest with half their brain in the sleep state at a time, chemical oscillations, oscillations in bubbly fluids, synchronization of pedestrian walking on foot bridges, clapping audiences, synchronization in Josephson junction circuits, and many others. This talk will demonstrate and illustrate [1] a technique that reduces the study of the long time temporal behavior of these models to that of low dimensional dynamical systems (e.g., to a small number of ODEs). In particular, it is shown [2] that all the attractors of such systems are captured. Discussion of the basic mechanism responsible for this reduction and of extensions (e.g., to dynamics on networks and spatio-temporal patterning models) will also be presented.

[1] E.Ott and T.M.Antonsen, Chaos (2008).
[2] E.Ott and T.M.Antonsen, Chaos (2009).

P_02: Epaminondas Rosa, Jr.

Alternating Synchronization in Coupled Chaotic Oscillators

Department of Physics
Illinois State Univertity
Normal, IL 61790-4560
USA

Synchronization in chaotic systems is a well studied phenomenon, with many examples of various types of chaos synchronization. One kind of synchronization of special interest involves systems with their phases in step with each other while maintaining no correlation about their amplitudes. There are many instances where an oscillator (A), coupled to two other oscillators (B and C), alternates phase synchronous states: Oscillator A synchronizes initially with oscillator B, but not with oscillator C. After a while, oscillator A breaks synchrony with oscillator B and
synchronizes with oscillator C for a while, breaks it and synchronizes back with oscillator

B, etc. This pattern has been observed in a number of oscillators, both experimentally and theoretically, including plasmas, lasers, Chua circuits, and Roessler and neurological systems. Some of these cases will be presented and the mechanism behind such alternating processes will be discussed. Challenges posed by neurological processes will be addressed.

P_03: Leonardo A. B. Torres
Energy Based Analysis of Dynamical Systems Synchronization

Centro de Pesquisas e Desenvolvimento em Engenharia Elétrica
Universidade Federal de Minas Gerais
31270-010 - Belo Horizonte – MG
Brazil

Synchronization of nonlinear dynamical systems has been an active research theme due to the ubiquitous nature of the subject in diverse areas of science and engineering. Currently, a very interesting approach to the investigation of conditions that ensure the stability of the synchronized behavior of multiple interconnected systems is related to the analysis of energy exchange among these coupled systems. This approach has received considerable attention, particularly in the analysis of networks of interconnected mechanical systems, viewed as Euler-Lagrange systems. However, problems outside mechanics can also benefit from this approach, as long as they can be recast in a energy flow exchange context. One such instance where this technique seems to be promising is the synchronization of a unknown number of parallel connected uninterruptible power supplies – UPS. In this case, the problem is to implement the same control algorithm is each unit such that the whole ensemble becomes able to sustain a load that demands more energy than each unit can provide separately, while keeping a sinusoidal low harmonic content voltage signal across the power bus. It is a interesting to notice that the standard solution to this problem is to make each UPS behaves like an electromechanical power generator, i.e., the frequency and amplitude of each UPS output voltage is varied according to the instantaneous power flow from the UPS to the power bus.

P_04: Alejandro Colman-Lerner
Signal propagation, information transmission and cell to cell variation during the activation of the S. cerevisiae pheromone response pathway

Instituto de Fisiologia, Biologia Molecular y Neurosciencias
Consejo Nacional de Investigaciones Cientificas e
Departamento de Fisiologia, Biologia Molecular y Celular
Facultad the Ciencias Exactas y Naturales
Universidad de Buenos Aires

Buenos Aires, Argentina

We studied the quantitative behavior of a prototypical eukaryotic information sensing, relaying and decision-making system, the mating pheromone response pathway in yeast. We used fluorescent protein fusions to pathway components expressed from native chromosomal promoters to measure signal propagation in single cells with seconds to minutes time resolution. We quantified membrane recruitment of the MAP kinase cascade scaffold Ste5 and activation of the transcription factor Ste12 in the nucleus. We found that, after stimulation with a constant concentration of pheromone, system activity at each measurement point rises, peaks and declines. We also studied how faithfully this system relays information. I will discuss evidence that indicates that this information transmission relies on negative feedback originating on the MAP kinases. We found that only a small proportion of total cell-to-cell variation is caused by random fluctuations in gene transcription and translation during the response ('expression noise'). Instead, variation is dominated by differences in the capacity of individual cells to transmit signals through the pathway ('pathway capacity') and to express genes into proteins ('expression capacity'). Our results also identified mechanisms that regulate cell-to-cell variation in pathway capacity. First, the MAP kinase Fus3 suppresses variation at high pheromone levels, while the MAP kinase Kss1 enhances variation at low pheromone levels. We have developed higher throughput methods to measure fluorescent reporters in flow cytometry that accurately report changes in system output and cell to cell variation over time and under range of pheromone doses, and are thus now pursuing whole genome screenings to identify genes that regulate quantitative system behavior. I will present data that begins to dissect the different classes of quantitative mutants. Taken together, the results I will present highlight the importance of a quantitative and dynamic understanding of information carrying systems.

P_05: Gabriel B. Mindlin
Physiology and dynamics of birdsong production

Departamento de Fisica
Faculdad de Ciencias Exactas y Naturales
Universidad de Buenos Aires
Cidad Universitaria, Pabellón I
1428 – Buenos Aires – Argentina

Oscine birds are an optimal animal model to study how a nervous system reconfigures itself through experience, since, as humans and a few other examples in the animal kingdom , they require a tutor in order to master their vocalizations. During song production, oscine birds produce large air sac pressure pulses. During those pulses, energy is transferred to labia located at the juncture between the bronchii and the trachea, inducing the high frequency labial oscillations which are responsible for airflow modulations, i.e., the uttered sound. In order to generate diverse syllables, canaries

(Serinus canaria) use a set of air sac pressure patterns with characteristic shapes. In this talk I will show experimental data showing that these different shapes can be approximated by the subharmonic solutions of a low dimensional dynamical system. Alternative models for the neural architecture involved in the generation of these gestures will be discussed, as well as plausible mechanisms for the dimensionality reduction observed in the data. Interpreting the diversity of these physiological gestures as subharmonic solutions of a simple nonlinear system allows us to account simultaneously for their morphologicalfeatures as well as for the syllabic timing and suggests a strategy for the generation of complex motor patterns.

P_06: Flavio Ghezzi
Loops, mesostructures and fractals

Departament of Physics
Universidad Mayor de San Andrés – UMSA
c. 27 Cota-Cota,
Campus Universitario
La Paz
Bolivia

Using video-microscopic techniques, single layers (monolayers) of charged colloidal particles of 1- and 3-µm diameter were studied at an air–water interface. The particles normally arranged themselves in an ordered lattice-like array. The monolayer was exposed to a number of external influences: ions, electric current, and ultraviolet light. Depending on the perturbation applied, the lattice-like structure formed fractal aggregates, clusters (mesostructures), and two other particular structures, here referred to as striations and loops. The mechanisms of formation and implications of the different patterns are discussed. Finally, possible connections with recent suggestions of hither to unexpected attractive contributions to the pairwise interaction potential for bulk colloidal systems are discussed.

P_07: Sudeshna Sinhá

Logical Stochastic Resonance

The Institute of Mathematical Sciences
Taramani, Chennai 600 113
India

The response of a noisy nonlinear system to deterministic input signals ca be enhanced by cooperative phenomena. We show that when one presents two square waves as input to a two-state system, the response of the system can produce a logical output (NOR/OR) with a probability controlled by the noise intensity. As one increases the noise (for fixed threshold or nonliearity), the probability of the output reflecting a NOR/OR operation increases to unity and the decreases. Changing the nonlinearity (or the thresjolds) of the system changes the output into another logic operation (NAND/AND) whose probability displays analogous behavior. The interplay of nolinearity and noise can yield logic behavior, and the emergent outcome of such systems is a logic gate. This "logical stochastic resonance" is demonstrated via an experimental realization of a two-state system with two (adjustable) thresholds.

P_08: Jorge Tredicce

From Vortices to Localized Structures in Optics

S. Barland, M. Giudici, F. Pedaci, X. Hachair, P. Genevet, E. Caboche, G.Tissoni, and J. R. Tredicce
Institut Non Lineaire de Nice (INLN) UMR 6618
Universite de Nice-Sophia Antipolis, CNRS
1361 Route des Lucioles, 06560 Valbonne
France

We review recent advances made on the generation of spatio-temporal structures in optics. In particular we consider the case of localized structures, also called cavity solitons. We describe their properties and we discuss possible application devices like optical memories, shift registers or force microscopes. We analyze also the different experimental optical systems generating such structures. Finally we compare theoretical and experimental results and we give a perspective for future developments.

P_09: Lou Pecora

Regularization of Tunneling Rates with Quantum Chaos
Louis M. Pecora, Hoshik Lee, and Dong-Ho Wu
Naval Research Laboratory, code 6362, Washington, DC, 20375, USA

We study tunneling in various shaped, two-dimensional, flat, double wells by calculating the energy splitting between symmetric and anti-symmetric state pairs. For shapes that have regular or nearly regular classical behavior (e.g. rectangular or circular wells) we find that tunneling rates for nearby energy states vary over wide ranges. Rates for energetically close quantum states can differ by several orders of magnitude. As we transition to well shapes that admit more classically chaotic behavior (e.g. the stadium, the Sinai billiard) the range of tunneling rates narrows, often by an order of magnitude or more. For well shapes in which the classical behavior appears to be fully chaotic (as determined from numerical bounce maps) the tunneling rates' range narrows to about a factor of 4 or so between the smallest and largest rates in a wide range of energies. This dramatic narrowing appears to come from destabilization of periodic orbits in the

regular wells that produce the largest and smallest tunneling rates. It is in this sense that we say the quantum chaos regularizes the tunneling rates. Preliminary calculations of Husimi distributions suggest that the rates are strongly dependent on the magnitude of normal momentum and the magnitude of the wave function at the barrier. Recently, a theory based on a random plane wave approximation appears to qualitatively reproduce the changes in tunneling rate distributions seen in the numerical results.

P_10: Alfredo Ozório de Almeida

Threshold for generating quantum interferences in open chaotic systems

Centro Brasileiro de Pesquisas Físicas
Urca
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Quantum interferences in a wide range of experiments can be derived from the oscillations of the Wigner function. Unitary evolution generated by Hamiltonians that are classically chaotic generate new oscillations, but these are rapidly erased by decoherence in an open system, modeled by quantum Markovian dynamics. The combination of chaotic parameters (Lyapunov exponents) and those that lead to nonunitarity (such as the dissipation coefficient) will be presented that mark the threshold for the possible generation of interferences in an open chaotic systems. This result is based on the semiclassical theory for the evolution of the density operator in double phase space.

P_11: Pablo Cincotta

Chaotic diffusion in multidimensional Hamiltonian systems

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In the present talk we provide results and discussion concerning the processes that lead to chaotic diffusion in phase space of multidimensional Hamiltonian systems. Diffusion actually means variations of, for instance, the unperturbed integrals. Unfortunately, it does not yet exist any theory that could describe global diffusion in phase space. It is not possible to estimate either its routes or its extent. Though one could get accurate values of several indicators of the stability of the motion, they only provide local information in a neighborhood of a given point of phase space. A given orbit in a chaotic component of

phase space could have, for instance, a positive and large value for two of the Lyapunov exponents, however, this does not necessarily mean that the unperturbed integrals will change over a rather large domain. This fact is a natural consequence of the structure of phase space of almost all actual dynamical systems such as planetary systems or galaxies, and it is termed stable chaos. What is actually significant is the extent of the domain and the time--scale over which diffusion may occur. In a previous work, it is shown that in models similar to those suitable for the description of an elliptical galaxy, the time--scale over which diffusion becomes relevant is several orders of magnitude the Hubble time. On the other hand, in models corresponding to planetary or asteroidal dynamics, diffusion may occur in physical time--scales. All these issues are thoroughly discussed herein by dealing with a muldimensional conservative map that would be representative of the dynamics of a resonance interaction. Moreover, the computation of both the diffusion coefficient --defined through the variance of the unperturbed action variables-- as well as the finite time Shannon or Arnol'd Entropy in order to measure the extent of chaotic diffusion processes is addressed.

P_12: Claudia M. Giordano

Chaotic diffusion in multimensional conservative systems

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Diffusion actually means variations of, for instance, the unperturbed integrals. Unfortunately, it does not yet exist any theory that could describe global diffusion in phase space. It is not possible to estimate either its routes or its extent. Though one could get accurate values of several indicators of the stability of the motion (using some dynamical indicator), they only provide local information in a neighbourhood of a given point of phase space. A given orbit in a chaotic component of phase space could have, for instance, a positive and large value for two of the Lyapunov exponents, however, this does not necessarily mean that the unperturbed integrals will change over a rather large domain. This fact is a natural consequence of the structure of phase space of almost all actual multidimensional dynamical systems such as planetary systems or galaxies, and it is termed stable chaos. What is actually significant is the extent of the domain and the time--scale over which diffusion may occur. In a previous work, it is shown that in models similar to those suitable for the description of, for instance, an elliptical galaxy, the time--scale over which diffusion becomes relevant is several orders of magnitude the Hubble time. On the other hand, in models corresponding to planetary or asteroids dynamics, diffusion may occur in physical time--scales.

P_13: Ricardo Meucci

Chaotic dynamics in class B lasers: past and future perspectives

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Chaos in a single mode laser was numerically observed in 1963 [1] as early as the Lorenz model [2]. In fact the two dynamics are ruled by the same equations for three coupled variables [3]. However, in practical laser systems, the time scales associated with different variables are usually widely different, thus the relevant dynamics takes place with only 1 or 2 dominant variables. We have called class A and B, respectively, these dynamical situations [4]. Adding a third dynamical variable to a class B laser , single mode chaos has been demonstrated . The experimental implementation was realized with by modulation [5] or by feedback [6]. In the last experimental configuration homoclinic chaos has been thoroughly investigated.

A large variety of dynamical phenomena [7,9] have been tested and demonstrated using these systems, demonstrating their usefulness and versatility.

Here we focus the attention on the analogies in neuroscience with particular emphasis on spiking and bursting behaviours. Such a comparison is particularly interesting in semiconductor lasers and LEDs with a suitable optoelectronic feedback in order to slow down the characteristic dynamics in the range of milliseconds. Coupled arrays of these devices represent an analog simulation of neuron networks.

P_14: Felipe Barra

Propagating Modes in a Diffusive Periodic Waveguide

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We study the number of propagating Bloch modes in an infinite periodic waveguide. The asymptotic semiclassical behavior of this quantity depends on the phase-space dynamics of the unit cell, growing like with the wavenumber in diffusive systems with chaotic unit cells. We verify the semiclassical prediction and establish the connection between this result and the universality of the parametric variation of energy levels. We will also present some results for quantum networks and random matrix models of the waveguide.

P_15: Jose Daniel Muñoz Castaño

Modeling with Cellular Automata and Lattice Boltzmann

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Cellular automata and lattice Boltzmann are powerful tools to model physical systems. If an individual tracking of elements is required, a cellular automaton is a good choice, even if it is easy to give an heuristic evolution rule (traffic) or if a partial differential equation must be fulfilled (diffusion). In contrast, lattice Boltzmann are more adequate to model continuous systems with a set of conservation laws. As lattice-gases do, they define a set of velocity vectors to neighbohr cells, but carrying ditribution functions insted of particles. These functions decay to equilibrium values by following the Boltzmann's transport equation and resembles conservation laws in the macroscopic limit, via a Chapman-Enskog expanssion. Hereby we illustrate the use of cellular automata with models of mixed traffic in Bogota and of an inhibitor synapse mediated by GABA, and we show how to construct lattice Boltzmann models for almost any desired conservation law of a vector field, even with curls (like the Faraday's law), with examples in three-dimensional plasma physics and electrodynamics

P_16: Carlos Enrique Mejia Salazar

Stable Coefficient Identification by Mollification

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We present the use of discrete mollification for the numerical identification of unknown parameters in linear and nonlinear heat conduction equations. This is an ill-posed problem that requires a regularization procedure. Solutions of the associated direct problem observed with errors at a discrete set of points, are the required overposed data of the algorithm. In this talk, we introduce the mollification method and show how to use it for the stable recovery of undetermined coefficients of different kinds. Illustrative numerical examples are included

P_17: Mauro Copelli

Physics of Psychophysics: contributions from Statistical Mechanics to Neuroscience

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It has been known for over a century that psychophysical response curves (perception of a physical stimulus as a function of stimulus intensity) have a large dynamic range: several decades of stimulus intensity can be discriminated before saturation ensues. This is in stark contrast with response curves of sensory neurons, whose dynamic range is small, usually spanning only one or two decades. We argue that this (apparent) paradox can be solved through a collective phenomenon. By coupling (through chemical or electrical synapses) many excitable elements (each of which with small dynamic range), we show that the collective response has a large dynamic range, owing to the propagation of excitable waves. Varying the intensity of the coupling, we show that the dynamic range is maximum precisely at the critical point, where the system undergoes a phase transition to self-sustained activity. We discuss experimental data that suggest how this mechanism could be operating in the retina, the olfactory bulb and the cortex, providing a microscopic basis for macroscopic psychophysics laws.

P_18: Adilson E. Motter

Network Compensatory Perturbations: The Key to Rescue and Control the Dynamics of Complex Systems

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Genetic diseases, ecosystem collapses, cascading failures, network synchronization, materials design. These are some of the many outstanding interdisciplinary problems that could benefit from a predictive modeling approach to control the perturbation response of complex systems. The main obstacle to the development of such an approach has been that it is generally unclear how the large-scale collective behavior is affected by the local properties of the underlying interaction networks. In this talk I will discuss an alternative approach recently developed in my research group, which is based on inverting this perspective and seeking instead the conditions that should be imposed on the local network structure and/or dynamics to generate a desired (natural or human-

selected) global collective behavior. In the context of cellular metabolism, this approach has been used to predict that a faulty or sub-optimally operating metabolic network can often be rescued by the targeted removal of enzyme-coding genes. Predictions go as far as to assert that certain gene deletions can restore the growth of otherwise nonviable gene-deficient cells, an effect now known as synthetic rescue. In food-web systems, it leads to the prediction that the removal or growth suppression of specific species can be used to mitigate the spread of extinction cascades. In oscillator networks, it explains once and for all why the common expectations that synchronization would be generally easier to achieve with more interactions, that synchronization properties would change monotonically as the number of available interactions is varied, and that certain network structures would facilitate while others inhibit synchronization, are all false. In the context of network design, this approach can be used to rationally design complex systems with new functional properties, such as mechanical networks that contract when tensioned or exhibit other forms of negative mechanical response to external forces. I thus hope to convey that, besides helping explain why "less can be more" in complex systems, these concepts promise to lead to a predictive modeling framework that can be used to control network response by only exploiting resources available in the system.

P_19: Sergio Alejandro Cannas

Emergent Complexity in Natural Networks out of Stability Selection Pressure

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Although most networks in nature exhibit complex topology the origins of such complexity remains unclear. We introduce a model of a growing network of interacting agents in which each new agent's membership to the network is determined by the agent's effect on the stability of the underlying dynamics. It is shown that out of this stability constraint, several complex topology properties emerge in a self organized manner. This offers an explanation for the ubiquity of complex topological properties observed in biological networks.

P_20: Martine Chevrollier

Radiation Trapping and Lévy Flights of Photons in Atomic Media

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Radiation trapping is a general term encompassing processes of multiple scattering of photons in resonant atomic media. Depending on the system's conditions, the photos transport properties can exhibit diffusice or superdiffusive behavior. While Gaussian statistics satisfactorily describe the diffusive behavior as a random walk process of finite mean free path and variance, superdiffusion eludes this usual interpretation and is described through Lévy statistics, with a heavy-tail photons step distribution P(x), asymptotically decaying as P(x)~1/xα with α<3. In these so-called Lévy flights, the overall spread of displacement is dictated by very large, through rare steps. We report on our experimental measurements of the step distribution of photons in a hot resonant atomic vapor and show thet they follow a Lévy-flight pattern. We present Monte Carlo simulations that give insights into the frequency redistribution process that takes place during the multiple scattering of photons by the moving atoms and which is at the origin of the superdiffusive behavior.

P_21: Christian Otto

Complex Dynamics of Semiconductor Quantum-Dot Lasers subjected to Delayed Optical Feedback

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We investigate the complex dynamics of semiconductor quantum dot (QD) lasers subjected to optical feedback from an external mirror. The system with delayed feedback is modeled by a modified Lang-Kobayashi equation for the electric field combined with microscopically based rate equations for the carriers in the QDs and the surrounding wetting layer. In contrast to simpler rate equations our model separately treats electrons and holes in the QDs and the surrounding wetting layer allowing for insights into the internal nonlinear dynamics of the laser. In dependence of the external feedback strength we study the bifurcation scenarios of the optical output of the laser. It shows periodic and chaotic intensity pulsations as well as windows of stable steady state (cw) operations. By comparing these QD devices to the operation of standard quantum well lasers we are able to attribute the reduced feedback sensitivity of QD lasers to their small linewidth enhancement factor as well as to their strongly damped relaxation oscillations. The nonlinear microscopic scattering rates that determine the damping rate and relaxation oscillation frequency of the solitary laser are shown to determine the quantitative position, i.e. the critical feedback strength of the occurring

instabilities.

P_22: Hans Ingo Weber

Nonlinear Dynamics and Multibodies Rotating inSpace

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Several connected rigid bodies are well analyzed using Multibody Dynamics. If excursions are large in the rotating motion of the system, nonlinear dynamics tools are essential to understand the behavior. To explain the phenomena at a possible situation, a non-axisimetric rotor will be considered, supported cardanically by other two bodies. The well known and classical problem in Mechanics of the free motion in space is considered. The motion starts to be fascinating when the principal moments of inertia are unequal. A rotation started around the axis of intermediate inertia will be naturally unstable and the tumbling motion will start right away. The motion may also start with a rotation around the other two axes and the rotation will be stable till a certain amount of perturbation. This perturbation can be imagined as an impact from another body which may result in large amplitude motions. The gimbal bodies will have their own dynamics, which may influence considerably the overall dynamics. The connection between the bodies injects damping in the system. The point that will be addressed in the presentation compares the use of traditional Euler angles and the use of quaternions when the goal is to get information through nonlinear tools, like Poincaré maps, bifurcation diagrams and Lyapunov exponents.

P_23: Ricardo Egydio

Dynamical Transport Barriers

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Barries of tansport correspond to important tools for the confinement of trajectories in some particular regions, especially in the contexto f plama physics. Many techiques have been developed to produce transport barriers in order to increase the confinement time for particles magnetically confined in tokamaks. These techniques to implement transport barriers introduce invariant curves on the associated phase space. Dynamical

Concepts have been applied to interpret the confinement improvement observed in several experiments.
In this work we propose new transport barriers which interfere strongly in the dynamics on the phase space. We introduce an infinite barrier, caller robust torus, which remain intact under the action of many generic perturbation. We also generate an ensemble of meandering curves, called labyrinthic stickiness, which traps the trajectory that attains its neighborhood. These new barriers are associated with a very rich nonlinear dynamics and they may play an important role for the plasma physics approaches.

P_24: Katharina Krischer

Globally Coupled Oscillators: An Experimental Approach Towards an Associative Memory Device

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Information processing in biological systems involves a large number of highly interconnected neurons that act in parallel to accomplish a task. One of the big challenges in nonlinear sciences is to mimic the basic principles of biological neural networks with a man-made `neurocomputer'. One possible architecture discussed in literature is a globally coupled network of oscillators where the communication among the oscillators is realized through a dynamic connectivity [1]. This ansatz has a crucial advantage from a practical point of view: Each oscillator possesses only one physical connection that links it to a global support. Such a network can be trained without the need to change or adapt any connections of the hardware. In the talk, we introduce an experimental realization of such a network consisting of electrical oscillators, demonstrate how the relaxational character of the oscillators influences the dynamics of the network, and discuss the relation between the realistic evolution equations derived from the circuit components and the idealized evolution equations of the phase of the oscillators for which the theory [1] was derived.
[1] F.C. Hoppenstedt and E.M. Izhikevich, Weakly Connected Neural Networks, Springer, New York (1997)

P_25: Celia Anteneodo

Lyapunov Exponents of Many particle Systems

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In a chaotic system, nearby trajectories diverge exponentially fast, with an asymptotic rate given by the largest Lyapunov exponent (LLE). Formally, the LLE is extracted from the dynamics in tangent space.
So, for a Hamiltonian system, isolated and in equilibrium, the LLE must be a function of the (microcanonical) statistical properties of the Hessian of the Hamiltonian. The basic idea is to treat the tangent dynamics with standard techniques of stochastic differential equations. We show that, in weakly correlated regimes, the LLE can be expressed in terms of few suitable thermal averages.
A satisfactory quantitative agreement is found when comparing the predictions of the theory with the results of numerical simulations of Hamiltonian systems.

P_26: Paulo R. de Souza Mendes

A Novel Approach for Modeling the Thixotropic Elastoviscoplastic Behavior of Structured Fluids

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A novel approach for modeling the mechanical behavior of thixotropic elastoviscoplastic liquids is presented. Non-monotonic flow curves, stress overshoot during microstructure breakdown flows at constant shear rate, and viscosity bifurcation are some of the common aspects of viscoplastic liquids that are predicted by the new model. It involves two evolution equations, one for the stress and the other for the structure parameter. Simple ideas are employed to describe the microstructure, and, as a result, a model with a clear physical basis is obtained. In addition to the flow curve, which by construction is exactly predicted, it is shown that the model is able to predict correctly the behavior observed in the usual rheometric transient flows, among which: abrupt changes in shear rate (microstructure buildup or breakdown experiments); abrupt changes in shear stress (viscosity bifurcation experiments); and oscillatory tests (amplitud sweep and frequency sweep). The model is frame-indifferent and applicable to complex flows.

P_27: Jürgen Kurths

Dynamical Systems and Complex Networks: Are such Thoeries Useful for Neuroscience and Geoscience ?

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Complex networks were firstly studied by Leonhard Euler in 1736 when he solved the Königsberger Brückenproblem. Recent research has revealed a rich and complicated network topology in various model systems as well as in several fields of applications, such as transportation and social networks, or the WWW. It will be discussed whether this approach can lead to useful new insights into rather large complex systems or whether it is fashionable only to interpret various phenomena from this viewpoint and publish papers on that.

A challenging task is to understand the implications of complex network structures on the functional organization of the brain activities. We investigate synchronization dynamics on the cortico-cortical network of the cat and find that the network displays clustered synchronization behaviour and the dynamical clusters coincide with the topological community structures observed in the anatomical network.

P_28: Murilo da Silva Baptista

Communication in Complex Networks

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In this talk I will present recent results detailing how much information two nodes in a complex network can exchange as a function of the network connecting topology, the synchronisation level, and the type of coupling between the nodes. I will show how these results can be used to understand the appearance of synchronisation and the transmission of information the Hindmarsh-Rose neural network whose neurons are simultaneously connected by electrical and by chemical synapses. I will clarify the recent dilemma concerning the reason of why 30% of the neurons in the brain have electrical connections, in addition to the usually known chemical synapses. Further, I will explain a recent conjecture which allows one to calculate the upper bound for the amount of information that a large complex network can produce by using information provided by two coupled nodes, allowing one to predict the global behaviour of a neural networks.

P_29: Philip Morrison

Chaos in Nontwist Hamiltonian Systems

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An integrable Hamiltonian system satisfies the twist condition if its frequency is a monotonic function of the action variable. Many theorems about the nonintegrable perturbation of such Hamiltonian systems rely on this condition, examples being early KAM theorems and the Poincare Birkhoff theorem. The generic nontwist systems one for which the frequency possesses an isolated extremum. Perturbed nontwist systems display phenomena that are quite different from twist systems – in particular the nature of the destruction and the vicinity of the shearless torus at criticality. For convenience, nontwist phenomena will be described in terms of the standard nontwist symplectic map (see www.scholarpedia.org/article/Nontwist maps), focusing on torus destruction and transport. Applications to fluid mechanics and plasma physics will also be discussed.

P_30: Peter McClintock

Wave Turbulence in Superfluid 4He: Energy Cascades, Rogue Waves and Kinetic Phenomena in the Laboratory

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Experiments on superfluid helium are being used to explore in the laboratory how rogue waves occasionally develop in interacting systems of nonlinear waves. Rogue waves on the surface of the ocean are of particular importance, as they are suspected of being responsible for many unexplained losses of large ships. These waves are quite different from the tsunami created by undersea earthquakes, which in the open sea are usually so low as to be almost invisible. In contrast, survivors describe rogue waves as being like ‘a wall of water’, perhaps 100 feet or more in height.
Where do rogue ocean waves come from? Nobody knows for sure, but one theory postulates that they arise through nonlinear wave interactions. Under the right conditions, the energy of ordinary wind-blown waves could get concentrated to form rogues. The trouble is that the universally accepted picture, based on the work of the famous Russian mathematician Andrei Kolmogorov (1903-1987) envisages

waves decaying through a 'turbulent cascade' of energy towards shorter and shorter wavelengths until, eventually, it becomes possible for viscosity to dissipate the energy as heat. In contrast, however, our recent experiments on superfluid helium have revealed that exactly the opposite effect can sometimes occur - a flux of energy towards longer wavelengths (inverse cascade) leading to the appearance of isolated rogue waves in our cryostat.

P_31: Luca Moriconi

Turbulent Boundary Layer Fluctuations and Horseshoe Vortices

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Turbulent boundary layers are the stage of the complex dynamics of a whole "zoo" of flow configurations, like low speed streaks, sweeps, ejections, and a number of vortex structures. It has been conjectured, from extensive experimental and numerical investigations performed along the last decades, that the so-called "horseshoe vortices" could play a dominant role in the statistical properties of turbulent boundary layers.
Motivated by this conjecture, we introduce an elementary model of a turbulent boundary layer over a flat surface, given as a vertical random distribution of spanwise Lamb-Oseen vortex configurations placed over a non-slip boundary condition line. We are able to reproduce several important features of realistic flows, such as the viscous and logarithmic boundary sublayers, and the general behavior of the first statistical moments (turbulent intensity, skewness and flatness) of the streamwise velocity fluctuations. We advance, furthermore, some heuristic considerations on the boundary layer underlying kinematics that could be associated with the phenomenon of drag reduction by polymers, finding some suggestive qualitative support from recent experimental observations.

P_32: Imre M. Jánosi

Chaotic advection of passive tracers in the atmosphere: laboratory models and numerical tests with reanalysis wind fields

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Air pollution, transport and mixing in geophysical flows are recently in a special

attention among both atmospheric scientists and the public. One of the most important developments in the area is the finding that very simple flow fields can give rise to Lagrangian chaos when the dynamics of tracer particles are considered. On the empirical level, the most obvious fingerprint of nontrivial behavior is a marked deviation from normal diffusive dispersion including the subdiffusive (trapping) and superdiffusive regimes. In this talk, I will give an overview of the various tools invented to study this subject, such as field observations, laboratory experiments and numerical simulations. Besides the basic physics, I will concentrate on aspects which have particular environmental relevance.

P_33: Cristina Masoller

Quantifying complexity via information theory measures

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In this talk I will discuss how information theory measures such as the statistical complexity can be employed to detect subtle signatures of noise-induced complexity in stochastic nonlinear systems. First I will illustrate the method with two paradigmatic models, the model of stochastic resonance (a Brownian particle in a sinusoidally modulated bistable potential), and the model of coherence resonance (the FitzHugh-Nagumo (FHN) model of excitable systems). The methodology employed is based on the analysis of the relative length and ordering of the time intervals between consecutive events (switchings in the bistable potential model, or spikes in the FHN model), disregarding their absolute durations. In this way, a continuous-time, continuous-state dynamics is replaced by a discrete-time and discrete-state process, the information about the precise timing of the events (switchings or spikes) is not taken into account. In the two models resonant-like behavior is found in the form of enhanced temporal order induced by the variation of a system parameter or by the variation of the noise level. This enhanced order is detected as a minimum of Shannon's entropy accompanied by a maximum of the statistical complexity [1,2].
I will also discuss how this methodology can be applied to the analysis of global climate dynamics. I will present results of the analysis of monthly surface air temperature data covering 58 years and 10226 spatial locations (or "nodes") over the planet, and I will show that the methodology provides a powerful tool for detecting subtle signatures of correlations and internal couplings in the climate network. Comparison of yearly-consecutive values in each location gives results which are consistent with those obtained from conventional quantifiers (such as the Pearson cross correlation coefficient and the mutual information) while comparison of monthly-consecutive values in each

location results in a different network structure, which cannot be inferred from the cross-correlation and mutual information quantifiers.

[1] O. A. Rosso, C. Masoller, "Detecting and quantifying stochastic and coherence resonances via information-theory complexity measurements", Phys. Rev. E 79, 040106(R) (2009).

[2] O. A. Rosso, C. Masoller, "Detecting and quantifying temporal correlations in stochastic resonance via information theory measures", Eur. Phys. J. B 69, 37-43 (2009).

P_34: Marcus A. M. de Aguiar

A Neural Theory of Speciation and Diversity

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The number of living species on Earth has been estimated to be between 10 and 100 million. Understanding the processes that have generated such remarkable diversity is one of the greatest challenges in evolutionary biology. Speciation is usually related to the isolation of subpopulations by geographic barriers, that stop the genetic flow between the isolated groups, promoting differentiations by mutations and local adaptations that ultimately lead to speciation. In this talk I will dicuss a new mechanism of speciation that does not involve geographical barriers and natural selection. In this model
a population with genetically identical individuals, homogeneously distributed in space, spontaneously breaks up into species when subjected to mutations and to two mating restrictions: individuals can select a mate only from within a maximum spatial distance S from itself and only if the genetic distance between itself and the selected partner is less than a maximum value G. Species develop depending on the mutation rate and on the parameters S and G. The resulting species-area relationships and abundance distributions thus obtained are consistent with observations in Nature.

P_35: Marcel Clerc

Liquid-solid-like transition in quasi-one-dimensional driven granular media

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The theory of non-ideal gases at thermodynamic equilibrium, for instance the van der

Waals gasmodel, has played a central role in our understanding of coexisting phases, as well as the transitions between them. In crontrast, the theory fails with granular matter because collisions between the grains dissipate energy, and their macroscopic size renders thermal fluctuations negligible. When a mass of grains is subjected to mechanical vibration, it can make a transition to a fluid stat. In this state, granular matter exhibits patterns and instabilities that resemble those of molecular fluids. Here, we report a granular solid-liquid phase transition in a vibrating granular monolayer. Unexpectedly, the transition is mediated by waves and is triggered by a negative compressibility, as for van der Waals phase coexistence, although the system does not satisfy the hypotheses used to understand atomic systems. The dynamic behavior that we observe – coalescence, coagulation and wave propagation – is common to a wide class of phase transitions. We have combined experimental, numerical and theoretical studies to build a theoretical framework for this transition.

P_36: Ying-Cheng Lai

Relativistic Quantum Scars

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The concentrations of wave functions about classical periodic orbits, or quantum scars, are a fundamental phenomenon in physics. An open question is whether scarring can occur in relativistic quantum systems. We investigated confinements made of graphene whose classical dynamics are chaotic and found unequivocal evidence of relativistic quantum scars. The scarred states can lead to strong conductance fluctuations in the corresponding open quantum dots via the mechanism of resonant transmission.

P_37: Ruedi Stoop

Shrimps and their relation to perception

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Islands of periodicities of characteristic shapes ('shrimps') have shown to be connected by means of spirals, emanating from a joint focal point, offering ways to wander around in parameter space without ever having to cross the chaotic sea. We confirm experimentally the real-world relevance of these structures, by probing the parameter space of a hardware nonlinear electronic systems family and comparing it to the corresponding numerical simulations. The claim is then made that the shrimp phenomenon may be responsible for clustering difficulties in the area of bioinformatics. To this end, we compare systematically the performance of generally used classical clustering methods (such as k-means and Ward's linkage clustering) with that of a recently developed brain-like synchronization and Hebbian learning-based data clustering algorithm using spiking neurons. The latter's outstanding ability of finding arbitrary numbers of clusters of arbitrary shape in noisy background data is analyzed, and traced back to a synchronization phenomenon between the implemented neurons. Applications of visual scene segmentation demonstrate the superiority of the synchronization-based approach.

P_38: Marcelo Barreiro Parrilo

Climate Predictability over South America

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The understanding of variability and predictability has been a central focus of climate research. Forced atmospheric variability mainly due to anomalous sea surface temperature gives rise to the possibility of seasonal climate forecasts to an otherwise chaotic system. Most of the areas that show potential predictability are in the deep tropics where sea surface temperature dominates the low-frequency atmospheric variability and the previous knowledge of surface ocean conditions allows prediction of precipitation and temperature anomalies. Away from the tropical region, on the other hand, atmospheric internal variability dominates and climate anomalies cannot generally be predicted beyond the 10 days limit determined by chaotic dynamics. In these regions additional predictability may come from atmospheric teleconnection patterns induced by tropical SST anomalies. In this talk I will concentrate in two regions of large economic and social importance: Northeast Brazil and Southeastern South America. It will be shown how these regions are influenced by the El Niño phenomenon in the equatorial Pacific, as well as by the neighboring oceanic conditions over the Atlantic. This suggests that climate models used for seasonal prediction should simulate correctly not only the remote El Niño signal, but also the local air-sea coupling. Thus, improvement of seasonal-to-interannual predictions in these regions will only be possible through the understanding of the interactions between the signals arising from different ocean basins.

bifurcations can be extended to a class of nonlinear piecewise-continuous systems.

Mini-Symposia

S1 - Minisymposyum on: The Brain and its functioning.

Organizers (in alphabetical order): Antonio Roque da Silva Filho[1], Hilda A. Cerdeira[2] and Koichi Sameshima

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The functioning of the brain presents a complex dynamics. Intense research has not yet unveiled the mysteries of its behavior. How the brain orchestrates its parts to manage and produce information is still a mystery. In this mini symposium, we propose to collect submitted contributions in: models of spiking neural populations, impact of single neuron dynamics, correlations, spatiotemporal patterns, analysis of EE, methods to interpret experimental data, etc., with the intention to shed some light in the field.

We propose two main talks, and the rest of the talks should be selected from the submitted contributions:

Physics of Psychophysics: contributions from Statistical Mechanics to Neuroscience

Mauro Copelli
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It has been known for over a century that psychophysical response curves (perception of a physical stimulus as a function of stimulus intensity) have a large dynamic range: several decades of stimulus intensity can be discriminated before saturation ensues. This is in stark contrast with response curves of sensory neurons, whose dynamic range is small, usually spanning only one or two decades. We argue that this (apparent) paradox can be solved through a collective phenomenon. By coupling (through chemical or electrical synapses) many excitable elements (each of which with small dynamic range), we show that the collective response has a large dynamic range, owing to the propagation of excitable waves. Varying the intensity of the coupling, we show that the dynamic range is maximum precisely at the critical point, where the system undergoes a phase transition to self-sustained activity. We discuss experimental data that suggest how this mechanism could be operating in the retina, the olfactory bulb and the cortex, providing a microscopic basis for macroscopic psychophysics laws.
Keywords: excitable media, psychophysics, phase transition, neuroscience.

Biomedical signal analysis based detection and diagnosis: gap between theory and clinical applications.

Koichi Sameshima

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We have been witnessing heightened interest in the dynamics of biological system, particularly in the cardiac and neural systems mainly due to the large number of brain and heart dynamics related diseases. Technological advances in instrumentation allow for the continuous monitoring of biological signals at ever increasing spatial and temporal. For instance, novel approaches using multiple electrode techniques are now commonly used for the study of function of cortical areas in animal study. However the use of quantitative analysis of electroencephalography still has limited application in clinical practice as it shows low sensitivity and specificity for most of diagnostic purposes, and we still rely mostly on EEG trace detection capacity of clinical neurophysiologists. The data analysis practitioners know that methods based on any analysis results should be interpreted and valued with great care, since mathematical approaches hold strength and limitations that commonly clinicians don't quite understand. I will discuss and raise questions on how we might be able to tighten the gap between theory of dynamical systems and clinical practices in cardiology, neurology and psychiatry.

Keywords: translational medicine; experimental neurology; brain functional analysis.

Gaussian-Like Representation of 4-Point Spike Correlation Functions: Taming The Matrix Size Explosion In Population Coding

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Abstract: Suppose we subject an organism to a signal and we want to reconstruct this signal from the response of several neurons. Suppose that these neurons generate spike trains, consisting of sequences of identical action-potentials and we measure the times every neuron fires. Suppose further that we subdivide our time axis into bins of size, say 2 miliseconds and we want to reconstruct the signal in windows of 200 bins. This reconstruction amounts to convolute the spike trains with matrix kernels, which then have to be inverted. This matrix inversion is computationally intractable, due to its huge size. We show that, at least for the particular case of neurons in the fly's optical tract, an underlying gaussian structure is able to tame this size explosion.

Keywords: population coding, spike trains, neuron.

S2 - Minisymposyum on: The struture dynamics networks.

Organizer: Francisco Aparecido Rodrigues.

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The relationship between the structure and dynamics of complex networks is discussed by the introduction of methods for network characterization and classification based on pattern recognition approaches. It is also presented some studies relating structural and dynamic features of networks, such as information processing and handling in grid computing systems and pinning control techniques for network synchronization.

TITLE: Identification of patterns in networks

Francisco Aparecido Rodrigues[1]

1 Departamento de Matemática Aplicada e Estatística, Instituto de Ciências Matemáticas e de Computação

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Abstract: Pattern recognition techniques can be used for identification of patterns in networks, i.e. cluster of nodes with similar features. These methods can be applied for analysis of the relationship between structural and dynamic properties of networks. We present a pattern recognition technique for identification of clusters and outliers in networks, as well as some possible studies relating the structure, function and dynamic of networks.

keywords: Complex networks, Pattern recognition

TITLE: Classification of complex networks

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Abstract: Although many network measurements have been developed for a precise description of network structure, there is no unique measure for providing a complete description of network topologies. In order to take into account a large set of network measurements, it is necessary to use pattern recognition approaches, which are suitable for identification of the best model for a given real-world network. We present an approach for network classification according to a set of models and measurements.

keywords: Complex networks, Pattern recognition, Classification

TITLE: Impact of network topology in grid computing

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Abstract: The dynamic of complex systems is highly influenced by their organization, as verified for studies involving scale-free and small-world networks. The structure-dynamics relationship is also verified in grids. Basically, a grid is a combination of computer resources

from multiple administrative domains for a common goal. We present the impact of network topology in information processing and handling in grid computing systems

keywords: Complex networks, Grid Computing

On pinning control synchronization of complex networks

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Abstract: Pinning control techniques have been effectively applied for the synchronization of complex networks. Different pinning control synchronization strategies are proven to guarantee the synchronization of the entire network onto a known reference solution In this work we present a resume of these strategies, from the off line feedback strategy to hybrid adaptive strategies.

keywords: Complex networks, synchronization, pinning control.

S3 - Minisymposyum on: Synchronization and Collective Bheavior in Network.

Organizer: Mario G. Cosenza.

Departamento – Centro de Física Fundamental – Universidade de Los Andes Venezuela, **E-mail**: mario.cosenza@gmail.com

This minisymposium is focused on synchronization phenomena and collective behavior in networks of interacting dynamical elements, including collective oscillations, pattern formation, delay dynamics, etc.

Chaotic Chimera In Dynamical Networks

O. Alvarez-LLamoza[1] , M. G. Cosenza[2] , G. Paredes[3]

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keywords: Synchronization; Chaotic Dynamics; Collective Phenomena; Self-organization.

A chimera in an array of coupled identical oscillators consists of the coexistence of two localized domains: one coherent or phase-locked, the other incoherent and desynchronized [1,2]. Here we report an observation of chaotic chimera states in a network of chaotic maps consisting of two subsystems, each having local interactions, and which are mutually coupled through their respective mean fields. For some range of parameters, a chimera emerges in the system: one subsystem is synchronized in chaos while the other subsystem is incoherent. This result is independent of the partition chosen for the subsystems. Other collective states appear as the parameters are varied. A simple two-dimensional map system is proposed as a model to characterize the observed behavior.

References:

[1] S. Shima and Y. Kuramoto, Phys. Rev. E 69, 036213 (2004).

[2] D. M. Abrams and S. H. Strogatz, Phys. Rev. Lett. 93,

174102 (2004).

Synchronization of Chaotic Maps In Complex Networks:

Advances Perspectives And Applications

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Keywords: Synchronization; Networks; Time Delay.

The synchronization of nonlinear units coupled on complex networks is one of the hottest topics in Nonlinear Physics. In this presentation we review recent advances, perspectives and applications on synchronization of chaotic maps in complex networks. We extend our previous works to Bernoulli, tent, sine, and bi-stable maps paying special attention to the relation between the topology and the distribution of the time delays. The time delays associated with the links are either heterogeneous (Gaussian distributed) or homogeneous (i.e., the transmission speed is the same for all links; as a particular case we also study instantaneous interactions). We show that, depending on the specific map, when the connectivity is low and the coupling strength is weak, the network displays an irregular oscillatory dynamics that is rather independent of the detailed network topology and delay distribution. For large enough connectivity and coupling strength, the synchronization of the network is mainly determined by the delay times: when the delays are homogeneous the network exhibits collective synchronous oscillations; when the delays are heterogeneous, the network synchronizes in a steady-state. We show that depending on the characteristics of the maps for some choices of initial conditions and time-delay distributions an island of synchronization appears, which corresponds with a periodic dynamical state of the system. The addition of noise on the initial conditions is also studied. We compare numerical simulations with analytical results obtained for different maps. We also present experimental results on the synchronization times of light controlled oscillators in different coupling configurations.

Common Behavior In Higher Dimensional Nonintegrable

Conservative Coupled Maps Systems

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keywords: Chaotic Dynamics; Synchronization; Networks.

“Sticky'” motion in mixed phase space of conservative systems is difficult to detect and to characterize, in particular for high dimensional phase spaces. Its effect on quasi-regular motion is quantified here with four different measures, related to the distribution of the finite time Lyapunov exponents. We study systematically standard maps from the uncoupled two-dimensional case up to coupled maps of dimension 20. We find a common behavior in all unstable directions above a threshold K_d of the nonlinearity parameter K for the high dimensional cases d=10,20. Moreover, as K increases we can clearly identify the transition from quasiregular to totally chaotic motion which occurs simultaneously in all unstable directions. The results show that all four statistical measures sensitively probe the phase space in high dimensional systems.

The Stable Oscillations In Lindberg's Oscillator

And In Optically Injected Semiconductor Lasers

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keywords: Chaotic Dynamics; Synchronization; Bifurcation theory and analysis.

We show that, although intensively applied and studied since introduced by Leibniz in 1676, differential equations still harbor a plethora of useful and unanticipated regularities. They are not properties of isolated solutions but become evident when contemplating the systematic way that large families of solutions, periodic or not, organize themselves collectively in parameter space (phase diagrams). Such phase diagrams reflect the self-organization of stable oscillations that are not difficult to observe experimentally for a variety of popular oscillators across all disciplines of natural sciences. As examples, we discuss novel regularities found in the control space of a

Lindberg oscillator, an autonomous Duffing-like three-dimensional oscillator cleverly designed very recently as a proxy capable of bypassing noisy spectra polluting driven (non-autonomous) oscillators. Lindberg's proxy displays infinite spirals like periodicity hubs but of a very remarkable new kind. The new spirals consist of an alternation of disconnected pieces, with ends containing the pair of stability structures, cusp and ``fish'', known to be normal forms of all cubic dynamics. In addition, we also describe how to find spirals and hubs of both kinds, continuous or not, in semiconductor lasers.

Equivalent Synchronization Of Chaos In Driven And In Autonomous Systems

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keywords: Synchronization; Chaotic Dynamics; Networks; Collective Behavior.

The synchronization behavior of a network of chaotic elements subject to either an external forcing or a coupling function of their internal variables can be inferred from the behavior of a single element in the system, which can be seen as a single drive-response system. From the conditions for stable synchronization in this simple drive-response model with minimal ingredients, we find minimal conditions for the emergence of complete and generalized chaos synchronization in both driven and autonomous associated systems. Our results show that the presence of a common drive or a coupling function for all times is not indispensable for reaching synchronization in a system of chaotic oscillators, nor is the simultaneous sharing of a field, either external or internal, by all the elements. In the case of an autonomous system, the coupling function does not need to depend on all the internal variables for achieving synchronization, and its functional form is not crucial for generalized synchronization. What becomes essential for reaching synchronization in an extended system is the sharing of some minimal information by its elements, on the average, over long times, independently of the nature (external or internal) of its source.

S4 - Minisymposyum on: Nonlinear Aeroelasticity

Organizer: Roberto Barroso Ramos.

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The aim of this minisymposium is to present state-of-the-art research on the modeling and control of nonlinear aeroelastic systems for rotorcraft, aircraft, and aerospace applications. The nonlinearities may arise from structural dynamics, aerodynamics, control actuator saturation, or smart-materials behavior. Simulation results can support aeroelastic systems design for improved safety.

HELICOPTER AEROELASTICITY

Roberto Ramos

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Abstract: The modeling of helicopter rotor nonlinear flap-lag dynamics in hover is presented. Blade-element aerodynamics is adopted. Simulation results on aeroelastic stability from a linearized model are obtained, involving design parameters for safe operations.

keywords: Helicopter aeroelasticity, nonlinear dynamics, flap-lag stability.

HELICOPTER BLADE-SAILING CONTROL

Roberto Ramos

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Abstract: The increasing use of helicopters in the maritime environment requires the understanding and reduction of blade-sailing vibrations in high winds. The aeroelastic modeling of the nonlinear flap-lag dynamics subjected to gust aerodynamic effects, during rotor engagement/disengagement operations, is presented. A feedback individual blade controller is designed from the obtained nonlinear parametric oscillator model by using numerical simulations, considering actuator saturation.

keywords: Helicopter aeroelasticity, blade-sailing, nonlinear dynamics, individual blade control.

FLUID-STRUCTURE INTERACTION: ROTATING STRUCTURES

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Abstract: The study of the complex phenomena related to the interaction between flexible structures and fluid flow is relevant to the design of rotorcraft, aircraft, wind turbines, turbomachines, bridges, and biomechanical systems. The understanding of these phenomena requires the modeling of both the flow field and the structural dynamics. In this talk, a fluid-structure interaction model for rotating flexible structures in fluid flow will be presented, including some simulation results.

keywords: Fluid-structure interaction, rotating flexible structures, mathematical modeling.

FLOW-INDUCED VIBRATION CONTROL

André Fenili1, Cayo Prado Fernandes Francisco2

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Abstract: Vibration control of a flexible beam-like structure in slewing motion with a cubic nonlinearity is presented. The effects of a drag force modeled through the Rayleigh dissipation function are included. A nonlinear control method is applied, considering large angular displacements and velocities.

keywords: Flow-induced vibrations, slewing motion, nonlinear control.

BLADE-SAILING CONTROL USING SMART MATERIALS

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Abstract: The problem of helicopter blade-sailing control is tackled by using two smart materials as actuation devices. Shape Memory Alloys can enhance the rotor blade flapping stiffness according to an applied temperature variation. Magneto-Rheological Fluids can enhance the rotor blade flapping damping according to an applied current variation. Nonlinear effects and control design aspects are considered.

keywords: Helicopter blade-sailing, smart materials, nonlinear systems, control.

S5 - Minisymposyum on: Chaos and Transport in Hamiltonian Systems

Organizer: Pablo Miguel Cincotta .

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The aim of this minisymposium is to address the problem of chaos and transport phenomena (or diffusion) in multidimensional Hamiltonian systems, by different approaches, from a more physical even heuristic one, and from a rigorous point of view. In this direction, topics like dynamical indicators, chaotic diffusion and efficient and precise numerical routines to integrate ODEs, as the Hamilotnian flow, will be thoroughly discussed.

TITLE - Dynamic and Transportation in Chaotic Hamiltonian Systems

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Abstract: In this work we analyze both theoretically and numerically the phenomena of anomalous diffusion and mixing in chaotic Hamiltonian systems, specially in two-dimension systems. Firstly, we characterize how the chaotic dynamics pop up due to the rupture of the separatix that joints two hyperbolic points. Further, inside the chaotic region in phase space we have the presence of many islands that possess invariant stable curves in their interior. The process that results in the appearance of these islands is understood as well as we investigate their effects on the dynamics of particle transportation (diffusion). Finally, we derive an expression that relates the characteristics of chaotic trajectories with the fractal geometry of that islands.

keywords: difussion, mixing, chaos, islands, fractal.

TITLE:Comparison of several dynamical indicators

Maffione, Nicolás (1); Darriba, Luciano (2); Giordano, Claudia (3); Cincotta, Pablo (4)

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Abstract: The aim of the present work is to test the reliability of a package of indicators based on the evolution of deviation vectors: the Lyapunov Indicator (LI), the Mean Exponential Growth factor of Nearby Orbits (MEGNO), the Relative Lyapunov Indicator (RLI), the Smaller Alignment Index (SALI), the Fast Lyapunov Indicator (FLI), Dynamic Spectra of stretching numbers and their corresponding Spectral Distance. In order to perfom this test we make a numerical study in growing complexity scenarios (two maps and two hamiltonian systems): the Skokos variant of Froeschlé's 4D symplectic map, 4D map composed of two coupled standar maps,2D Hénon-Heiles system and finally a 6D triaxial galactic model.

Keywords: MEGNO, SALI, RLI, FLI, Lyapunov indicators

A comparison of numerical integrators of ODEs

Darriba, L.A. (1) , Giordano, C.M (2)., Cincotta, P.M. (3)

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Abstract: In most of the problems that arise from the investigation on dynamical systems, such us for instance the study of diffusion in phase space of non integrable Hamiltonian Systems, as well as in every realistic physical model, the corresponding differential equations have to be solved by means of numerical techniques. The concomitant computational implementation should be as fast and precise as possible, in order to minimize both the numerical errors and the computing time. Here we compare the efficiency of an original software, developed by Jorba and Zou, which integrates differential equations by means of the Taylor method, against other two well known integrators, one based on a Runge-Kutta method (DOPRI8) and the other on a predictor-corrector integrator (Bulirsch-Stöer). Particularly, we perform this test considering 3D systems, a perturbed quartic oscillator and a rough realistic model of elliptical galaxy. In this direction we compare the efficiency between these numerical integrators when applied to the computation of the MEGNO, the largest Lyapunov Characteristic Number and the solely integration of the Hamiltonian flow.

Keywords Numerical method, Taylor method, ODE integrator, Integrator comparison

S6 - Minisymposyum on: Neuronal Dynamics

Organizers (in alphabetical order): Thiago Pereira[1], Rafael Dias Viela[2]

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Different aspects of neuronal dynamics will be addressed, ranging from spreading depression waves to collective behavior of noisy excitable neurons.

Title: A comparative study of different noise-driven integrate-and-fire neurons

Rafael Dias Vilela 1 and Benjamin Lindner 2

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2 Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

Abstract: Stochastic integrate-and-fire (IF) neuron models have found widespread applications in computational neuroscience. I will report results on the white-noise-driven perfect, leaky, and quadratic IF models, focusing on the spectral statistics (power spectra, cross spectra, and coherence functions) in different dynamical regimes (noise-induced and tonic firing regimes with low or moderate noise).
We have made the models comparable by tuning parameters such that the mean value and the coefficient of variation of the interspike interval match for all of them. We have found that, under these conditions, the power spectrum under white-noise stimulation is often very similar while the response characteristics, described by the cross spectrum between a fraction of the input noise and the output spike train, can differ drastically. We have also investigated how the spike

trains of two neurons of the same kind (e.g. two leaky IF neurons) correlate if they share a common noise input. I will show that, depending on the dynamical regime, either two quadratic IF models or two leaky IFs are more strongly correlated. Our results suggest that, when choosing among simple IF models for network simulations, the details of the model have a strong effect on correlation and regularity of the output.

Title: "Collective behavior of noisy excitable neurons: analytical results from a family of simple models"

Authors: Vladimir R. V. Assis and Mauro Copelli

Departamento de Física, Universidade Federal de Pernambuco 50670-901 Recife, PE, BRAZIL

Abstract: Understanding collective effects of noisy excitable elements is essential for several disciplines, such as neuroscience, epidemiology, and chemistry, among others. An isolated excitable element is a dynamical system which stays in a quiescent state until it suffers a sufficiently strong perturbation. In that case its subsequent trajectory in phase space can be characterized by an excited state, which is then followed by refractoriness to further perturbations before returning to rest. Collective dynamics emerge because quiescent elements are typically perturbed by excited elements. Differently from networks of autonomous oscillators, however, connected excitable units always have as a collective solution a fixed point corresponding to global rest. What other types of collective behavior (e.g. synchronization) can we expect to coexist with global rest and how robust are they?

In biophysically realistic models of neuronal networks, a plethora of interesting phenomena emerges from the interplay of noise, nonlinearity and high-dimensionality. However, these are also the very elements which usually render models analytically untreatable. To overcome these difficulties, we employ in our networks a minimal (discrete) model of a stochastic excitable element, which consists of a cyclic three-state system whose transition rates depend on the states of their neighbors. By adapting to the excitable case an exponential coupling recently proposed for oscillatory units [1], we obtain a family of models which amount to nonlinear variants of the continuous-time stochastic susceptible-infected-recovered-susceptible (SIRS) model. We show that these variants can exhibit 1) continuous or discontinuous phase transitions into a phase of self-sustained (but asynchronous) activity 2) infinite-period phase transitions and 3) global oscillations (synchronization). In particular, we discuss the differences with respect to discrete-time models (cellular automata) and connections with experimental data.

[1] K. Wood, C. Van den Broeck, R. Kawai and K. Lindenberg, "Universality of Synchrony: Critical Behavior in a Discrete Model of Stochastic Phase-Coupled Oscillators", Phys. Rev. Lett. {\bf 96}, 145701 (2006)

Title: Migraine: A dynamical disease.

Markus Dahlem

Abstract: A mechanism is presented by which traveling spreading depression (SD) waves, which cause migraine, are formed in the 2D folded human cortex. The predicted wave is maintained only transiently but with a characteristic form (shape and size). Such patterns contradict the established image of a SD wave engulfing one cortical hemisphere, but we found that such confined waves are in agreement with our results obtained from a study using functional magnetic resonance imaging. The mechanism is based on an unstable dissipative solitons that exists in generic reaction-diffusion media of activator-inhibitor type. This solution can vanish in a saddle-node bifurcation if excitability is globally controlled. This creates a bottleneck region in phase space that sucks in all sufficiently largely perturbed cortical states (ignition phase in migraine). While, as a consequence, recovery is slowed down, a SD pattern with universal space and time scales emerges. Our bifurcation analysis is also supported by numerical simulations. Moreover, it is shown analytically and with simulations that such confined SD waves favor certain cortical geometries. Consequences are discussed for the design and application of biomedically engineered devices that can be used in therapeutic approaches to intelligently target migraine waves by changing the bottleneck passage time and thus more quickly revive the physiological state of the cortex.

Title: Nonlinear Dynamics at the Transition of the Interictal to Ictal Epileptic Activity

Tiago Pereira / Gerson Florence

Abstract: Epilepsy is a chronic neurological disorder that affects a large number of individuals. It is characterized by recurrent unprovoked seizures.

Many studies have been focusing on the cellular mechanisms responsible for the epileptic seizures, as a result, it is well grounded that the seizures are generated by an increased neuronal excitability. There are different hypotheses concerning the hyper-excitability scenario, one of them is related to extracellular ionic variations. During the seizure it has been observed an increased extracellular concentration of potassium $[K^+]_o$ and a decreased extracellular concentration of calcium $[Ca^{2+}]_o$. This shows an existence of a non synaptic mechanisms taking place at the epileptic seizure. These variations in the concentrations of potassium and calcium lead to the raise of neuronal excitability. However, up to now, it is unclear how these variations could influence in the transition to an epileptic activity. We analyze the role of ions on the transition to the ictal activity. We use bifurcation theory to study the participation of extracellular $[K^+]_o$ and $[Ca^{2+}]_o$ in the transition to a neuronal hyper-excitable state.

S7 - Minisymposyum on: Bifurcations of Non-Smooth Systems

Organizer: Gerard Olivar Tost

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Non-smooth systems (namely piecewise-smooth systems) have received much attention in the last decade. Many contributions in this area show that theory and applications (electronic circuits, mechanical systems, ...) are relevant to problems in science and engineering. Specially, new bifurcations have been reported in the literature, and this will be the topic of this minisymposium. Thus both bifurcation theory and its applications are wellcome to this minisymposium.

ON THE EXISTENCE OF HIGH-PERIOD ORBITS IN N-DIMENSIONAL PIECEWISE-LINEAR DISCONTINUOUS MAPS BY MEANS OF SYMBOLIC COMPUTATION

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Abstract: Bifurcation theory for 1D and 2D piecewise-continuous systems has been well-developed in the literature. In this paper some important results on existence of m-periodic orbits in n-dimensional piecewise-linear discontinuous maps are reported by means of symbolic computation that helps in analyzing border collision bifurcations that occur in n-dimensional discontinuous maps. Discontinuous maps have been observed in many practical systems such as the Colpitts oscillator and dc-dc converters.

keywords: non-smooth, periodicity, symbolic dynamics

EXTENDING ZIP BIFURCATION PHENOMENA TO A CLASS OF PIECEWISE-CONTINUOUS SYSTEMS

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Abstract: Zip bifurcation was introduced by Miklós Farkas in 1984 in a smooth system describing the competition of two predator species for a snigle regenerating prey. In this paper it is shown that the phenomena of occurrence of Andronov-Hopf and Zip bifurcations can be extended to a class of nonlinear piecewise-continuous systems. Moreover, for the case where the two-dimensional invariant manifolds of the non-smooth system is preserved at the switching surface a strategy for classification is presented.

keywords: non-smooth, Zip bifurcation, predator-prey.

NON-SMOOTH PHENOMENA IN ENERGY MARKETS

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Abstract: Electrical power systems have been studied in the literature. Regarding to nonlinear phenomena, saddle-node and Hopf bifurcation and codimension-two points have been detected. On the other side, energy markets have also been studied, mainly from system dynamics theory. In this paper a new non-smooth model for a simple energy market is proposed, and some non-smooth bifurcations are computed, which show several differences from the traditional smooth models.

keywords: energy, non-smooth, bifurcations.

BIFURCATIONS OF LINEAR SYSTEMS WITH SATURATIONS

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Abstract: Non-smooth phenomena such as sliding behavior have been reported in Filippov systems. Linear systems with saturations in the states can be thought as a subclass of Filippov systems. Taking advantage of the linearity, deeper general results can be stated for the non-smooth system. In this paper some of these nice properties are shown, as well as the corresponding numerical simulations.

keywords: saturation, non-smooth, bifurcations.

S8 - Minisymposyum on: Clock Distribution Systems

Organizer: José Roberto Castilho Piqueira

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An overview of clock distribution systems, considering architectures, reachability, stability and optimizations of pahse-locked loop networks.

Architectures for Clock Distribution Systems

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Abstract: In order to have accurate operation, synchronous telecommunication networks, distributed control systems and integrated circuits need a reliable time basis signal extracted from the line data stream in each node. When the nodes are synchronized, routing and detection can be performed, guaranteeing the correct sequence of information distribution among the several users of a transmission trunk. Consequently, an auxiliary network is created inside the main network, a sub-network, dedicated to the distribution of the clock signals. There are different solutions for the architecture of the time distribution sub-network and choosing one of them depends on cost, precision, reliability and operational security. In this work we analyze the possible time distribution networks and formulate the main possible topologies and arrangements, in order to have precise and stable clock distribution systems.

Keywords: Phase-locked loop, master-slave network, synchronous network.

Synchronous State in Clock Distribution Systems: Reachability and Stability

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Abstract: Second-order phase locked loops (PLLs) are devices that are able to provide synchronization between the nodes in a network even under severe quality restrictions in the signal propagation. Consequently, they are widely used in telecommunication and control.

Trying to investigate the reachability and stability of synchronous state in realistic networks composed of non identical phase-locked loop is bound to be a difficult problem to deal with. Here, we try to answer under what conditions will the network lose the synchronous state; under what condition will the network get synchronized and how much time does the synchronization process need.

In order to exemplify situations for which a synchronous state exists for the network but this state is not reached for any initial condition of the system, the operation of a four-node fully-connected PLL network was simulated.

keywords: Phase-locked loop, synchronous network, reachability and stability.

Clock Distribution Systems: Network Optimization

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Abstract: In this work the problem of synchronization networks optimization is considered. Fully connected topologies are considered and the transmission delays between nodes are neglected. The problem is formulated differently depending on the type of oscillators composing the network. We present the problem formulation and optimization results for networks composed of analog PLLs and digital ones. Different forms of attacking the problem considering mutually connected networks of analog and digital PLLs are shown. Elucidative results indicate that no simple rule may be used for optimization of synchronization networks.

keywords: Synchronization Networks, oscillators, optimization.

S9 - Minisymposyum on: Chalenges in Autonomous Learning

Organizer: Roseli A. F. Romero

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TITLE: Chalenges in Autonomous Learning

Abstract: The main purpose of this minisymposium is to present the more recent techniques proposed for developing autonomous systems. Among them are approaches based on probabilistic, swarm, potential field, reinforcement learning, fuzzy and neural networks systems.

keywords: intelligent control techniques, .autonomous learning, orthesis autonomous

This minisyposium will be constituted by the following talkings:

Incremental Probabilistic Neural Networks for Concept Formation and Robotic Localization and Mapping

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This paper presents a new probabilistic neural network model, called IPNN (for Incremental Probabilistic Neural Network), which is able to learn continuously probability distributions from data flows. The proposed model is inspired in the Specht's general regression neural network,

but have several improvements, which makes it more suitable to be used in on-line and robotic tasks. Moreover, IPNN is able to automatically define the network structure in an incremental and on-line way, with new units added whenever necessary to represent new training data. The experiments performed using the proposed model shows that IPNN is able to approximate continuous functions using few probabilistic units.

Title: Coordination of Robotic Swarms

Prof. Luiz Chaimowiz
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Abstract: The use of large groups of robots in the execution of complex tasks has received much attention in recent years. Generally called swarms, these systems employ a large number of simpler agents to perform different types of tasks, oftentimes inspired by their biological counterparts. In general, swarms of robots must perform without a designated leader and using limited communication. Due to these challenges, new algorithms to control and coordinate these very large groups of robots have been developed.

In this talk, we discuss some techniques to coordinate and control large groups of robots in a scalable and efficient fashion. Specifically, we present distributed coordination algorithms that allow a swarm of robots to navigate in complex environments. We present algorithms to solve two main problems: (i) Navigating and synthesizing shapes in environments with unknown obstacles; (ii) Navigating in a more coordinated and efficient fashion, avoiding congestion situations. We present simulation results, including experimental analysis, and results using a group of real robots, showing the viability of the proposed algorithms.

Title: SLAM using Growing Topological Maps

Silvia Botelho

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Abstract: This work proposes an approach of simultaneous localization and mapping for generic environment (structured or not) based on sensor fusion and topological mapping, using as basis growing cell structures. As we integrate such method, with our sensor fusion approach we achieve a method, which deal with sensor imprecision, in order to get better results of robot position. A test set with real robot navigation data was accomplished to measure the accuracy of the method using a simulator developed to the work. The obtained results show sensorial robustness and accuracy gain of robot localization, resulting in a better sensor error treatment.

ROBOTIC SYSTEM ORIENTED TO THE REHABILITATION OF THE UPPER LIMB MOVIMENTS

Caurin, G. A. P.[1], Joaquim, R.[2], Ito, G.G..[3]

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Abstract: This work is concerned with the development of an orthesis dedicated to the wrist rehabilitation process. Wrists often develop stiffness or lose strength after lesions. Fuzzy logic approach was used to develop a model that implements the Indiana Hand Center treatment protocol for distal radius fracture. This artificial inteligence based model also provides feedback about the current rehabilitation phase of the patient. For this reason, this study used a classification model of the patient's performance and the basis for classification was implemented using the knowledge of different professionals (Hand therapist, Physiotherapist and Orthopedist), generating rules, which the apparatus must follow to indicate the stage of rehabilitation. As a result, we have numerical outputs, which represent the knowledge of each expert and may be used to improve the vision of the professional in the rehabilitation process and prepare the base to be loaded on an orthesis autonomous.

Title: A Hybrid Adaptive Architecture for Mobile Robots Based on Reactive Behaviors and Reinforcement Learning

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Abstract: Intelligent mobile robots have attracted intense research in recent years. The field of intelligent mobile robotics involves simulations and real world implementations of robots which adapt themselves to their partially unknown, unpredictable and sometimes dynamic environments. The design and control of autonomous intelligent mobile robotic systems operating in unstructured changing environments and using techniques such as reinforcement learning and evolutionary computation in the robot designs is an emergent research topic, since it presents many objective difficulties. In this talk we present an architecture that enable autonomous mobile robots to adapt themselves to fit in their environments. Particularly, we present a hybrid adaptive architecture for mobile robots called AAREACT that has the ability to learn how to coordinate primitive behaviors codified by the Potential Fields method by using Reinforcement Learning. The proposed architecture is evaluated in terms of its performance when the robot is moved from a scenario to a different one. Experiments were performed in the robot Pioneer's simulator, from ActivMedia Robotics. Results suggest that AAREACT has good adaptation skills for specific environment and task.

Improving the stability of algorithms for path planning based

on boundary value problems

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Abstract: The first robots were used for industrial production processes automation. Such robots, did not need to deal with dynamic environments (and unforeseen situations), just performing repetitive tasks well defined. So, it was possible to program all the possible actions for the robotic agent performed them satisfactorily. With technological development, robots begun to be used for other purposes, in dynamics environments, as with entertainment (games), medicine (surgery), and performing tasks in dangerous or inaccessible environments to human (space and underwater).In this context, raise up autonomous mobile robots with the purpose of do a great number of complex tasks, that theirs predecessors (industrial robots) can't realize.

The main limitation on work with this robots is on how to control them, i.e., how to develop methods able to operate these complex machines. Complexity grows even more when it is considered, not just one robot, but a robot team. Then, techniques are required to enable the robot to interact with the environment. An essential part of this interaction is the path planning which allows each robot to know its own way into the environment.

Oriented Potential Fields (OPF) and Locally Oriented Potential Fields (LOPF) are path planning techniques applicable to control multiple robots. These are based on numerical solutions of Boundary Value Problems (a BVP generates a given trajectory) of a particular Elliptic Partial Differential Equation. As it will be shown, these techniques have a limitation in crucial part of PDE, that, in fact, tunes the robot´s behavior. It will be also shown, a numerical procedure different from that usual, i.e, utilizing upwind scheme, for proving that limitation existing does not come from OPF or LOPF. It is from the numeric method adopted for solving the PDE. In this way, it becomes possible create new behaviors to the robots. These behaviors are being evaluated and tested.

S10 - Minisymposyum on: Astrodynamics - Part I

Organizers (in alphabetical order): Othon Cabo Winter[1] Antonio F.B.A.Prado[2]

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The symposium will cover all aspects of orbital dynamics, from celestial mechanics and solar system dynamics to space flight dynamics.

The evolution of planet crossing asteroids in the inner Main Belt

Anderson O. Ribeiro(1), Fernando Roig(1)

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Abstract: We study the long term orbital evolution of asteroids in planet crossing orbits between 2.1 and 2.5 AU. The evolution is followed by a direct numerical integration of massless particles under the gravitational influence of all planets from Venus to Neptune. The simulations include the Yarkovsky effect introduced as an anti-dissipative force that produce a positive drift in semi-major axis.

keywords: asteroids, celestial mechanics

Dynamical Erosion of Asteroid groups in the region of the Phocaea family

Valerio Carruba

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Abstract: Here I am investigating the dynamical evolution and possible origin of the Phocaea dynamical family and of asteroids groups in the region. Using analytical and numerical tools I found that the presence of the nu_6 secular resonance forces asteroids with |g-g_6| < 2.55 arcsec/yr to reach values of eccentricities high enough to allow them to experience deep close encounters with Mars. I found that while the clumps identified in the space of proper elements quickly disperse when the Yarkovsky effect is considered.

keywords: Asteroids, celestial mechanics

COORBITAL SATELLITE FORMATION THROUGH DISRUPTION

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Abstract: In the present study we examine the necessary conditions to form co-orbital satellite systems generated from disruption caused by impacts during the early age of Saturn's satellite system. We considered the following scenario: A parent satellite suffers a light collision, which

remove fragments from it, generating a cloud of smaller bodies that escape from its surface. Then, a small co-orbital satellite might be the outcome from the dynamical evolution of the cloud of fragments.

keywords: Asteroids, celestial mechanics

Possible Origin of the Janus-Epimetheus ring

D. Foryta[1], A.P.S. Souza[2], O.C. Winter[2], S.M. Giuliatti Winter[2], D. Mourão[2], R. Sfair[2]

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2 – UNESP, Guaratinguetá, Brazil

Abstract: Applying an impact-generated dust torus model (like Dikarev, Krivov & Grün, 2006) to the case of Janus-Epimetheus coorbital satellites we analyse this torus as a possible source of observed dust coorbital to the satellites in Cassini images.

keywords: Coorbitais, Celestial Machanics

S11- Minisymposyum on: Dynamics Suspensions Part I - Coagulation and Trapping

Organizers (in alphabetical order): Rafael Dias Viela[1] Michael Wikinson[2] Jean-Regis Angilella[3]

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3 Université de Nancy, France, **E-mail** Jean-Regis.Angilella@ensem.inpl-nancy.fr

This session will be devoted to two aspects of the dynamics of suspensions. The first talk will discuss coagulation processes beyond mean field theory. The last two talks will address the problem of trapping of inertial particles in flows displaying chaotic advection.

COAGULATION KINETICS IN AEROSOL SUSPENSIONS BEYOND MEAN FIELD THEORY

Ian J. Ford Department of Physics and Astronomy and London Centre for Nanotechnology, UCL, Gower Street, London WC1E 6BT, UK. i.ford@ucl.ac.uk

Abstract: The stochastic nature of the process of coagulation of suspended particles gives rise to statistical fluctuations in population. These are ignored in traditional models, since they are based on a mean field approximation that converts complicated master equations into much simpler (and non-linear) kinetic equations. Instead, we can reformulate the description in terms of complex populations which retains the effects of fluctuations. We get analytical solutions for the case of a size-independent coagulation rate, and can treat more complicated systems by numerical simulation.

keywords: Coagulation, stochastic dynamics, fluctuations

CHAOTIC MOTION AND TRAPPING OF INERTIAL PARTICLES IN INVISCID VORTEX PAIRS

Jean-Régis Angilella

Nancy-Université-INPL, LAEGO, Vandoeuvre-les-Nancy, France, Jean-Regis.Angilella@ensem.inpl-nancy.fr

Abstract: The motion of heavy inertial particles in the vicinity of a co-rotating inviscid point vortex pair is investigated to understand how interacting vortices can induce chaotic particle trajectories as well as trapping. Particle dynamics is investigated in the reference frame rotating with the vortices, where the flow is steady. In the limit of vanishing particle response times it is shown that gravity, acting in the plane perpendicular to vorticity, induces a periodic forcing which is responsible for the appearance of chaotic trajectories provided the Froude number is small enough. The critical Froude number above which a regular particle motion takes place is obtained by writing the dynamics as a perturbed Hamiltonian system, and using classical Melnikov techniques. In the limit of large Froude numbers, particles with a finite response time are not necessarily centrifugated away from the vortices. It is shown that they can have several equilibrium positions in the rotating reference frame where the centrifugal force balances the Stokes drag. Two of these “hydrodynamical Lagrange points” are shown to be asymptotically stable provided the particle response time lies in an appropriate range. These points are observed to exist temporarily when viscosity, and therefore vortex coalescence, is present. These results suggest that vortex pairing in various environmental flows could influence particle mixing and/or trapping in several situations of interest.

keywords: Chaotic motion, inertial particles, attractor.

Trapping, packing, and ejection in chaotic flows

Rafael D. Vilela & Adilson E. Motter

Abstract: I will report results on the dynamics of aerosol suspensions in open chaotic flows displaying nonperiodicities of different types. The trapping, packing in point clusters, and ejection of the particles from the chaotic regions was found to be a frequently occurring outcome. I will discuss both the case where the nonperiodic flow behavior has a dynamical origin and the case of flows with stochastic time evolution.

S12- Minisymposyum on: Nonlinear Vibrations Elastic Structures

Organizers (in alphabetical order): Marcio José Horta Dantas[1] José Manoel Balthazar[2] Paulo Batista Gonçalves[3]

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The aim of this symposium is to gather specialists of different areas working on the non linear dynamics of problems related to elastic structures such as plates, shells, beams, cables and so on.On the actual demand of the modern technology, in the modeling of such structures, is unavoidable to take into account nonlinearities of the basic equations. New phenomena in Dynamics are expected to be discovered in the theoretical and numeric investigations of those structures.

Mechanical Systems Under Strong Dissipation

Márcio José Horta Dantas

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Abstract: This paper deals with a class of mechanical systems under very strong dissipation. An example for this is an elastic structure under wind forces. In these situations there is no way controlling some parameters. So it is more adequate to suppose that those ones are big. Hence ,in most of the cases, the mathematical model leads to singular perturbation problems. And one the most effective ways to deal with them is to use Integral Manifolds. This approach leads to a dimension reduction of the phase space. In this paper a generalization of a "singular" version of a problem given at T. Bakri, R.Nabergoj, A. Tondl, F. Verhulst " Parametric excitation in non-linear dynamics ", International Journal of Non-Linear Mechanics 39(2004) 311-329. it has been taken into account and some general results are obtained using this approach. Indeed, a general criterion has been obtained that gives sufficient conditions for the existence of autoparametric resonance.

keywords: Singularly Perturbed Systems, Autoparametric Resonance, Integral Manifolds

Integration Methods for Structural Dynamics: Basic Things To Be Considered In Their Design

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Abstract: A set of necessary and desirable properties and characteristics has been long since established for numerical integration methods to be used in structural dynamics. There are some analytical tools that may assure their presence. New methods for non-linear problems have frequently been developed by adapting linear case former versions containing those desirable properties. A brief presentation and discussion of such characteristics, like stability and other ones will be here performed.

keywords: Integration methods, structural dynamics

The Partial Difference Equation for the Modified Kdv: Periodicsolutions And Control For Chaotic Behavior

Berenice Camargo Damasceno[1], Fábio Roberto Chavarette[2],

José Manoel Balthazar[3] , Luciano Barbanti[4]

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3 UNESP – Univ Estadual Paulista, Departament of Statistics, Applied Mathematics and Computation, C.P. 178, 13500-230, Rio Claro, SP, Brazil, [3] jmbaltha@rc.unesp.br

Abstract: We will be dealing here with the so called Modified Korteweg-de Vries equation as considered by G.Eilenberger in his studies on solutions. A process at difference equations is associated to the KdV with specified solitary wave solutions. Periodic solutions and chaotic behavior will be considered as well as control chaos dynamics.

keywords: Korteweg-de Vries equation, Periodic Solutions.

Discussions on the Sdre Control of a Nonlinear Slewing Flexible Structure

André Fenili

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Abstract: Position and vibration control of a nonlinear flexible beam-like structure in slewing motion is investigated here. The nonlinear control method named SDRE (State Dependent Riccati Equation) is applied to the actuator axis. Using this control method, there are several possibilities for the state matrix A(x) that will have influence in the optimal control gains. In this paper, all the possibilities for this matrix for the system under investigation are verified and the different results compared.

Keywords: slewing flexible structures, nonlinear systems, SDRE, nonlinear control.

S13- Minisymposyum on: Communication with Chaos Part I

Organizers (in alphabetical order): Rafael Dias Viela[1] Michael Wikinson[2] Jean-Regis Angilella[3]

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3 Université de Nancy, France, **E-mail** Jean-Regis.Angilella@ensem.inpl-nancy.fr

This session will be devoted to two aspects of the dynamics of suspensions. The first talk will discuss coagulation processes beyond mean field theory. The last two talks will address the problem of trapping of inertial particles in flows displaying chaotic advection.

A New Cryptographyc Method Based On a Hyperchaotic System

Murilo da Silva Baptista

Institute for Complex Systems and Mathematical Biology, King's College, University of Aberdeen, Aberdeen, United Kingdon, murilo.baptista@abdn.ac.uk

Abstract: In this talk I will present a cryptographic method based on a hyperchaotic system and a protocol which inherits some properties of the quantum cryptography but that can be straightforwardly applied on the existing communication systems. Due to the method's design it is an appropriate tool to provide security on software applications for VoIP, as in Skype, dedicated to voice communication through Internet. It also permits to extend the quantum cryptography properties to non-optical communication channels. That would enable that an information packet is transferred through the Internet with the similar security levels as the level one would be offered in case this same packet is transferred in an optical channel under a quantum cryptographic scheme.

keywords: Communication with Chaos, Cryptography,VoIP.

Conditions for the synchronization of band-limited discrete-time chaotic systems

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Abstract: In this talk we present a discrete-time bandlimited chaos-based communication system. To mantain synchronization in bandlimited chanels we employ identical digtal finite impulse response filters on the transmiter and receiver subsystems. We numerically investigate for which filter's orders and cut-off frequencies it is possible to obtain chaotic signals.

Keywords: Communication with Chaos, synchronization, discrete-time dynamical systems, bandwidth limitation.

OFDM Transmission with chaotic subcarriers

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Abstract: Chaotic based systems have not yet shown a distinguished performance in terms of bit error rate when transmitted in narrow band channels .This work attempts to overcome this issue by using chaotic modulation employed in sub-carriers of traditional OFDM. A chaotic sequences, will be generated, in a one- dimensional map controlled by a parameter p which defines the central region of the map, and the chaotic behavior of the generated sequence. Then, OFDM scheme will be applied. Simulations in a Matlab environment will be reported.

keywords: Communication with Chaos, Communication , Chaos, OFDM.

Blind Extraction and Separation of Chaotic Sources Results and Perspectives

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Abstract: In this work, we discuss different approaches for dealing with the problems of blind source extraction (BSE) – which, when chaotic and stochastic signals are mixed, may correspond to a classical time series denoising task – and blind source separation (BSS). These problems can be considered central to the study of chaotic signal processing and are also relevant from the standpoint of methods for communicating with chaos. The first strategy we analyze is more closely related to the problem of BSE in the presence of stochastic signals, being based on the use of the dynamic features underlying the generation of the chaotic sources to recover a signal that be "as deterministic as possible". The solution employs a recurrence plot – a classical tool for the study of nonlinear dynamical systems – to build cost functions based on classical estimators given by recurrence quantification analysis (RQA). These functions are compared with classical independent component analysis (ICA) methodologies under different simulation scenarios. A second strategy, which assumes knowledge about the dynamical

structure of the chaotic signals – albeit not of its initial conditions and parameters – allows the formulation of the BSE and BSS problems as optimization tasks related to the determination of these unknowns within a state estimation framework. The resulting optimization problem is solved using bio-inspired global search algorithms. After exposing these proposals, we discuss perspectives concerning their application to the separation and denoising of chaotic signals in multiuser communications systems, as well as possibilities involving the combination of ICA, RQA and bio-inspired algorithms.

keywords: Communication with chaos, blind extraction, blind source separation, recurrence quantification analysis, independent component analysis.

S14- Minisymposyum on: Astrodynamics - Part II

Organizers (in alphabetical order): Othon Cabo Winter[1] Antonio F.B.A.Prado[2]

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The symposium will cover all aspects of orbital dynamics, from celestial mechanics and solar system dynamics to space flight dynamics.

Extrasolar Comets in the Solar System

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Abstract: Comets are icy objects which are considered to have been ejected from a primordial solar system accretion disk by the giant planets and deposited at large distances from the Sun by the aid of galactic tides. We have performed numerical simulations of encounters between stars with their scattering disks that show that a non negligible fraction of comets would be captured by the primordial Sun and would be part of present Oort cloud.

keywords: Cometas, Celestial Mechanics,

SATELLITES OF URANUS DURING THE PLANETARY MIGRATION

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Abstract: According to many authors, it is well believed that the distant satellites (called irregular) are captured objects, while those close to the planets (regular) are primordial and they were immune to the migration phenomena. In this work, following Nice model, we study the stability of the regular satellites as well as their limit-distance of the stability during the migration. In particular, attention is devoted to possible satellites beyond Oberon, the farthest regular object of Uranus.

keywords: Satellites, Celestial Mechanics

The region near Nix and Hydra, small satellites of Pluto: effects due to small hypothetical satellites and the evolution of dust particles

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Abstract: Our results, derived from a sample of numerical simulations, show that hypothetical satellites can exist in specific regions without provoking any significant effects on Nix and Hydra's orbital elements. These specific regions are coorbital to Nix and Hydra, in a small range between the orbits of them, and beyond Hydra's orbit. Our histogram shows the size of the hypothetical satellites and their location.

keywords: Pluto, satellites, dust

Capture and Passage Through the 3/1 Jovian Mean-Motion Resonance

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Abstract: We analyze under which dynamical configurations and initial conditions, a massless particle interacting with the Jovian 3/1 mean-motion resonance will suffer a capture or crossing when evolving in convergent migration. The resonance dynamics is modeled with a simple analytical Hamiltonian expression incorporated into a simplectic mapping. We consider both adiabatic and non-adiabatic regimes, and analyze the capture probability in each case.

keywords: Resonance, Celestial Mechanics

S15- Minisymposyum on: Dynamics Suspensions Part II - Turbulence

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This session will be devoted to the transport of heavy impurities, also called inertial particles, in turbulence. Collision rates in synthetic flows, correlation dimension for inertial particles suspended in random flows, and specular scattering from fractal attractors populated by inertial particles are topics to be discussed.

COLLISION RATE OF HEAVY PARTICLES IN SYNTHETIC TURBULENTS FLOWS

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Abstract: In high Reynolds flows, the shear due to the turbulent motion leads to an enhancement of the collision rate be- tween particles [1]. Further enhancement is expected in the case of small, heavy particles that do not exactly follow the flow. The enhancement is due to two effects. On one end, the particle distribution in the flow is observed to be very inhomogeneous, leading to the formation of regions with an increased concentration of particles, where collisions are thus more probable. In addition, when the particle inertia is large enough, particles may acquire velocities very different from the surrounding fluid, thus leading to "jets of particles', which may collide with large relative velocity. The latter ef- fect, known as the 'sling effect, [2, 3], provides an appeal- ing framework to estimate the collision rate between heavy particles, which may plays an important role in a number of natural processes, such as formation of rain drops in a cloud [2, 4].

In the present work, we discuss quantiatively the sling ef- fect, in a simplified model of turbulent flows. Specifically, we use kinematic simulations [5], which simply represent the flow as a superposition of a small number of Fourier modes, mimicking Kolmogorov scaling laws. Our work proceeds by (1) obtaining directly the collision rate in a finite system by simply counting collisions, and (2) by using a theoret- ical framework recently developed to capture the collision enhancement. The simplicity of the kinematic simulation flows enables an accurate determination of the collision rates, which is much more difficult in direct numerical simulations of the Navier Stokes equation.

The results found by using kinematic simulations are gen- erally consistent with the results obtained with the Navier- Stokes equations.

We show here how to identify the contribution of the sling contribution while counting the collision between particles. The sling contribution grows as a function of the Stokes num- ber St, defined as the ratio between particles response time and the small time scale of the flow, like $\sim \exp(-A/St)$, where A is a constant that depends (weakly) on the flow, at least at moderate values of the Stokes number. The precise form of the dependence at higher Stokes number can also be obtained, and compared with simple considerations [6].

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keywords: Fluid Dynamics, Plasma and Turbulence; Climate Dynamics.

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Correlation Dimension of Inertial Particles in Random Flows

We obtain an implicit equation for the correlation dimension of dynamical systems in terms of an integral over a propagator. We illustrate the utility of this approach by evaluating the correlation dimension for inertial particles suspended in a random flow. In the limit where the correlation time of the flow field approaches zero, taking the short-time limit of the propagator enables the correlation dimension to be determined from the solution of a partial differential equation. We develop the solution as a power series in a dimensionless parameter which represents the strength of inertial effects.

The talk is based on the manuscript
M. Wilkinson, B. Mehlig, and K. Gustavsson, http://arxiv.org/abs/0909.0955

Spectals: specular scattering from fractal attractors

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Many fractal sets, particularly those generated by dynamical systems, are locally anisotropic in structure, even if they are globally statistically isotropic. The anisotropic structure implies that points cluster onto lines or surfaces. The fractal distributions of inertial particles in turbulent flows is an example. We consider the case where the particles scatter waves. We argue that the anisotropic structures in the strange attractor can cause speckles of high intensity scattering from points where a condition for phase-coherent specular reflection is satisfied. For this reason the anisotropic fractal sets are termed 'spectals'. The accumulation of phase points on a surface of lower dimension is characterised by a spectal exponent, γ, and the enhanced specular scattering is characterised by a spectal dimension, $D_{\rm s}$.

S16- Minisymposyum on: Nonlinear Analysis Simulation Space Physics

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Abstract: Recent advances in signal processing and nonlinear time series analysis and simulation are offering a variety of new techniques for characterization and modeling of nonlinear processes in space physics in the broad sense. The aim of this MS is to serve as an interdisciplinary forum for bringing together specialists from space physics working on data analysis and data modeling which searchs for nonlinear processes as chaos, multifractality, turbulence and extreme events dynamics from planetary and solar physics to cosmology.

keywords: space physics, nonlinear dynamics, chaos, turbulence.

Observation and Simulation Of Alfven Intermmittent Turbulence and Chaos In Space Plasmas

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Abstract: First we describe the observation of Alfven intermittent turbulence in space plasmas based on in situ data measured by spacecraft in the solar wind. The duality of amplitude and phase synchronization associated with nonlinear multiscale interactions in the inertial subrange is demonstrated in the interplanetary magnetic field fluctuations by computing kurtosis (fourth-order structure function) and the phase coherence index. Next we discuss the theory of Alfven intermittency driven by chaos in space plasmas based on numerical simulations of the derivative nonlinear Schroedinger equation. The collision of a chaotic attractor with a mediating unstable periodic orbit leads to an interior crisis. After the interior crisis, an Alfven intermittency appears due to the coexistence of two chaotic saddles coupled by unstable periodic orbits created by an explosion in the gap regions of chaotic saddles. The dynamical systems approach to intermittent turbulence provides a deep insight to the origin and nature of nonlinear processes in space plasmas.

keywords: Turbulence, chaos, Alfven waves, space plasmas, solar wind

Supertransient Magnetohydrodynamic Turbulence

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Abstract: The present letter explores the onset of turbulence in three-dimensional, zero net flux, MHD simulations of accretion disks as a function of the magnetic Reynolds number. We focus on the statistical aspects of the subcritical transition, which is an approach that has been unexplored in MHD simulations, despite its popularity in the hydrodynamics community. From our results, there seems to be no clear transition to sustained turbulence. Instead, the average lifetime of the turbulence grows as an exponential function of Reynolds number, following a type-II supertransient law.

keywords: Applications of Nonlinear Sciences; Fluid Dynamics, Plasma and Turbulence.

Analysis of the Gravitational Influence on Density Fingerings Generated From Miscible Displacement Flows in Porous Media

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Abstract: Structural characterization of miscible displacement in porous media (Hele-Shaw cell-type) is of special interest to understand, among several processes, fingering time evolution of gravity-driven thin coating films. When the heavy solution lies on top of the lighter one in the gravity field, a complex convective fingerlike deformation of the front is observed experimentally. In this paper, nonlinear interactions between chemical reactions and miscible density fingering are studied by direct numerical simulations taking into account different gravity intensities in a Darcy-Boussinesq system. The nonlinear pattern formation of the fingers for different values of g (the intensity of the planetary gravitational acceleration) is characterized by two complementary analytical methods: (i) linear stability analysis and (ii) nonlinear entropic analysis. Both methods are very sensitive in detecting nonlinear fine response of the fingering process when the gravitational field is slightly changed. Here, for the first time, is presented the theoretical fine variation of the density fingering fronts in a porous media as a function of the gravitational acceleration (we have considered typical values, in m/s^2, at the surface of the known solar system planets (3.69, 4.00, 4.70, 8.75, 9.82, 9.89, 10.99, 11.08, 25.99). Finally, due to new discoveries in reaction-diffusion processes, which have been made under space conditions, we discuss the importance of this result in future space missions under distinct planetary gravitational acceleration.

keywords: gravitational fluid flows, density fingering pattern formation, nonlinear dynamics.

The Role of Extreme Event Dynamics in the Cold Dark Matter Cosmology

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Abstract: The search for turbulent-like patterns in nonlinear gravitational clustering has recently advanced due to N-body simulations based on the cold dark matter scenario. In this work we present a computational statistical analysis of the formation of galaxy halos by gravitational collapse in N-body simulation from the Virgo Consortium Data. We find that rescaled data points of gravitational energy for different redshifts collapse into similar patterns, well approximated by a Generalized Extreme Value (GEV) distribution. Once similar statistical behavior was found for chaotic advection, this result is discussed in the context of non-dissipative turbulent-like behavior. From our analysis the unstable gravity field itself behaves as a chaotic advecting flow where the particles (galaxies) can be interpreted as turbulent tracers.

Keywords: cold dark matter, large scale structure formation, extreme event dynamics.

S17- Minisymposyum on: Communication with Chaos Part II

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The objective of this minisymposium is to allow the exchange of experiences between researchers and students that work in various aspects related to applications of chaotic signals in communications, a very promising field. They include but are not limited to chaos-based communication systems, estimation of chaotic signals, source separation techniques, synchronization and pseudorandom sequences generation. This is the second part of a two parts minisymposium.

Synchronization Analysis for Chaotic Communication on a Satellite Formation Flying

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ABSTRACT: Chaos-based communication systems have drawn increasing attention in the last years. The intrinsic complexity embedded on the chaotic dynamics with its hallmark property of sensitive dependence on initial conditions provides a masterful framework that can be exploited to develop remarkably fast, efficient and robust communication systems at low cost. The main idea is to embed the information signal in the chaotic signal which is transmitted over the communication channel. The remarkable properties of those systems have being extensively demonstrated in laboratory experiments. Very recently, a field experiment using commercial optical network was undertaken in which messages encoded in a chaotic waveform were successfully transmitted at gigabit per second range over 120 km of optical fiber in the metropolitan area network of Athens, Greece. Chaotic based communication systems, due to its remarkable characteristics of efficiency and robustness, can also be used to support intensive distributed communication process over a network. This is also the scenario that may exist when the concept of satellite formation flying is used. A satellite in a formation flying is a group of satellites that fly within close range of each other. The formation operates as a “virtual” satellite

with a very large capability that otherwise would require a huge, complex and expensive monolithic satellite. In this work, we address the synchronization issue, which is the framework to build a communication strategy based on chaos for a satellite formation flying scenario. For this case, the propagation time of the signal among the satellites must be taken in consideration. This time is not the same for all the satellites. As so, we analyze strategies for synchronization that must be used according with the topology of the configuration. The results show that even in very demanding scenario, it is possible to achieve synchronization among the satellites so that chaos-based communication can be implemented properly. Furthermore, the performance picture of the overall system is shown in numerical simulations.

Comparing Single and Coupled Maps Synchronzation Performance under Additive Noise

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Abstract: In recent decades many articles have discussed the possibilities of applications of chaos in communications. However, the vast majority consider ideal channel condition, which is clearly a restringing condition, in practical terms. Some papers show that when there is additive noise, the synchronization error often disrupts communication. In this talk, we present preliminary results of a comparison between synchronization error due to additive gaussian noise when the transmitter and receiver are implemented by single or coupled maps.

Keywords: Communication with Chaos, Coupled maps, Additive noise.

Chaos-based Pseudo-random Sequences for Spread Spectrum Systems

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Abstract: Spread spectrum is a modulation technique that uses pseudo-random sequences to increase the frequency band occupied by the transmitted signal. Conventionally, shift registers are employed to generate these sequences, but their generation using chaotic signals has been studied in recent years. This paper compares these alternatives using correlation functions and bit error rate. The computational complexity of both sequence generators is also addressed..

keywords: Communication with chaos, Spread spectrum, Pseudo-random sequence, Chaotic signal.

Digital Modulation using High Period Unstable Periodic Orbits

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Abstract: Transmission of digital information relying on sequences generated by chaotic maps presents some interesting features related to the possible enhancement of communication system security against unauthorized access. On the other hand, the efficiency of such digital modulation schemes in additive white Gaussian noise - AWGN channels is inferior to that obtained with more conventional modulation techniques commonly based on periodic signals. One alternative that seems to be represent a good trade-off between the aforementioned characteristics is the use of high period Unstable Periodic Orbits – UPOs from chaotic systems as symbols to be transmitted. A preliminary study is presented in this work comparing two digital modulation strategies for binary transmission, namely: (i) Maximum Likelihood Chaos Shift Keying with two chaotic maps - ML-CSK, and (ii) Maximum Likelihood Unstable Periodic Orbits Shift Keying – ML-UPOSK. In both methods, following previous work on the subject, the Viterbi algorithm is used in the process of detecting the noise contaminated transmitted symbol in order to enhance the overall communication system efficiency.

keywords: Communication with Chaos, Unstable Periodic Orbits, Digital modulation

S18- Minisymposyum on: Astrodynamics Part III

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The symposium will cover all aspects of orbital dynamics, from celestial mechanics and solar system dynamics to space flight dynamics

Comparison Between Jpl Planetary Ephemerides

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2 - Observatorio do Valongo – UFRJ, , Rio de Janeiro, Brazil

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Abstract: SPICE is an information system built by NASA's Navigation and Ancillary Information Facility (NAIF) whose application extends from mission concept development to the post mission data analysis. Among others, it includes a large collection of routines and kernels from which the user can access the state vector of Solar System bodies within a large time interval. It also allows the use of ephemerids that are not available through the JPL Horizons system, like

DE421. In this work, we present a comparison between DE405, DE413, DE418, DE421, and positions of Pluto as determined from recent observations

keywords: Resonance, Celestial Mechanics

Dynamics of tether-connected spacecrafts near the collinear points

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Abstract: This presentation examines the dynamics of tether-connected two-spacecraft systems in the vicinity of the L_2 Lagrangian point of the Earth-Moon and Sun-Earth system. Equilibrium configuragions of the system are determined as functions of the tether length and the small motions about these configurations are analyzed. Numerical simulation is carried out for both systems. We also determine Lyapunov periodic orbits for several values of the length of the tether within the
region of validity of our model.

keywords: Resonance, Celestial Mechanics

Stability analysis for the Photogravitational Planar Restricted Three-Body Problem

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Abstract: One method to analyze the stability of equilibrium points of nonlinear system was proposed by Kovalev and Savchenko (1975). This method that has been used to study equilibrium solutions in the rotational motion of artificial satellites is here applied to study the equilibrium solutions in the photogravitational restricted three body problem. Based in the Lie-Hori theory, an analytical method to normalize the Hamiltonian up to the fourth order is used.

keywords: Resonance, Celestial Mechanics

Study of Coorbital Satellite around the Lagragian Point L_5 of Saturn

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Abstract: The main objective of this work is to investigate the stability of the coorbital satellites systems of Saturn. In this work, a study is done to the same cases, but around the triangular equilibrium lagrangian point L_5. We performed numerical simulations of 50 particles around point L_5 taking into account the pertubations of Mimas, Enceladus, Tethys, Dione Titan and the oblateness of Saturn. The expoent H was computed with diffusion in major semimajor-axis, eccentricity and longitude.

Keywords: Resonance, Celestial Mechanics

S19- Minisymposyum on: Turbulence in Fluids and Plasma

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Turbulence is one of the key problems of classical physics, and it has been the object of intense research in the last decades in a large spectrum of problems involving fluids and plasmas. The main goal of this minisymposium is to present recent developments in both fundamental aspects and dynamical analyses of turbulence in nonlinear waves and fusion plasmas. Among the questions to be addressed are the onset and control of turbulence and spatio-temporal chaos.

P. J. Morrison (Univ. Texas Austin): "The Hamiltonian and Action Principle Formulations of Continua"

Abstract: A general discussion of Hamiltonian and action principle formulations of continua, e.g. fluid and plasma models, is given. A procedure based on Hamilton's principle of mechanics, adapted for continua, for the construction of action principles is given. The transformation from action principles in terms of the Lagrangian variable description to the Eulerian variable description in terms of noncanonical Poisson brackets is described. Two examples are developed: ideal magnetohydrodynamics and Braginskii's fluid model with gyroviscosity. Several applications of the formalism are discussed.

Dynamical characteristics of plasma turbulence with high MHD activity in TCABR tokamak

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Abstract: In some TCABR discharges the plasma edge electrostatic turbulence and the (MHD) activity may increase. For these discharges, spectral linear analyzes of electrostatic turbulence and magnetic fluctuations present several common features with a noticeable dominant peak in the same frequency. Here, dynamical analyzes were applied to find other common characteristics between these fluctuations. Thus, a spectral version of order parameter reveals that the turbulence fluctuations are synchronized with the Mirnov fluctuations only in the MHD frequency. Moreover, the bicoherence spectra of these fluctuations are similar with high values in the MHD frequency. In addition, these effects are both concentrated inside the plasma, near the edge. Furthermore, the recurrence quantification analysis shows that the turbulence determinism radial profile is substantially changed, becoming more radially uniform, during the high MHD activity. In contrast with all the mentioned spectral changes that are radially localized, the turbulence recurrence is broadly altered at the plasma edge and the scrape-off layer. In conclusion, all these results indicate that models considering coupled electrostatic and magnetic fluctuations are required to properly describe the reported influence of the high MHD activity on the turbulence.

S. R. Lopes (Univ. Fed. Paraná): "Two-state on-off intermittency and the onset of turbulence in a spatiotemporally chaotic system"

Abstract: We show the existence of two-state on-off intermittent behavior in spatially extended dynamical systems, using as an example the damped and forced drift wave equation. The two states are stationary solutions corresponding to different wave energies. In the language of (Fourier mode) phase space these states are embedded in two invariant manifolds that become transversely unstable in the regime where two-state on-off intermittency sets in. The distribution of laminar duration sizes is compatible with the similar phenomenon occurring in time only in the presence of noise. In extended system the noisy effect is provided by the spatial modes excited by the perturbation. We show that this intermittency is a precursor of the onset of strong turbulence in the system.

R. L. Viana (Univ. Fed. Paraná): "Bubbling transition to turbulence in a spatially extended nonlinear three-wave interacting model"

Abstract: We investigated the transition to turbulence in spatially extended nonlinear dynamical systems possessing an invariant subspace with a low-dimensional attractor. When the latter is chaotic and the subspace is transversely stable we have a spatially homogeneous state only. The onset of spatio-temporal chaos, i.e. the excitation of spatially inhomogeneous modes, occur through the loss of transversal stability of some unstable periodic orbit embedded in the chaotic attractor lying in the invariant subspace. This is a bubbling transition, since there is a switching between spatially homogeneous and non-homogeneous states with statistical properties of on-off intermittency. Hence the onset of spatio-temporal chaos depends critically both on the existence of a chaotic attractor in the invariant subspace and its being transversely stable or unstable.

S20- Minisymposyum on: Zero Average Dynamics - ZAD

Organizers (in alphabetical order): Gerard Plivar[1] Fabiola Angulo[2] Gustavo Adolfo Osorio[3]

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Zero Average Dynamics (ZAD) strategy control has been developed in the last decade. It is somehow a weak version of sliding-mode control. Several papers consider applications to DC-DC converters, an report smooth and non-smooth bifurcations of equilibrium points, periodic orbits, tori and chaotic sets. In this minisymposium several recent works about this technique will be shown with also experimental simulations.

Applications of Linear Systems With Saturations

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Abstract: Theoretical results about linear systems with saturations, being a subclass of Filippov systems, have been obtained through analysis and numerical simulations. In this paper several applications to circuits and motors will be shown. Numerical simulations agree with experimental data from the prototypes built in the lab. Smooth and non-smooth bifurcations will be computed and explained within this framework.

Keywords: saturation, non-smooth, experimental.

Existence and Stability of Periodic Orbits In A Boost Converter With Zad Strategy

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Abstract: In this paper sufficient conditions for the existence of periodic orbits in a Boost power converter with Zero Averaged Dynamics (ZAD) strategy will be stated. The stability of the orbits is studied through analytical computation of Floquet exponents. Additionally, numerical calculation of Lyapunov exponents and characteristic multipliers are performed in order to obtain the stability limit of these periodic orbits and also in order to compare these results with Floquet analysis.

Keywords: Boost, non-smooth, bifurcations.

Non-Smooth Torus Bifurcations in a Dc-Dc Converter Controlled With Zad Strategy

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Abstract: DC-DC converters with a delayed ZAD strategy control can be modeled through a low-dimensional map. This map shows rich bifurcation dynamics including smooth and non-smooth bifurcations of invariant sets such as equilibrium points and periodic orbits. This paper is focused to bifurcations of tori, which have been less investigated. Several routes to torus destruction are described and compared with the corresponding smooth transitions.

Keywords: Boost, non-smooth, bifurcations.

Big-Bang-Like Bifurcations in A Zad-Controlled Boost Dc-Dc Converter

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Abstract: Big-Bang bifurcations in maps have been reported in the literature, regarding basically academic examples. At these big-bang bifurcation points, an infinite number of bifurcation curves accumulate. In this paper a big-bang bifurcation is detected in a Boost power converter controlled with ZAD strategy. Several two-dimensional bifurcation diagrams are shown and a brief description of why this big-bang bifurcation appears in ZAD-controlled systems is given.

keywords: Big-bang, non-smooth, bifurcations.

Quantization Instability in a Zad-Controlled Buck Converter

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Abstract: ZAD strategy has been extensively studied in the last decade. Although it has been numerically shown to be stable in a big range of parameter values, experimental simulations

sometimes do not agree with the numerics. Then, a further technique has to be applied in order to stabilize the experimental converter prototype. In this paper it is shown that disagreement is produced by the ADC (analog-to-digital converter) included in the system, due to bit-quantization.

keywords: quantization, non-smooth, bifurcations.

S21- Minisymposyum on: Astrodynamics part IV

Organizers (in alphabetical order): Othon Cabo Winter[1] Antonio F.B.A.Prado[2]

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The symposium will cover all aspects of orbital dynamics, from celestial mechanics and solar system dynamics to space flight dynamics.

SHORT LYAPUNOV TIME: A method for identifying confined chaos

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Abstract: In the current work we present a simple approach to estimate the contribution of the radial component of the LCE. We considered a rotating reference system such that one of the axis keeps on the radial direction of the reference trajectory. Then, the measure of the distance in the phase space between the two nearby orbits allowed us to separate the contribution of the radial component from the others. We applied the method to two solar system dynamics problems.

keywords: Chaos, Celestial Mechanics

A study of unstable asteroids in the 3:1 resonance neighborhood

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Abstract: We search for short-lived asteroids in the neighborhood of the 3:1 resonance. A semi-analytical global study of the orbits for this nonlinear dynamical system is made through this convenient plane. We find that about 30% of these asteroids enter into the 3:1 resonance within 100 Myr and are subsequently dynamical eliminated and the mean life, the dynamical evolution and the mass distribution of these unstable asteroids are also determined.

keywords: Resonance, Celestial Mechanics

The background populations of asteroids in the Main Belt

Anderson O. Ribeiro(1), Fernando Roig(1), Jorge Carvano(1) & David Nesrvorny(2)

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2 - Southwest Research Institute, Boulder CO, USA

Abstract: We analyze the existence of possible correlations between the orbital parameters and the taxonomy among the background populations of asteroids in the Main Belt. Our results indicate that there are weak correlations between the spectral slope and the orbital eccentricities and inclinations. This suggests that the primordial population of Main Belt asteroids would have been almost totally depleted during the early evolution of the Belt, and the population that we observe nowadays is the remnant of the subsequent collisional cascade provoked by the few large bodies that survived in that region of the Solar System.

keywords: Resonance, Celestial Mechanics

The effects a close passage of a cloud of particles by a large planet

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Abstract: In this research we study the passage of a cloud of particles near a celestial body. We mainly perform a study of the effects of this close approach in the three-dimensional space between a planet and a cloud of particles, with the goal of understanding the dispersion of this cloud in terms of the variations of velocity, energy, angular momentum and inclination. A numerical algorithm is developed and implemented to study this problem and then it is applied to a cloud of particles.

keywords: Particles, Celestial Mechanics

Reassessing the binary capture scenario of Triton

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3 - OCA, França

Abstract: We have numerically integrated the orbits of the giant planets and a disk of planetesimals according to the Nice model and saved all close encounter data to use as initial conditions for capture simulations according to the model presented by Agnor and Hamilton. We find a probability of 25% to get Triton from the Agnor and Hamilton model if all Tritons are in equal-mass binaries.

keywords: Triton, Celestial Mechanics

Contributive Talks

C1 - Neuronal Dynamics

Computation by heteroclinic switching

Fabio Schittler Neves, Marc Timme, Network Dynamics Group, Max Planck Institute for Dynamics and Self-Organization., Germany.

Abstract. Switching dynamics among saddles persistently emerges in a broad range of systems and may reliably encode ``memory items'''' in neuronal networks. Their computational capabilities, however, are far from being understood. For models of neural networks, we here analyze how controllable persistent switching naturally emerges in the presence of inhomogeneities; we show that one system is capable of computing distinct binary functions, e.g. AND, OR, and XOR, by entering into switching sequences in a controlled way. These functions may be combined into any arbitrary logic function. Neural switching dynamics thus offers a highly flexible new kind of universal computation.

Model architecture for pattern recognition and discrimination in a neural network of spiking neurons

Everton Agnes, Universidade Federal do Rio Grande do Sul, Brazil
Rubem Erichsen, Instituto de Física - Universidade Federal do Rio Grande do Sul, Brazil
Leonardo Brunnet, Universidade Federal do Rio Grande do Sul, Brazil.

Abstract. A synaptic connectivity model is assembled on a spiking neurons network aiming to build up a dynamic pattern recognition system. The connection architecture includes gap junctions and both inhibitory and excitatory chemical synapses based on Hebb hypothesis. The network evolution resulting from external stimulus is sampled in a properly defined frequency space. Neurons responses to different current injections are mapped onto a subspace using Principal Component Analysis. Departing from the base fixed point, related to a quiescent state, different external stimuli drive the network to specific trajectories in this subspace.

Bifurcations of smooth and lurching waves in a thalamic neuronal network

Jaime Cisternas, Universidad de los Andes, Chile
Thomas Wasylenko, Massachusetts Institute of Technology, USA
Carlo Laing, Massey University, New Zealand
Ioannis Kevrekidis, Princeton University, USA.

Abstract. In this work we consider a one-dimensional lattice of neurons, where each lattice point has both an excitatory thalamocortical and an inhibitory reticular thalamic neuron. Such networks are known to support "lurching" waves, for which propagation is not smooth but rather progresses in a saltatory fashion. We show that these lurching waves are fixed points of appropriately defined Poincare maps, and follow these fixed points as parameters are varied. By doing this we are able to explain the observed

transitions in behavior. Our analysis is quite general and could be applied to other spatially extended systems which show non-trivial forms of wave propagation.

The Skew Tent Map Entropy Production

Fabiano Ferrari, Universidade Estadual de Ponta Grossa, Brazil
Sandro Pinto, State University of Ponta Grossa, Brazil.

Abstract. The tent map shows important dynamical properties. Through the coupled map lattices, one can measure the entropy, and consequently, the uncertainness present in this system. The study of tent map is relevant, it describes a triangular wave very useful in electronic systems.

C2 - Complex Network

Hub Synchronization in Large Scale-Free Networks

Tiago Pereira, Federal University of ABC, Brazil.

Abstract. Heterogeneity in the degree distribution is known to suppress global synchronization in complex networks of symmetrically coupled oscillators. Scale-free networks present strong heterogeneity, there are a few highly connected nodes, termed hubs, while the majority of nodes has only a few connections. We show that a stable partially synchronized state may take place in scale-free networks: hubs undergo a transition to synchronization while the remaining nodes are unsynchronized. We present illustrative examples of this partially synchronized state and an analytical treatment of its stability problem. This constitutes a general phenomenon and may occur in any large heterogenous network, regardless of the network global synchronization properties.

Adaptive Node-to-Node Pinning Control of Complex Networks

Luiz Felipe R. Turci, Inpe, Brazil
Elbert E. N. Macau, Instituto Nacional de Pesquisas Espaciais, Brazil.

Abstract. In this work we present a decentralized fully adaptive node-to-node strategy for synchronization control of complex networks. We proof that the proposed strategy guarantees global asymptotic stability of the synchronized solution xs; and we show, via intensive simulation, that such strategy can present better performance than the usual node-to- node pinning strategy.

Effective dynamics for chaos synchronization in networks with time-varying topologies

Rodrigo Pereira, Romeu Szmoski, Sandro Pinto, State University of Ponta Grossa, Brazil.

Abstract. A coupled map lattice, whose topology changes each time step, is considered. We show that the transversal dynamics of the synchronized state can be studied by the introduction of effective dynamical quantities. We show that an ensemble of short time

observations can be used to predict the long time behavior of the lattice. Finally, we point out that is possible obtain a lattice with constant topology whose dynamical behavior is identical to one of the time-varying topologies.

Identification of functional information subgraphs in complex networks

Vadas Gintautas, Luis Bettencourt, Michael Ham, Los Alamos National Laboratory, USA.

Abstract. We present a general information theoretic approach for identifying functional subgraphs in complex networks where the dynamics of each node are observable. We show that the uncertainty in the state of each node can be written as a sum of information quantities involving a growing number of variables at other nodes. We demonstrate that each term in this sum is generated by successively conditioning mutual informations on new measured variables, in a way analogous to a discrete differential calculus. The analogy to a Taylor series suggests efficient optimization algorithms for determining the state of a target variable in terms of functional groups of other nodes. We apply this methodology to electrophysiological recordings of cortical neuronal network grown in vitro. Despite strong stochasticity, we show that each cells firing is generally explained by the activity of a small number of other neurons. We identify these neuronal subgraphs in terms of their redundant or synergetic character and reconstruct neuronal circuits that account for the state of target cells.

C3 - Population and Dynamics

Neutral Speciation in Spatially Distributed Populations

Marcus de Aguiar, Elizabeth Baptestini, Universidade Estadual de Campinas, Brazil
Yaneer Bar-Yam, New England Complex Systems Institute, USA
Les Kaufman, Boston University, USA
Michel Baranger, MIT, USA.

Abstract. The number of living species on Earth has been estimated to be between 10 and 100 million. Understanding the processes that have generated such remarkable diversity is one of the greatest challenges in evolutionary biology. In this talk I will discuss a recently proposed mechanism of speciation in which a population, with genetically identical individuals homogeneously distributed in space, spontaneously breaks up into species when subjected to mutations and to two mating restrictions: individuals can select a mate only from within a maximum spatial distance S from itself and only if the genetic distance between itself and the selected partner is less than a maximum value G. Species develop depending on the mutation rate and on the parameters S and G. The resulting species-area relationships and abundance distributions thus obtained is consistent with observations in nature.

Solving the Levins' paradox in the logistic map of population growth

Evaldo de Oliveira, Universidade de Sao Paulo, Brazil
Vicente Barros, Universidade Federal da Bahia, Brazil
Roberto Kraenkel, Universidade Estadual Paulista, Brazil.

Abstract. We introduce a method to improve maps by adding prior informations and/or constraints. The method starts from an initial map model, wherefrom a likelihood function is defined which is regulated by a temperature-like parameter. Then, the new constraints are added by the use of Bayes rule in the prior distribution. We applied the method to the logistic map of population growth of single species. We show that the population size is limited for all ranges of parameters, allowing thus to overcome difficulties in interpretation of the concept of carrying capacity known as the Levins'' paradox.

The basic reproduction number in SI staged progression model: a probabilistic approach

Juliana Kodaira, Universidade Estadual Paulista "Julio de Mesquita Filho" - campus de Botucatu, Brazil.

Abstract. The SI (susceptible; infected) staged progression model is used for many diseases where the transmission probabilities vary as the viral load in an infected individual changes. We work with a version of the SI staged progression model proposed by van den Driessche & Watmough (2002). In this paper, we present for this model the effect of the uniform random perturbations in the some parameters in the basic reproduction number (R0) using the Monte Carlo simulation technique, which produces uncertainty in R0. The results show that the uncertainty related to the basic reproduction number R0, performed by the Monte Carlo simulation technique, is useful to describe the effects of the parameters changes in the SI staged progression dynamic system model.

Sustainable Development Through Complex Networks

Fabiola Angulo, Gerard Olivar, Gustavo Osorio, Universidad Nacional de Colombia, Colombia.

Abstract. This paper regards a novel sustainable development modeling through complex networks and ordinary differential equations. The modeling elements are two: the first one concerns to a complex network with nonlinear differential equations involving the state variables, represented by nodes, and the second is an indicator system (indicators, variables components and dimensions) built on the state variables. Finally, we also model the community perception. Modeling this situation is totally different from the previous one. Since each community member perceives different, we use random variables. We introduce also the information concept and perform statistical simulations in order to obtain significant data. Several questions arise such as if the sustainability actions must be thought in order to make the technical model identical to the perceived model. Manizales sustainable development is based on an indicators system which shows the general picture of the development of the city. There are 128 basic indicators (collected by IDEA Manizales), which are organized into different categories: dimensions, components, variables and basic indicators. We pretend a new

development modeling, through complex networks, with the following properties: better scenarios forecast, possibilities for control actions (sustainability actions), institutional planning and link with the actual system (IDEA Manizales).

C4 - Applications in Nonlinear Sciences

Isolas of periodic orbits in a molecular model of a laser with a saturable absorber

Carlos Pando, Universidad Autonoma de Puebla, Mexico
Eusebius Doedel, Bart Oldeman, Concordia University, Canada.

Abstract. TITLE : "ISOLAS OF PERIODIC ORBITS IN A MOLECULAR MODEL OF A LASER WITH A SATURABLE ABSORBER". E.J. Doedel (1), B.A. Oldeman (1) and C.L. Pando L. (2) (1) Concordia University, Montreal, Canada. (2) Universidad Autónoma de Puebla, Puebla, Mexico, e-mail : carlos@sirio.ifuap.buap.mx ; 52-222-2295610 KEYWORDS : Applications of Nonlinear Sciences, Laser dynamics. BASIC INFORMATION The field of laser physics provides mathematical models that, in many cases, can be tested with great accuracy in experiments [1]. One of these models is the laser with saturable absorber, consisting fundamentally of a laser cavity, an amplifier medium and an absorber. This system has a rich dynamical behaviour with several scenarios for the onset of chaos. We consider the bifurcations of periodic orbits and the associated onset of chaos. EXTENDED ABSTRACT We consider a new mathematical model of a CO_2 laser with a fast saturable absorber. We find isolas of periodic solutions along with their bifurcations as the main parameters change, namely, the incoherent pump and the nonlinear losses parameter. We find that the characteristic chaotic behaviour is an intermittent process between the periodic orbits belonging to the aforementioned isolas [2]. CONCLUSION A new mathematical model is considered, where a family of isolas of periodic orbits determines the bifurcation structures and the chaotic behaviour of the system. References [1] Abraham N.B. et al. Progress in Optics XXV, p. 3-190, 1988, North-Holland, ed. Wolf E. [2] Accepted for publicaction in the International Journal of Bifurcations and Chaos (IJBC) , February 2010.

Influence of damping in the long term behavior of a cardanically suspended body

Danny Carrera, Pontifical Catholic University of Rio de Janeiro, Brazil
Hans Weber, PUC-Rio, Brazil.

Abstract. The contribution of this work besides showing the effect of friction and asymmetry of inertia on a cardanically suspended body is relevant for the analysis of tumbling bodies in space. Curiously, if the initial energy is enough to start the tumbling, the movement does not damp out and remain inside a basin of attraction, but continues changing basin of attraction regardless to the kinetic energy becoming lesser due to friction. Newton-Euler laws were used to obtain the equations of movement, with a procedure of normalization for to reduce one parameter in the equation and a dimensionless model of a gyroscope is obtained. This work uses tools of nonlinear dynamics and chaos theory to characterize the rotational motion.

The effect of poisoning species on the oscillatory dynamics of a surface catalyzed reaction

Bruno Batista, University of São Paulo, Brazil
Graziela Ferreira, IQSC, Brazil
Hamilton Varela, University of São Paulo, Brazil.

Abstract. We have studied the oscillatory behavior displayed by a set of differential equations representing an inhibited surface catalyzed reaction. Bifurcation diagrams were constructed for several conditions of inhibition along with an analysis of the evolution of the frequency of oscillation. Numerical results showed a behavior qualitatively similar to a selected experimental system for which an adsorbing anion blocks catalyst sites inhibiting a oxidation reaction.

A note on the dynamics of ferroelectric liquid crystals

Gerard Gomes, University of Barcelona, Spain
Dora Izzo, Universidade Federal do Rio de Janeiro, Brazil
Carles Simó, University of Barcelona, Spain
Teresinha Stuchi, UFRJ, Brazil.

Abstract. We study theoretically the phase diagram of ferroelectric liquid crystals under an external field using the Landau-Ginsburg expansions of the free energy. In order to perform a non linear extension of the literature results we reduce the original number of parameters. This reduction enable us to make a complete analysis of the topology of the linear analogue. We also make a study of a suitable Poincaré section and present several families of periodic orbits, some of them stemming from the linear ones corresponding to the classical results found in the literature.

C5 - Synchronization

Transients and Arnold tongues for synchronized electronic fireflies

Gonzalo Marcelo Ramírez Ávila, Universidad Mayor de San Andrés, Bolivia
Arturo Marti, Universidad de la Republica, Uruguay.

Abstract. Fireflies constitute a paradigm of pulse-coupled oscillators. This pulse coupling form is extensively common in Biology ---the chirp of crickets, pacemaker cells firing and luminescent algae \\emph{Gonyaulax}, among many---. The study of how pulse-coupled oscillators achieve synchrony is important due to experimental observations of synchronous neural firing patterns of various mammalians, insects and reptilian species. In order to tackle the problems related to synchrony of pulse-coupled oscillators, a Light-Controlled Oscillator (LCO) model is presented. LCOs constitute unidimensional relaxation oscillators described by two distinct timescales meant to mimic \\emph{Pteroptyx malaccae} fireflies in a simple fashion, with great parameter malleability and easy experimental implementation. Dynamical results dealt range from transient

behaviours for different coupling configurations and intensities, to stable states of arbitrary order. Furthermore, analytical expressions regarding situation are also exhibited. Construction of return maps reveal stability issues, bifurcations of fixed points as control parameters are tunned and as the number of oscillators involved is increased. Numerical simulations complement all studies.

The role of periodic boundary conditions on the synchronization of coupled oscillators in a ring

Hassan El-Nashar, University of Alkharj, Saudi Arabia
Hilda Cerdeira, Universidade Estadual Paulista, Brazil.

Abstract. We study a system of N oscillators in a chain with nearest neighbors coupling with periodic boundary conditions. The oscillators are assigned initial frequencies at random from a Gaussian distribution. Upon increasing the coupling strength, they arrive to a common value of the frequency, and remain synchronized in this single cluster state of common frequency as long as the coupling strength is larger than the critical value. We analyze the system of oscillators just before complete synchronization occurs, when the oscillators accommodate themselves into two clusters, which will merge into one at synchronization. At such stage we are able to quantify the major quantities that characterize the behavior of the system. These quantities are well studied for different initial frequencies and different number of oscillators. We found that there are always two distinct quantities, related to four oscillators, which are at the borders of the clusters and they are nearest neighbors between themselves. The phase differences between these neighboring oscillators have the absolute maximum and minimum value among all phase differences between any two neighbouring oscillators anywhere in the chain. At the stage of synchronization, there are always two oscillators, and only two in the chain, which have a phase difference of $\pm \pi/2$. Knowing these oscillators allows us to calculate analytically the value of the critical coupling strength. However, we are not able to locate these two oscillators, without searching numerically in order to determine the value of the critical coupling. Therefore, we analyze the dynamics of the phase differences between neighboring oscillators, instead of phases, and we find their dependency on the initial as well as boundary conditions. Then, we build a technique based on numerical observations of the behaviour of all the phase differences and develop a geometrical description to arrive to the two oscillators that have a phase difference equal to $|\pi/2|$ thus getting an exact analytical result for the coupling strength.

Synchronization conditions in two coupled pendulums

Armando Ticona, Universidad Mayor de San Andres, Bolivia.

Abstract. Based in a damped pendulum discrete model, we have studied the synchronization conditions for two coupled pendulums, varying both the pendulums features and the coupling conditions. We found the basin of attraction for several situations in which the control parameters were fixed. Varying the control parameters (length, mass and damping coefficient), we have found phase diagrams related to the

initial conditions of one of the pendulums; on these diagrams we have identified synchronization regions. We emphasize the 1 (synchronization 1:1); synchronization with a winding number S1).

Nevertheless, other synchronization orders are possible.

Instabilities in coupled Huygens pendula

Josue Fonseca, Jose R. Rios Leite, Universidade Federal de Pernambuco, Brazil.

Abstract. The behavior of two coupled pendula, as described originally by C. Huygens will be presented in their nonlinear regime of oscillations. Empirical observations in a real system shall be described and compared with numerical solutions of the classical equations of motion. Including frictional dissipation terms the evolution of the system presents instabilities due to mode frequency-locking. Bifurcations from periodic initial conditions into quasi-periodic and chaotic motion was characterized for a range of parameters of the oscillators. The role of symmetry on the dynamics of the system will be discussed.

C6 - Bifuraction Thoery and Applications

Bifurcation Analysis of a Typical Section with Control Surface Freeplay

Eulo Balvedi Jr., Instituto Tecnológico de Aeronáutica, Brazil
Roberto da Silva, IAE-CTA, Brazil.

Abstract. A bifurcation analysis of a typical section airfoil with control surface freeplay nonlinearity is carried out. Two approaches are used to evaluate the limit cycle behavior: time marching numerical integration and harmonic balance method. Also, the sensitivity to the initial condition is discussed. Linear analyses are conducted to provide guidance for the nonlinear analysis. The universal scaling law for the dependence of limit cycle oscillations and bifurcation parameters, elucidated by Tang, Dowell, and Virgin (Ref. [2]) are confirmed. Comparisons between the bifurcation diagrams generated by the harmonic balance and the numerical integration show good agreement, considering the hypotheses adopted.

A Novel Non-Smooth Bifurcation in a Chemical Process DAEs System

Gerard Olivar, Juan Bernardo Restrepo, Angélica María Alzate, Universidad Nacional de Colombia, Colombia.

Abstract. The use of Differential algebraic equations is common in the dynamic simulation of chemical engineering plants and apparatus that deal with physical equilibrium, special cases of that would be the the Liquid-Liquid equilibrium and the Vapor-Liquid-Liquid equilibrium that are systems that are described by piecewise smooth non linear differential algebraic equations with non trivial discontinuity frontiers, the analysis of shortcut design chemical engineering models such as residue curves and

liquid-liquid contactors leads to the appearance of bifurcations over the discontinuity frontier.

Robust Tori in a Double-Waved Hamiltonian Model

Caroline Martins, UNESP, Brazil.

Abstract. A Hamiltonian system perturbed by two waves with particular wave numbers can present robust tori, barriers created by the vanishing of the perturbed Hamiltonian at some defined positions. When robust tori exist, any trajectory in phase space passing close to them is blocked by emergent invariant curves that prevent the chaotic transport. Our results indicate that the considered particular solution for the two waves Hamiltonian model shows plenty robust tori blocking radial transport.

Entropy generation (and reduction) in a thermomechnically driven simple harmonic oscillaotr

Ian Ford, University College London, Great Britain.

Abstract. When a system undergoes a spontaneous thermodynamic process, we expect the entropy of the universe to increase. In elementary thermodynamics textbooks this is demonstrated by calculating the difference in thermodynamic properties of the initial and final equilibrium situations. For a system that is continuously driven by external thermal or mechanical forces, we also expect there to be entropy generation, though we now need to be define the entropy change without reference to equilibrium properties. Some might even claim that the term `entropy should only ever refer to an equilibrium property, so we need to tread carefully. Nevertheless, recent developments in non-equilibrium statistical physics suggest how we can define a quantity that strongly resembles irreversible entropy change. These insights have also led to the Fluctuation Theorem(s) [1,2] and the Jarzynski equality [3]. Starting from this framework, we have studied the properties of the so-called dissipation functional for the simple case of a thermomechanically-driven harmonic oscillator, in order to demonstrate that it possesses several of the expected properties of irreversible thermodynamic entropy production. We can also characterise how it fluctuates, depending on the natural randomness of the process, so that it is possible to speak of entropy destruction during periods of the process. Our analysis quantifies the entropy generation and (occasional) reduction, as well as providing an average rate of entropy generation that goes beyond the usual linear regime.

C7 - Hamiltonian Systems and Billards

Superdiffusion in time-dependent open horizon billiards

Alexander Loskutov, Moscow State University, Russia.

Abstract. It is shown that Fermi acceleration, which is inherent in time-dependent open horizon billiards, leads to anomalous transport properties. The stochastic oscillations of the scatterers results in superdiffusion of particles, when the mean squared displacement grows asymptotically quadratically in time.

Suppressing Fermi acceleration in oval like driven billiards

Edson Denis Leonel, DEMAC, Brazil.

Abstract. We consider a dissipative oval-like shaped billiard with a periodically moving boundary. The dissipation considered is proportional to a power of the velocity V of the particle. The three specific types of power laws used are: (i) $F\\propto -V$; (ii) $F\\propto -V^2$ and (iii) $F\\propto -V^{\\delta}$ with $1<\\delta<2$. In the course of the dynamics of the particle, if a large initial velocity is considered, case (i) shows that the decay of the particle''s velocity is a linear function of the number of collisions with the boundary. For case (ii), an exponential decay is observed, and for $1<\\delta<2$, an power-like decay is observed. Scaling laws were used to characterize a phase transition from limited to unlimited energy gain for case (ii). The critical exponents obtained for the phase transition are the same as those obtained for the dissipative bouncer model. Therefore near this phase transition, these two rather different models belong to the same class of universality. For all types of dissipation, the results obtained allow us to conclude that suppression of the unlimited energy growth is indeed observed.

Dividing surfaces and reaction rates in the H+H2 -> H_2+H chemical reaction

Jose Salas, University of La Rioja, Spain.

Abstract. By means of the Dynamical Transition State Theory (DTST), we study the chemical reaction H+H2 in the collinear case. We identify the geometrical objects that, in phase space, control the reaction. Finally, we use the DTST to calcule the reaction probability P(E) as a function of the energy. It is worth noting that this method is computationally much more efficient than the standard time-consuming brute-force Monte Carlo sampling procedures. The results of the ionization probabilities we have computed with both procedures are in very good agreement.

Intense--Laser Double Ionization: Insights from Nonlinear Dynamics

Turgay Uzer, Goergia Institute of Technology, USA.

Abstract. Entirely classical interactions are adequate to generate the strong two-electron correlation needed for correlated double ionization in atoms and molecules. In this talk, I will revisit the recollision mechanism using a nonlinear dynamics perspective. I will show that this recollision scenario has to be complemented by the dynamical picture of the inner electron. Using this global picture of the dynamics, we were able to derive verifiable predictions on the characteristic features of the ``nonsequential'''' process.

C8 - Time Series Analisis

Decentralized observer for a class of nonlinear norm bounded systems

Marcus Silva, Universidade Federal do Pará, Brazil
Celso Bottura, Universidade Estadual de Campinas, Brazil.

Abstract. The problem of state estimation of nonlinear systems is a very important issue in practical applications where the system state to be controlled is unavailable or its measurement is very expensive as in power systems, design of spacecraft, vehicle control, etc. This paper develops a methodology for designing a decentralized observer for a class norm bounded nonlinear systems. For this, we use the second method of Lyapunov LMI (Linear Matrix Inequalities) and a procedure we propose.

Optimal irregular delay embeddings

Lucas Uzal, Pablo Verdes, CIFASIS - French Argentine International Center for Information and Systems Sciences UPCAM / UNR - C, Argentina.

Abstract. In this paper we propose a criterion to select an optimal state-space reconstruction of the dynamics of a physical system from time series. Optimal parameter values for the embedding dimension and time lags can be simultaneously selected by a global optimization of a proposed cost function. In particular, we explore the advantages of irregular time-delay embeddings, as opposed to homogeneous ones, for the reconstruction of dynamical systems.

A simple conceptual model to interpret the 100000 years dynamics of paleo-climate records

Sebastián Quiroga Lombard, Physics Department, University of Buenos Aires, Argentina
Pablo Balenzuela, University of Buenos Aires, Argentina
Holger Braun, Eidelberg Academy of Sciences and Humanities, University of Heidelberg, Heidelberg, Germany, Germany
Dante R. Chialvo, Department of Physiology, David Geffen School of Medicine, UCLA, Los Angeles, CA. USA., USA.

Abstract. Spectral analysis performed on records of cosmogenic nuclides reveals a group of dominant periodicities during the Holocene period. Only a few of them are related to known solar cycles, i.e, the De Vries/Suess, Gleissberg and Hallstat cycles. The origin of the others remains uncertain. On the other hand, time series of North Atlantic atmospheric/sea surface temperatures during the last ice age reveal the existence of repeated large-scale warming events, called Dansgaard-Oeschger (DO) events. The De Vries/Suess and Gleissberg cycles with periods close to 1470/7 (aprox. 210) and 1470/17 (aprox. 86.5) year has been proposed to explain these periodicities. In this work we found that a conceptual bistable model forced with the De Vries/Suess and Gleissberg cycles plus noise displays a group of dominant frequencies similar to those obtained from Fourier spectra from 14C register during the Holocene. Moreover, we show

that simply changing the noise amplitude in the model we obtain similar power spectra to those corresponding to GISP2 d18O (Greenland Ice Sheet Project 2) during the last ice age. These results give a general dynamical framework which allows to interpret the main characteristic of paleoclimate records from last 100,000 years.

C9 - Control

Optimal Control in Noisy Chaotic Systems

Benjamin Toledo, Universidad de Chile, Chile
Felipe Asenjo, 1Departamento de Física, Facultad de Ciencias, Universidad de Chile, Santiago, Chile
Abraham Chian, National Institute for Space Research (INPE), Brazil
Thiago das Chagas, Instituto Tecnológico de Aeronáutica, Brazil
Victor Munoz, Departamento de Fisica, Facultad de Ciencias, Universidad de Chile, Chile
Erico Rempel, ITA, Brazil
Jose Rogan, Departamento de Fisica, Facultad de Ciencias, Universidad de Chile, Chile
Juan Valdivia, Universidad de Chile, Chile.

Abstract. Controlling chaos is of great importance in nature and in technical applications. The growing interest in this field stems from the pioneering works done by Ott, Grebogi, and Yorke [1] in chaos control. Our method, which is based on their ideas and in the method proposed by Pyragas [2], allow us to map the task of controlling one of the many unstable periodic orbits (UPO) in a nonlinear system, to an optimization problem, where the forcing converge to a small control effort consistent with a given noise level. To apply this method, we first identify an UPO. Next we calculate the Lyapunov vectors and exponents over the UPO, through the fundamental matrix, which comes from the linearization of the problem. The noise is cleaned through a singular value decomposition (SVD), which is usually used in image processing [3]. This method was successfully applied to noisy Lorenz, Rossler and Van der Pol systems, and to a hyperchaotic system [4]. References [1] E. Ott, C. Grebogi, and J. A. Yorke. Controlling chaos. Phys. Rev. Lett., 64(11):1196-1199, 1990. [2] K. Pyragas. Continuous control of chaos by self-controlling feedback. Phys. Lett. A, 170(6):421{428, 1992. [3] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery. Numerical Recipes in C++. Cambridge University Press, Second Edition, 2002. [4] F. Asenjo, B. A. Toledo, V. Munoz, J. Rogan, and J. A. Valdivia. Optimal control in a noisy system. Chaos: An Interdisciplinary Journal of Nonlinear Science, 18(3):033106, 2008.

Stabilizing equilibrium by linear feedback for controlling chaos in Chen system

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Graciela González, Universidad de Buenos Aires, Argentina.

Abstract. Stabilization of a chaotic system in one of its equilibrium by applying small perturbations is studied. Feedback control, Lyapunov stability and ergodicity are combined to improve performance

The controlling role of envelope mismatches in intense inhomogeneous charged beams

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Abstract. Inhomogeneous cold beams undergo wave breaking as they move along the axis of a magnetic focusing system. All the remaining control parameters fixed, the earliest wave breaking is a sensitive function of the inhomogeneity parameter: the larger the inhomogeneity, the sooner the breaking. The present work analyzes the role of envelope size mismatches in the wave breaking process. The analysis reveals that the wave breaking time is also very susceptible to the mismatch; judiciously chosen mismatches can largely extend beam lifetimes. The work is extended to include recently discussed issues on the presences of fast and slow regimes of wave breaking, and the theory is shown to be accurate against simulations.

Control of the Belousov-Zhabotinsky reaction by small external forces, especially gravity

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Abstract. The Belousov-Zhabothinsky (BZ) reaction is a chemical reaction which exhibits spatial as well as temporal pattern formation. Being an excitable medium, it can be influenced by even small external forces. One of these small forces which under ground conditions permanently is given is gravity. The gravity dependence of the BZ-reaction has been investigated in some detail up to now, and it has been found that especially the propagation velocity of waves in thin layers of fluid BZ-medium depends significantly on gravity-amplitude and -orientation. This finding has been mainly assigned to an interaction of gravity with diffusion and convection in the medium at the wave front, and consequently it has been stated that the propagation of waves in gels of BZ-medium is not significantly gravity dependent. We have now done more detailed experiments and have been able to show that also in gels the propagation velocity of BZ-waves is altered by gravity, but less than in fluid systems. Experiments have been performed in a lab centrifuge, a sounding rocket experiment and a parabolic flight mission . In a stirred bulk system stable oscillations can exist in the absence of diffusion, sedimentation, buoyancy, and convection with a period in the 1 min range. In parabolic flight missions usually taken to be a μ-gravity platform, such a system can be investigated under gravity conditions changing between 1g, 1.8g and μ-g just on this timescale. Under these conditions we have found that the temporal pattern formation of a BZ reaction oscillating in time becomes locked to the period of the gravity changes but is also destabilized due to the partially stochastic nature of the gravity changes. This points out to a gravity dependence of one of the plain chemical rate constants of the BZ-system. The BZ-reaction is the perfect system for such studies and can serve among others as a model for self-

organization and pattern formation in biological systems, especially biological rhythms, including man. The possibility of the lack of gravity or changes in gravity destabilizing self-organization and pattern formation especially in biological systems is of major interest in studying live under space conditions for later manned space-flight, but also points out to possible effects of other small external forces fluctuating on proper timescales, i.e. electromagnetic fields. It has also been found that heavy water (D2O) has an effect on the Belousov Zhabotinsky reaction in a complex manner, possibly by a reduced diffuion due to the higher viscosity of the medium. Using this idea for control experiments, we have now performed a series of experiments in cerium and ferroin catalyzed BZ-reactions and have first shown that D2O induces a delayed set-up of the BZ reaction in stirred bulk systems and slows down the oscillation. Both effects can be explained by D2O changing rate constants in the chemical equations being used to describe the Oscillating BZ reaction. Second we have investigated wave propagation in thin fluid layers of BZ medium and in thin gels of BZ medium and found a variety of effects. In both cases, the excitability of the systems is reduced, this can be seen as a delayed wave set-up and a smaller number of excitation centers in heavy water compared to normal water. Especially in gels the system is obviously close to the limit of being no longer excitable, due to the fact that the waves do no longer penetrate the whole area of the gels and that open fronts and dying away type wave fronts are found at an increased number. In fluid systems additionally the system often stops but can be re-initiated by mixing the solution again. In gels and in fluid systems furthermore wave propagation is slowed down, in gels signifivcaantly more than in fluid systems. One of the reasons for our findings could be the reduced diffusion of substances in D2O as a consequence of the increased viscosity of the medium, in additon to the already mentioned effectss of D2O on chemical rate constants

C10 - Celestial Mechanics

Intriguing structures in iterative maps motivated by N-body problem

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Abstract. Conventional approaches to modeling any system try to incorporate more and more realistic features into the model, thereby making it more and more complex. An opposite approach seeks to build simpler and simpler conceptual models capable of capturing some observed features of a system. This trend began with Lorenz, who simplified models of the atmosphere to obtain the Lorenz model consisting of a system of only three equations. Despite the simplicity of these equations, this system displayed immensely rich properties, and has been used as a conceptual model in diverse disciplines. Poincare maps help study ordinary differential equations from a qualitative perspective. Several investigators like Henon and Feigenbaum followed the simplification approach; instead of investigating Poincare maps of realistic systems, they, along with several others, investigated simple maps for their own sake. Despite lack of realism, this

approach yielded rich dividends. A map, as simple as the Logistic map, became an important conceptual modeling paradigm. Although very simple, the Logistic map offered bewildering richness. It provided a tool for understanding bifurcation routes to chaos, which were verified experimentally through various experiments in diverse fields. Coupled map lattices (CML)help explore partial differential equations (PDE). Further simplification led to the introduction of Cellular Automata (CA). These fields continue to be explored with vigor and have given rise to a rich body of knowledge, conceptually useful over a wide spectrum of disciplines. In this paper, we follow the simplification approach for modelling the N-body problem. N-body simulations, say in Gravitation, give rise to filamentary structures. Such structures are observed in the actual observed Galactic distribution. The mechanism for creation of such structures is not well understood. We explore some simple dynamical models, which, though unrealistic, produce such filamentary structures. We found a variety of intriguing structures. We believe that an attempt to understand these structures will lead to useful insights similar to those provided by investigations in maps, CML, CA etc. The problem of N-body simulation in 3-dimensions consists of solving a set of 6N first order ODEs, 3 position and 3 velocity components for each particle. Numerical simulation requires replacement of continuous time by discrete time. Our first simplification replaces 6N ODEs by a set of N maps. We find that this simplified model also gives rise to filamentary structures similar to realistic N-body simulations. In this model the changes in the positions of the particle are made synchronously. In the next stage of simplification, we make the changes in position asynchronously by pickng a particle randomly and changing its position according to the above rule. This model also gives rise to filamentary structures. Next, we make further departure from realistic modeling. Instead of picking a particle and changing its position by summing the effects of all other particles, we choose a particle and change the positions of all other particles according to a specified map. If particle i is chosen, the positions of all the other particles change according to the rule . At each instant, a randomly chosen particle becomes an attractor, bringing all the other particles closer to it. Each particle moves a distance, which depends on its distance from the attracting particle. We explored an iterative dynamical systems motivated by the N-body problem. It is more tractable than standard N-body models. Yet this family exhibits very intriguing structures which need to be explained. We could explain some of the behaviour observed using concepts from nonlinear dynamics. However, many properties remain unexplained. Analysis of this dynamical system may shed light on the mechanism responsible for creation of filamentary structures in the N-body simulation. It is hoped that the dynamical system introduced in this paper will lead to a body of knowledge as rich as that produced by Logistic and other maps, Coupled Map Lattices, Cellular Automata etc.

Direct Hamiltonization - The Generalization of the Alternative Hamiltonization

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Abstract. A new procedure named direct Hamiltonization gives another foundations to Analytical Mechanics, since in this formalism of the Hamiltonian Mechanics the Hamiltonian function can be obtained for all mechanical systems. The principal change

proposed in this procedure is that the conjugate momenta cannot be defined a priori, but instead of this, they are determinate as a consequence of a canonical description of the mechanical system. As the direct Hamiltonization is a generalization of the alternative one, then the usual Hamiltonization and momenta is recovered while the envelope solution is selected in that procedure. Also this procedure assures the existence of a Hamiltonian function without any constraints for any mechanical system therefore the usual quantization is always allowed. This procedure can be applied to non Lagrangian, Nambu, non holonomic and dynamical systems since there are no restriction in this formalism to the number of equations of motion.

Homoclinic Chaos in Axisymmetric Bianchi-IX cosmological models with an ``ad hoc'' quantum potential

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Abstract. In this work we study the dynamics of the axisymmetric Bianchi IX cosmological model with a term of quantum potential added. As it is well known this class of Bianchi IX models are homogeneous and anisotropic with two scale factors, $A(t)$ and $B(t)$, derived from the solution of Einstein''s equation for General Relativity. The model we use in this work has a cosmological constant and the matter content is dust. To this model we add a quantum-inspired potential that is intended to represent short-range effects due to the general relativistic behavior of matter in small scales and play the role of a repulsive force near the singularity. We find that this potential restricts the dynamics of the model to positive values of $A(t)$ and $B(t)$ and alters some qualitative and quantitative characteristics of the dynamics studied previously by several authors. We make a complete analysis of the phase space of the model finding critical points, periodic orbits, stable/unstable manifolds using numerical techniques such as Poincar\\''e section, numerical continuation of orbits and numerical globalization of invariant manifolds. We compare the classical and the quantum models. Our main result is the existence of homoclinic crossings of the stable and unstable manifolds in the physically meaningful region of the phase space (where both $A(t)$ and $B(t)$ are positive), indicating chaotic escape to inflation and bouncing near the singularity.

C11 - Self-organization and Collective Phenomena

Chaos and criticality in city traffic under resonant conditions

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Abstract. We explore in detail the traffic model proposed in Toledo et. al. (Phys. Rev. E 70 016107, 2004) in which a single car travels through a sequence of traffic lights. The chaotic behavior shown for a given bound in the acceleration/braking ratio is examined more carefully, and the region in parameter space for which we observe chaotic behavior is found. The complex behavior that occurs when traffic lights are synchronized is studied. Two strategies are considered: all lights in phase, and a "green wave" with a propagating green signal. It is found that traffic variables such as traveling time, velocity, and fuel consumption, near resonance, follow critical scaling laws. For the green wave, it is shown that time and velocity scaling laws hold even for random separation between traffic lights. The system is also modeled with cellular automatons, where an analogous resonant behavior is found for the two strategies mentioned above. The resilient of the critical behavior is analyzed as we introduce perturbations. These results suggest the concept of transient resonances, which can be induced by adaptively changing the phase of traffic lights. This may be important to consider when designing strategies for traffic control in cities, where short trajectories, and thus transient solutions, are likely to be relevant.

Description of realistic wealth distributions by kinetic trading models

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Abstract. A consistent observation for trading markets is that wealth distribution is distributed according to a power law (Pareto''s law). Models based on kinetic theory, where a set of interacting agents trade money, have been proposed to describe this behavior. These models are able to yield power law tails if agents are assigned a saving propensity. We show that these models also allow to solve the inverse problem, that is, finding the saving propensity distribution which yields a given wealth distribution. In particular, this shows that kinetic models are able to fit wealth distribution data for all wealth ranges, not only for the high-end tail. This is done explicitly for two comprehensive wealth datasets, one corresponding to world wealth distribution, and the other restricted to billionaires wealth distribution.

The Role Of Dipole Surface At CdS Nanoparticle Self Organization

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Abstract. Over the past decades there has been a great interest in researching nanostructures mainly due to the presence of new features which are not observed in the respective bulk material. Since small nanoparticles have a large ratio of atoms on the surface in comparison to the volume, the surface effects play a fundamental role in

physical and chemical properties. As an example, nanoparticles interactions are influenced by its surface properties and surfactant control is fundamental to avoid cluster formation. In addition, self organization is not a completely understood matter. Besides the relevance of studying nanoparticles surfaces, there is a lack of theoretical researches in this area. Our aim in this work is to contribute to the characterization of CdS nanoparticles atomic structure and self organization effects, by the use of density functional theory. We predict that the nanoparticle self organization process is resulted from two mechanisms that produce dipole moments: the charge density modification at the surface atoms and the difference in the number of atoms of each plane. We believe that this latter effect is responsible for long range interactions between nanoparticles, while the first effect, that presents a high dipole moment, is responsible for the structure''s cohesion and self organization . In this sense, it is fair to say that dipole moments derived from surface effects should be considered in addition to the dipole moment originated from the nanoparticle''s core.

Phase transition liquid-gas simulation in a bi-dimensional net

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Abstract. Using a bi-dimensional net we simulate the behavior of particles of a fluid, along an isotherm. Number of collisions against the walls of the system is analyzed as a function of the number of particles, showing a phase transition which resembles the one from liquid to gas, showing some features of the Virial expansion. Although the model seems to be so simply, many characteristics of phase transitions can be analyzed from these results.

C12 - Fulid Dynamics and Turbulence

Amplitude-phase synchronization in intermittent turbulence and spatiotemporal chaos

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Abraham Chian, National Institute for Space Research (INPE), Brazil
Daiki Koga, INPE, Brazil
Erico Rempel, ITA, Brazil
Yoshitaka Saiki, Hokkaido University, Japan
Michio Yamada, Kyoto University, Japan.

Abstract. In this paper we analyze synchronization due to multiscale interactions in observations of intermittent turbulence and numerical simulations of spatiotemporal intermittency. First, we apply kurtosis and phase coherence index to measure the degree of amplitude-phase synchronization of intermittent magnetic field turbulence observed in the solar wind. Next, we use a model of nonlinear waves to measure the degree of amplitude-phase synchronization by computing the power-phase spectral entropy, respectively, at the onset of spatiotemporal intermittency. Our results indicate that the

duality of amplitude-phase synchronization may be the origin of intermittency in fully-developed turbulence in the solar-terrestrial environment.

Edge of chaos in the GOY shell model of fully-developed turbulence

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Abstract. We apply the method of bisection to characterize the edge of chaos in a three-dimensional Gledzer-Ohkitani-Yamada (GOY) model of fully-developed turbulence. In a periodic window of the bifurcation diagram where there is a coexistence of a chaotic saddle and a periodic attractor, we identify the edge of chaos as the period-7 unstable periodic orbit that arises from a saddle-node bifurcation. The dynamical properties of the chaotic attractor and embedded chaotic saddles associated with the crisis-induced intermittency are analyzed using the Fourier-Lyapunov representation.

Two upwinding schemes for nonlinear problems in fluid dynamics

Giseli Lima, Laís Corrêa, Valdemir Garcia Ferreira, Universidade de São Paulo, Brazil.

Abstract. The appropriated modeling of convection terms is a key point for reproducing complex physical phenomena in fluid dynamics problems. In this context, the objective of this work is to present/compare two new high-order upwind schemes for approximating convective terms, namely the SDPUS-C1 and the ``Esquema teste'''' scheme. By the numerical results, we conclude SDPUS-C1 and ``Esquema teste'''' schemes are good tools for capturing shocks and complex structures

Turbulence and Cascades on Geodynamo

Breno Silva, Universidade de Sao Paulo, Brazil.

Abstract. We veriafied transference of magnetic energies between different sclaes of the geomagnetic field from observed data. Our analysis indicates that an inverse cascade process is taking place

C13 - Control in Complex Systems

Stability of a Restricted Three-Body Problem with the Spherical Plummer Potential

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Patricio Letelier, Universidad Politécnica de Valencia, Spain.

Abstract. In this work we investigate the stability of a circular, planar restricted three-body (namely a galaxy, a star and a planet) with a potential composed by the Newtonian and the Plummer potentials in order to study the influence of the halo of the galaxy over the system. We employ Poincare Sections and Lyapunov exponents and compare the system for different values of the mass ratio between the galaxy and the halo. We find that systems with bigger values of the halo mass are more stable. This behavior can be explained from the decrease of the potential energy in the presence of the halo, when compared with a system where all the mass is concentrated in the bulge.

Controlling self-organized criticality in complex networks

Daniel Cajueiro, UnB, Brazil.

Abstract. A control scheme to reduce the size of avalanches of the Bak-Tang-Wiesenfeld model on complex networks is proposed. Three network types are considered: those proposed by Erd\\H{o}s-Renyi, Goh-Kahng-Kim, and a real network representing the main connections of the electrical power grid of the western United States. The control scheme is based on the idea of triggering avalanches in the highest degree nodes that are near to become critical. We show that this strategy works in the sense that the dissipation of mass occurs most locally avoiding larger avalanches. We also compare this strategy with a random strategy where the nodes are chosen randomly. Although the random control has some ability to reduce the probability of large avalanches, its performance is much worse than the one based on the choice of the highest degree nodes. Finally, we argue that the ability of the proposed control scheme is related to its ability to reduce the concentration of mass on the network.

Stabilization due to Singular Perturbations in a Wind Model

Marcio Dantas, Universidade Federal de Uberlãndia, Brazil.

Abstract. In this note we deal with a model of the interaction between cables and wind. In order to avoid instabilities in this mechanical system adequate singular perturbations are introduced.These perturbation keep the system in a stable periodic orbit.

Squeezing of thermal noise in a parametrically-driven Duffing oscillator

Adriano Batista, Universidade Federal de Campina Grande, Brazil.

Abstract. A Microelectromechanical system (MEMS) device consisting of a doubly-clamped beam resonator is used as a very sensitive detector of vibrations, weak forces and as a mass spectrometer [1]. Therefore, the reduction of noise is a very important issue for the sensitivity of these systems. Here, we propose a theoretical model that studies the first normal-mode oscillations of this kind of resonator as a parametrically-driven Duffing oscillator under the action of thermal noise. We calculate the average fluctuations of these oscillations and show that squeezing of noise occurs. Furthermore, in the linear regime, we theoretically derive an expression for the amount of mechanical noise squeezing and notice that detuning of the first parametric resonance is a necessary condition for noise squeezing. We derive a family of quadrature average amplitude fluctuations of the oscillator, whose degree of squeezing depends on the strength of the

parametric force, detuning and the quality factor Q of the resonator. We also study the nonlinear contributions to noise squeezing by doing linear response and full-numerical integration of the equations of motion. Furthermore, we apply our technique to the calculation of gain for classical parametric amplifiers [2]. We make theoretical predictions for linear gain, nonlinear gain and the effect of noise on gain. We achieve very good agreement between numerical simulations and theoretical predictions. [1] D. Rugar and P.Grutter, Phys. Rev. Lett. 67, 699 (1991). [2] R. Almog et al., Appl. Phys. Lett. 88, 213509 (2006).

C14 - Communication with chaos and Coding

Digital Modulation using High Period Unstable Periodic Orbits

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Leonardo A Borges Torres, UFMG, Brazil.

Abstract. Transmission of digital information relying on sequences generated by chaotic maps presents some interesting features related to the possible enhancement of communication system security against unauthorized access. On the other hand, the efficiency of such digital modulation schemes in additive white Gaussian noise - AWGN channels is inferior to that obtained with more conventional modulation techniques commonly based on periodic signals. One alternative that seems to be represent a good trade-off between the aforementioned characteristics is the use of high period Unstable Periodic Orbits UPOs from chaotic systems as symbols to be transmitted. A preliminary study is presented in this work comparing two digital modulation strategies for binary transmission, namely: (i) Maximum Likelihood Chaos Shift Keying with two chaotic maps - ML-CSK, and (ii) Maximum Likelihood Unstable Periodic Orbits Shift Keying ML-UPOSK. In both methods, following previous work on the subject, the Viterbi algorithm is used in the process of detecting the noise contaminated transmitted symbol in order to enhance the overall communication system efficiency.

Blind extraction and separation of chaotic sources - results ans perspectives

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Ricardo Suyama, UFABC, Brazil
João Romano, UNICAMP, Brazil
Romis Attux, Universidade Estadual de Campinas, Brazil.

Abstract. In this work, we discuss different approaches for dealing with the problems of blind source extraction (BSE) which, when chaotic and stochastic signals are mixed, may correspond to a classical time series denoising task and blind source separation (BSS). These problems can be considered central to the study of chaotic signal processing and are also relevant from the standpoint of methods for communicating with chaos. The first strategy we analyze is more closely related to the problem of BSE in the presence of stochastic signals, being based on the use of the dynamic features underlying the

generation of the chaotic sources to recover a signal that be as deterministic as possible by means of recurrence quantification analysis (RQA).

Multiplexed Chaos-Based Communications with Semicondutor Lasers

Damien Rontani, David Citrin, Alexandre Locquet, Georgia Institute of Technology, France
Marc Sciamanna, Supélec, France.

Abstract. In this abstract, we propose a new theoretic architecture to ensure chaos multiplexing with a spectral efficiency of optical fields generated by several semiconductor lasers with identical free-running frequencies.

Properties of a Aithmetic Code for Geodesic Flows

Daniel Chaves, UNICAMP, Brazil.

Abstract. The knowledge of the properties of a set of code sequences is a first step in the study of the characteristics of a code. With the purpose of applying the geometric and algebraic properties of the hyperbolic manifolds to analyze dynamical systems, through the symbolic sequences that code the geodesics of a hyperbolic manyfold, we determine two characteristics of the set of symbolic sequences.

C15 - Dynamics of Granular Materials

Subharmonic wave transition in a quasi-one-dimensional noise fluidized shallow granular bed

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Marcel Clerc, University of Chile, Chile
Claudio Falcón, Nicolás Mujica, Universidad de Chile, Chile.

Abstract. We present an experimental and theoretical study of the pattern formation process of standing subharmonic waves in a fluidized quasi-one-dimensional shallow granular bed. The fluidization process is driven by means of a time-periodic air flow, analogous to a tapping type of forcing. Measurements of the amplitude of the critical mode close to the transition are in quite good agreement with those inferred from a universal stochastic amplitude equation. This allows us to determine both the bifurcation point of the deterministic system and the corresponding noise intensity. We also show that the probability density distribution is well described by a generalized Rayleigh distribution, which is the stationary solution of the corresponding Fokker-Planck equation of the universal stochastic amplitude equation that describes our system.

Soliton and disorder: wave propagation in elastic spin chains

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Abstract. We investigate the propagation and scattering of highly nonlinear waves in disordered chains composed of diatomic (two-mass) units of spheres that interact via

Hertzian contact. Using ideas from statistical mechanics, we consider each diatomic unit to be a spin, so that the granular chain can be viewed as a spin chain composed of units that are each oriented in one of two possible ways. Using experiments and numerical simulations, we examine the wave transmission as a function of the chain length and the level of disorder. We observe two different mechanisms of wave propagation: In low-disorder chains, we observe the propagation of solitary pulses; as the disorder is increased, we obtain a delocalized wave whose properties are insensitive to the level of disorder. We characterize the wave properties in both propagation regimes and propose a simple theoretical description of the wave propagation based on scattering mechanisms. Our study suggests that such an elastic spin chain can be used as a model system to investigate the role of disorder on the propagation of highly nonlinear waves.

Minkowski Spheropolyhedra for the simulation of Granular Materials

Sergio Andres Galindo Torres, The University of Queensland, Australia
Fernando Alonso-Marroquin, The University of Sydney, Australia
Jose Munoz, Universidad Nacional de Colombia, Colombia.

Abstract. Hereby we review the basics of construction and some applications of a novel discrete element for the simulation of grains, called spheropolyhedra, which are just the Minkowski opening of a polyhedron with a sphere. So, they combine the ability of polyhedra to resemble complex-shaped grains with the well known elastic forces and potentials of spheres and cilynders. First proposed by Pouring and Liebling (2005), they have being extended by Alonso (2008) to 2D non-convex particle shapes and further extended by Galido et. al. (2009,2010) to 3D Voronoi tessellations. After summarizing their construction procedure and interactions, we present some applications to soil mechanics, both 2D and 3D.These examples illustrate how spheropolyhedra can be useful to simulate granular materials, specially when the elastic energy needs to be exactly computed.

Partial annihilation of counter-propagating pulses

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Abstract. Partial annihilation of two counter-propagating dissipative solitons has been widely observed in different experimental contexts, from hydrodynamics to chemical reactions. Based on our results for coupled complex cubic-quintic Ginzburg Landau equations as well as for the FitzHugh-Nagumo equation we conjecture that noise induces partial annihilation of colliding dissipative solitons in many systems.

C16 - Plasma and Turbulence

Lagrangian Coherent Structures in a Nonlinear MHD Dynamo

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Abraham Chian, INPE - National Institute for Space Research, Brazil
Axel Brandenburg, AlbaNova University Ctr, NORDITA, Stockholm, Sweden

Michael Proctor, Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge, Great Britain.

Abstract. The analysis of passive scalars is a powerful way to trace the turbulence in hydrodynamical and magnetohydrodynamical flows. This work presents the detection of transport barriers called Lagrangian coherent structures in direct numerical simulations of a 3--D magnetohydrodynamic (MHD) dynamo. An MHD dynamo is the process responsible for the growth of an initially weak magnetic field in a magnetized fluid due to the conversion of kinetic energy to magnetic energy. We focus on the change in transport and mixing properties of the flow when the system undergoes a transition whereby a large--scale spatially coherent magnetic field loses its stability due to change in the magnetic diffusivity. The transition results in a magnetic field with complex spatiotemporal dynamics. LCS can be used in conjunction with classical tools to provide a better description of MHD turbulence in space and fusion plasmas.

Time Dependent Shocks and Forcing Effects in the Velocity Probability Distribution Functions of Burgers Turbulence

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Antônio Francisco Neto, Universidade Federal de São João Del-Rei, Brazil.

Abstract. We study Burgers turbulence driven by external stochastic forcing (Gaussian and white noise in time). As a refinement of previous work [L. Moriconi, PRE 79:046324 (2009)], we investigate how velocity-difference probability distribution functions (pdf) are corrected from the consideration of more realistic time-dependent shock profiles, necessarily subject to external forcing fluctuations. These issues are addressed with the help of the Martin-Siggia-Rose (MSR) field theory approach to to classical mechanics. This formulation provides an interesting stage for the use of standard quantum field theory non-perturbative techniques, such as the instanton calculus. We find, under general circumstances, and up to second order in the stochastic force, that the asymptotic scaling form of the velocity-difference pdf is stable, although its prefactor will depend on the particular structure of the ensemble of evolving shocks.

Dynamics of the Brazil-Malvinas Confluence

Cayo Francisco, Universidade Federal do ABC, Brazil.

Abstract. In this work, we investigated the mesoscale dynamics of the Brazil-Malvinas Confluence (BMC). Particularly, we were interested in the role of geophysical instability in the formation and development of the mesoscale features commonly observed in this region. We dinamically analyzed the results of numerical simulations of the CBM region conducted with Hybrid Coordinate Ocean Model (HYCOM). We verified that the necessary conditions for instability to occur in the modelled flow were satisfied, following Arnolds theorem. Additionally, we quantified the effect of barotropic and baroclinic instabilities in the modelled flow and showed the dominance of the latter in the region. Finally, we studied the wave-mean flow interactions and verified that baroclinic eddy

forces were associated with the deformation of the flow while barotropic eddy forces induced vorticity. In order to explore the main results of the dynamical analysis of HYCOM simulations, we constructed theoretical process study models. We isolated the baroclinic instability effect on the mesoscale dynamics of the confluence of two western boundary currents using a quasi-geostrophic inviscid f -plane two-layer ocean approach. We calculated the simplified vertical structure through employing a dynamical calibration scheme based on the first dynamical mode structure of the BMC region. We constructed two Contour Dynamics (DC) models: a linear and a nonlinear versions. The basic flow configuration consisted of two converging western boundary currents that form a zonal eastward jet in the upper layer. The lower layer flow was essentially divergent as a result of a westward zonal jet impinging on the western border. This choice of vertical shear assured that the system was baroclinically unstable. We showed through the experiments that the presence of the confluence,the western meridional boundary and the barotropic mode in the dynamical structure of the basic flow favored long wave patterns. The three experiments conducted with the nonlinear model exhibited the development of both a reflection pattern and vortical dipoles. The dipoles pinched off from either the retroflection lobe (i.e.,the primary crest of the wave train) or the primary trough when the baroclinically unstable current system was perturbed at the boundary vicinities. We verified that the nonlinear model simulations followed the instability properties predicted by the linear model in terms of meander growth rates, phase speeds and most unstable wavelengths. This suggested that while the baroclinic instability mechanism was responsible for the temporal growth of the meanders, the nonlinear effects caused the dipole isolation and pinch-off of the finite amplitude meanders. These dipoles could leave and propagate away from the current axis. Finally, we investigated the effect of isolated eddies, assumed to be previously shed from the BMC region, on the mean flow through the development of a third CD model. We intended with this study to confirm that the effect of barotropic forces, on the mean flow, was to induce vorticity. We developed a 1-1/2 layer quasi-geostrophic, inviscid, f -plane CD model of the confluence of two simmetric western boundary currents. These currents interacted with a cyclonic point vortex, located in the BC domain, and an anticyclonic point vortex, located in the MC domain. We runned six experiments where we varied the initial position and circulation intensity of the point vortices. We observed vortex formation due to the roll-up of the PV front around the point vortex, and the formation of dipoles and meandering without a defined pattern. The formation of these structures strongly depended on the initial conditions. The interactions seemed to agree with former results that pointed out the role of eddy momentum forces in inducing vorticity in the flow. They also revealed the occurrence of strong exchanges of waters between the two domains of different potential vorticity, mainly during the events of the front roll-up around the point eddy structures.

Spatial High Order Numerical Solution for Fluid Dynamics Applications

Carlos Breviglieri, Instituto Tecnologico de Aeronautica, Brazil
Joao Luiz F. Azevedo, Instituto de Aeronautica e Espaco, Brazil
Edson Basso, Instituto Tecnologico de Aeronautica, Brazil.

Abstract. The purpose of the present work is to discuss the advancements on the use of spatially high order, implicit, spectral finite volume (SFV) methods [1, 2] for compressible aerodynamic flows. It has become widely accepted that high order methods are necessary on the analysis of complex flows, in order to reduce the number of mesh elements one would otherwise need if using traditional second-order schemes. High order methods can potentially achieve a higher level of accuracy than low order ones given the same computational resources. In the present effort, several numerical techniques are explored in order to achieve such potential. The focus of the study is in the analysis of different cell partitions, different limiter formulations and different time-marching schemes, and their implications in terms of efficiency and robustness of the method. In particular, the ability to resolve discontinuities presented in the typical flowfields of interest is an important metric for the evaluation of the usefulness of the method. The paper discusses details for linear, quadratic, cubic and quartic polynomial reconstructions to achieve high-order accuracy.

C17 - Chaotic Dynamics

Chaos and complexity: a non-ordinary route - II

Ued Maluf, Universidade Federal Fluminense, Brazil.

Abstract. Chaos and complexity: a non-ordinary route - II Ued Maluf Master Degree Program of Art Science Instituto de Arte e Comunicação Social Master Degree Program of Environmental Science Instituto de Geociências Universidade Federal Fluminense Niterói, RJ, Brasil plato118@hotmail.com Abstract: The main purpose of this paper is to present another novel approach to complexity theory as an addendum to a previous one in the present DYNAMIC DAYS, based on Maluf´s Strangenesses Theory. keywords: complexity, non-ordinary, isomorphs mosaic.

Periodic windows distribution: A quantitative description in the two-parameter space

Rene Medrano-T., Physics Institute of Sâo Paulo University, Brazil
Iberê Luis Caldas, USP Instituto de Física, Brazil.

Abstract. Periodic solution parameters, in chaotic dynamical systems, form periodic windows with characteristic distribution in two-parameter spaces. Recently, general properties of this organization have been reported, but a theoretical explanation for that remains unknown. Here, for the first time we associate the distribution of these periodic windows with scaling laws based in fundamental dynamic properties. For the R{\\"o}ssler system, we present a new scenery of periodic windows composed by multiple spirals,

continuously connected, converging to different points along of a homoclinic bifurcation set. We show that the bi-dimensional distribution of these periodic windows unexpectedly follows scales given by the one-parameter homoclinic theory. Our result is a strong evidence that, close to homoclinic bifurcations, periodic windows are aligned in the two-parameter space.

The chaotic Dynamics of Watt regulator generated frommap and differential equations

Elinei Santos, UFPA, Brazil.

Abstract. The study of chaotic dynamics is divided in two difference areas: dissipative chaos and conservative or Hamiltonian chaos. The main difference from these approaches is that hamiltonian system doesnt generated attractors whereas dissipative systems generated strange attractors that living in a finite area from phase space and in general shows chaotic behavior. Dissipative chaos in general have been studied from differential equations and hamiltonian chaos from finite differences equations or maps.We verify that in the regime of strong dissipation this map generated a strange chaotic attractor e shows a complex interwoven parameter space with different behavior. We using numeric Lyapunov exponent to generate a series of graphics analysis. We investigate both dynamics behavior using differents numerical techniques such as Lyapunov exponent, Fast Fourier Transform, Poincaré section and bifurcation diagrams.

Chaotic saddles in a numerical model of Pierce diode

Pablo Muñoz, National Institute for Space Research (INPE), Brazil
Joaquim José Barroso de Castro, INPE, Brazil
Abraham Chian, National Institute for Space Research (INPE), Brazil
Erico Rempel, ITA, Brazil.

Abstract. We examine the chaotic dynamics searching for chaotic saddles in a spatial extended system exemplified by the Pierce diode. The system is described by a set of fluid equations and integrated numerically with a finite difference scheme.The only control parameter is the transit angle or Pierce parameter \\alpha. We focus our study in a p-3 periodic window, near \\alpha=3\\pi. For the first time we characterize the interior crisis at the end of this periodic window, showing direct evidence of the collision between the chaotic attractor, the chaotic saddle and its stable manifold.

Chaotic Dynamics in Mathematical Economics: A Duopoly Model

Hiroyuki Yoshida, Nihon University, Japan.

Abstract. This paper studies the adjustment process of a duopoly model. My main objective is to examine the stability of the steady state for two dynamic adjustment systems. In the first model, which is a system of ordinary differential equations, I prove that the steady state is globally stable. In the second model, I examine a system of delay

differential equations, which is an extended version of the first model. In this case we can observe the existence of strange attractors by means of numerical simulation.

C18 - Dynamics of Byosistems and Health Applications

Generic dynamic modeling of metabolic systems

Delali Adiamah, Julia Handl, Jean-Marc Schwartz, University of Manchester, Great Britain.

Abstract. In this work, we present a modeling framework based on generic kinetic equations in order to enable the construction of large dynamic models of metabolic systems.

Deciding fate in adverse times: sporulation and competence in Bacillus subtilis

Daniel Schultz, Jose Onuchic, University of California at San Diego, USA
Eshel Ben Jacob, University of Tel Aviv, Israel.

Abstract. Bacteria serve as systems biology central arena for understanding how networks of genes and proteins process information and control cellular behaviors. In recent years much effort has been devoted to investigations of specific bacteria gene circuits as functioning modules. The next challenge is integrative modeling of the operation of complex cellular networks composed of many such modules. Here, a tractable integrative model of the sophisticated decision-making signal transduction system that determines the cell fate between sporulation and competence is presented. This provides an understanding of how information is sensed and processed to reach "informative" decision in the context of the cell state and signals from other cells. The competence module (ComK dynamics) is modeled as a stochastic switch whose transition rate is controlled by a quorum-sensing unit, and the sporulation module (Spo0A dynamics) is modeled as a timer whose clock rate is adjusted by a stress-sensing unit. The interplay between these modules is mediated via the Rap assessment system and the AbrB-Rok decision module. The sensing units are gated by the Rap system. The decision module creates an opportunity for competence within a specific window of the sporulation timer, and the timer is regulated via a special repressilator like inhibition of Spo0A by Spo0E that is inhibited by AbrB. For some stress and input signals, this repressilator can generate a frustration state with large variations (fluctuations or oscillations) in Spo0A and AbrB concentrations, which might serve an important role in generating cell variability. This integrative framework is a starting point that can be extended to include transition into cannibalism and the role of colony organization.

Propagation of calcium pulses in astrocyte networks by nonlinear gap junctions

Mati Goldberg, Maurizio De Pittà, Tel Aviv University, Israel
Vladislav Volman, The Salk Institute, USA
Hugues Berry, COMBINING Team, INRIA Rhône-Alpes, France
Eshel Ben-Jacob, Tel Aviv University, Israel

Abstract. A new paradigm has recently emerged in brain science whereby communications between glial cells and neuron-glia interactions should be considered together with neurons and their networks to understand higher brain functions. In particular, astrocytes, the main type of glial cells in the cortex, have been shown to communicate with neurons and among each other. They are thought to form a gap-junction-coupled syncytium supporting cell-cell communication via propagating calcium (Ca2+) waves. An identified mode of propagation is based on cytoplasm-to-cytoplasm transport of inositol trisphosphate (IP3) through gap junctions that locally triggers Ca2+ pulses via IP3-dependent Ca2+-induced Ca2+ release (CICR). It is however currently unknown whether this intracellular route is able to support the propagation of long-distance regenerative Ca2+ waves or is restricted to short distance signaling. Furthermore, the influence of the intracellular signaling dynamics on intercellular propagation remains to be understood. We propose a novel model of the gap-junctional route for intercellular Ca2+ wave propagation in astrocytes that yields two major predictions. First, we show that long-distance regenerative signaling requires nonlinear diffusion through gap junctions. Second, we show that even with nonlinear gap junctions, long-distance regenerative signaling is favored when the internal Ca2+ dynamics implements frequency modulation-encoding oscillations with pulsating dynamics, while amplitude modulation-encoding dynamics tends to restrict the propagation range. As a result, spatially heterogeneous molecular properties and/or weak couplings are shown to give rise to rich spatiotemporal dynamics that support complex propagation behaviors. These results shed new light on the mechanisms implicated in the propagation of Ca2+ waves across astrocytes and precise the conditions under which glial cells may participate in information processing in the brain.

A Minimalist Model Of Calcium-Voltage Coupling In GnRH Cells.

Rennie Machado, LRA/FEAU/UNIVAP, Brazil
Rossanna Chan, University of Auckland, New Zealand
David Schneider, Comisión Nacional de Energía Atómica, Argentina
James Sneyd, University of Auckland, New Zealand.

Abstract. We present a minimalist model to understand the interplay between burst firing and calcium dynamics in GnRH (Gonadotropin-releasing hormone) neurons. GnRH neurons are located in the basal hypothalamus, and are responsible for the production of the GnRH decapeptide. The episodic release of this hormone into the portal system stimulates the pituitary release of gonadotropines, LH and FSH, which drive sexual development and control the female menstrual cycle and male spermatogenesis. The detailed mechanisms governing GnRH release dynamics are still unknown, and the investigation of those mechanisms could provide some clues to understand central aspects of life such as maturation and fertility.

May suppression of the spatio-temporal chaos in cardiac tissue be a method for controlling the fibrillation phenomenon?

Alexander Loskutov, Moscow State University, Russia.

Abstract. We describe a method involving a smart chaos suppression which may help to understand how to treat the most dangerous cardiac decease - fibrillation. On the basis of a Panfilov-Hogeweg model the cardiac excitation we consider the defibrillation problem. It is shown that suppression of fibrillative dynamics can be achieved by a low-amplitude local non-feedback stimulation.

Posters

Poster Session (PT_1)

PT1- Nonlinear Bidimensional Sloshing Suppressor Model

Francisco Marcus, USP, Brazil
Marcio Tsukamoto, Everton Medeiros, University of São Paulo, Brazil.

Abstract. In this work, a two-dimensional model of a submerged body in a rectangular tank partially filled with a fluid and excited horizontally is described by a set of nonlinear differential equations. The linear method was developed based on potential theory and uses the dimensions of the tank and the filling level to calculate the velocity of the fluid in the position where the object is located. By using the velocity, the dimensions and the drag coefficient of the body, the force due to sloshing can be calculated. With the nonlinear system we investigate the parameters to onset of chaos and its consequence for the mechanical system.

PT2- Heat stress estimation as an inverse problem: variational approach.

Leonardo Santos, INPE - Instituto Nacional de Pesquisas Espaciais, Brazil
Haroldo Campos Velho, Instituto Nacional de Pesquisas Espaciais, Brazil.

Abstract. Is shown a methodology for estimation of heat stress (changes in the spatial dependence of thermal conductivity) based on solving the associated inverse problem by a variational method (Alifanov approach) in the form of the adjoint equation. Three profiles of thermal conductivitys spatial dependence are considered: a step function (discontinuous), a continuous function with discontinuous derivative, and a sigmoid function (continuous function with continuous derivative).

PT3 - Nonlinear electronic transport behavior in Indium Nitride

Clóves Rodrigues, Pontifícia Universidade Católica de Goiás, Brazil.

Abstract. A theoretical study on the nonlinear transport of electrons and of the nonequilibrium temperature in n-doped wurtzite Indium Nitride (InN), under influence of moderate to high electric fields, is presented. It is based on a nonlinear quantum kinetic theory which provides a description of the dissipative phenomena developing in the system. The dependence of the mobility on the electric field strength and the concentration of electrons and impurities is derived. Such dependence is determined by the nonequilibrium thermodynamic state of the system, which is led to far-from equilibrium conditions by the action of intermediate to strong electric fields. It is shown that the mobility decreases with the increase of the electric field strength and the concentration of carriers, in a way evidencing the influence of the nonlinear transport involved. Dependence of the mobility with the concentration following two types of regimes characterized by exponential laws are evidenced. They can also be approximately described by fractional power laws. The influence of the thermal bath temperature is also analyzed.

PT4 - Using Matlab as a Tool for the Teaching of Nonlinear Systems in Engineering: The Case of the Inverted Pendulum

Claudio Cesar Silva Freitas, Instituto de Estudos Superiores da Amazônia, Brazil
Brehme Dnapoli Reis de Mesquita, Instituto Federal de Educação, Ciência e Tecnologia do Pará, Brazil.

Abstract. Matlab is a powerful tool in engineering education and widely used in simulation and modeling of dynamic systems. In the study of nonlinear systems, students use various algorithms and theoretical methods that require a strong mathematical background and analysis of complex graphics. This article elaborates on the use of Matlab in engineering as a way to help the study of dynamical systems using the case of the inverted pendulum.

PT5 - Multistability in Systems with Impacts

Everton Medeiros, University of São Paulo, Brazil
Silvio de Souza, Universidade Federal São João del-Rei, Campus Alto Paraopeba, Brazil
Iberê Luiz Caldas, Instituto de Física da USP, Brazil.

Abstract. The global dynamics of a weakly dissipative impact-pair system, with a large number of coexisting attractors for a fixed set of parameters, is investigated. Bifurcation diagrams, phase portraits, and basins of attraction are used to analyze the attractors onset. The observed multistability arises in the limit of weak dissipation and the observed attractors emerge from the elliptic points, identified in the phase space, obtained for the limit case of vanishing dissipation.

PT6 - Weak perturbation to control chaos in an impact oscillator

Everton Medeiros, University of São Paulo, Brazil
Silvio de Souza, Universidade Federal São João del-Rei, Campus Alto Paraopeba, Brazil
Iberê Luiz Caldas, Instituto de Física da USP, Brazil
Rene Medrano-T, Instituto de Física, Universidade de São Paulo, São Paulo, Algeria.

Abstract. We apply a weak parametric perturbation to control the chaotic dynamics of an impact oscillator. For this driven oscillator we represent in the parameter space the areas with periodic and chaotic attractors and investigate the area alterations due to the considered perturbation.

PT7 - Mono and multifractal analysis of simulated heat release fluctuations in a spark.ignition heat engine

Pedro Curto-Risso, Universidad de la Republica, Uruguay
Alejandro Medina, Antonio Calvo-Hernandez, U. de Salamanca, Spain
Lev Guzman-Vargas, Fernando Angulo-Brown, Insituto Politecncio Nacional, Mexico.

Abstract. We study data from cycle-by-cycle variations in heat release for a simulated spark-ignited engine. Our analyses are based on non linear scaling properties of heat realease fluctuations obtained from a turbulent combustion model. We apply monofractal and multifractal methods to characterize the fluctuations for several fuel-air ratio values, $\\phi$, from lean mixtures to over stoichiometric situations. The monofractal approach reveals that for lean and stoichiometric conditions fluctuations are characterized by the presence of weak anticorrelations whereas for intermediate mixtures we observe complex dynamics characterized by a crossover in the scaling exponents, for short scales the variations display positive correlations while for large scales the fluctuations are close to white noise. Moreover, a broad multifractal spectrum is observed for intermediate fuel ratio values while for high and low mixtures the fluctuations lead to a narrow spectrum

PT8 - Fractal Dimension as a Marker of Cellular Rejection in Myocardial Biopsies from Patients Submitted to Heart Transplantation

Leandro Neves, UNESP, Brazil
Moacir Godoy, FAMERP, Brazil.

Abstract. In this work it is presented an algorithm to quantify patterns of cardiac cellular rejection in myocardial biopsies from patients submitted to heart transplantation, that is based on multiscalar fractal dimension (FD). The algorithm uses a model of automatic multilevel thresholding based on maximum entropy and confidence intervals. The results were significant and allowed identify behaviors for each grade of cardiac rejection.

PT9 - Lacunarity as a Descriptor of Cellular Rejection in Myocardial Biopsies from Patients Submitted to Heart Transplantation

Leandro Neves, UNESP, Brazil
Moacir Godoy, FAMERP, Brazil.

Abstract. In this work it is presented an algorithm to quantify patterns of cardiac cellular rejection in myocardial biopsies from patients submitted to heart transplantation, which is based on Multiscalar Lacunarity (ML). The algorithm uses a model of automatic multilevel thresholding based on maximum entropy and confidence intervals. The results were significant and allowed identify behaviors for each grade of cardiac rejection.

PT10 - Detection and Alert of muscle fatigue considering surface electromyography chaotic model

Victoria Salazar Herrera, Jesus Franklin Andrade Romero, Universidade Federal do ABC, Brazil
Mauricio Améstegui Moreno, Universidad Mayor de San andrés, Brazil

Abstract. This work propose a detection and alert algorithm for muscle fatigue in paraplegic patients undergoing electrotherapy sessions by means of surface electromyographic (SEMG) signal processing. The procedure is based on a mathematical chaotic model instead of real signals and a continuous Wavelet Transform. Finally quantification of results was obtained through Total Wavelet Entropy TWE values observed during electrical stimulation. These steps allow obtaining an implementable and practical alert and detection algorithm for muscle fatigue.

PT11 - Accounting for Complexes of Nodes in a Vulnerability Assessment of Proteins in the Human DNA Damage Response Interaction Network

Noah Levine-Small, Leenoy Meshulam, Tel Aviv University, Israel
Stefano Boccaletti, Tel Aviv University and The Italian Embassy in Israel, Israel
Ari Barzilai, Eshel Ben-Jacob, Tel Aviv University, Israel.

Abstract. A cells response to DNA damage involves the chemical interaction of a large network of proteins. These signaling pathways constitute logical circuits by which the cell determines its fate and adapts to surroundings and events. We have discovered that to correctly assess the theoretical effects of mutation on the array of both inductive and repressive protein signals of the mammalian DNA damage response it is necessary to account for a proteins participation in complexes. Failure to account for the process by which sets of nodes congress to form additional nodes (protein complexes) yields a misleading approximation of a proteins importance in the network and does not predict the importance of proteins found to be significant experimentally. In light of the consideration of complex participation, we compare the veracity of node importance predictors Node Eigenvector Centrality and Node Vulnerability. We discover that changes in network efficiency upon node deletion yields a more reliable predictor of importance in that it coincides better with experimental biology.

PT12 - Dynamic Analysis Of Neural Networks

Dionis Teshler, Tel Aviv University, Israel
Johnatan Aljadeff, Tel-Aviv University, Israel.

Abstract. In recent years, computational and quantitative studies of modeled neural networks are gaining momentum. Researchers are putting to use powerful mathematical tools such as analysis of non-linear dynamics, network theory and information theory. Neuroscientists have started to make the crucial step of moving from the analysis of single cell dynamics to network dynamics, realizing that only studies of macroscopic systems can help in revealing the mechanisms responsible for the functions of the brain. Although some progress has been made, in most cases networks were studied using simplistic models that cannot give rise to the complex biological reality. Experiments and theoretical work done by our collaborators and us suggest that current models for neural networks are not detailed enough to produce an accurate fit with biology.

PT13 - Dynamics of comportamental epidemic models with saturated treatment and prophlaxis functions

Andres Finkelsteyn, CITEDEF, Argentina.

Abstract. Two compartmental epidemic models with treatment and prophylaxis are proposed. Both models have saturated rates due to logistical constraints, such as a finite stockpile of antiviral drugs and a limited distribution capacity. It is found that a backward bifurcation occurs under certain conditions. The results suggest that decreasing the basic reproduction number is insufficient for epidemic control. However, these models can provide conditions for having lower attack rates.

PT14 - On a Asymptotic Behaviour of the Solution for a Stochastic Coupled System of Reaction-Difusion of Nonlocal Type

Jorge Ferreira, Federal University Rural of Pernambuco, Brazil
Edson Coayla, Federal University of Bahia, Brazil
Paulo Gonçalves, Federal University of Ouro Preto, Brazil.

Abstract. In this article we investigate the existence and uniqueness of the strong solutions for a stochastic nonlinear parabolic coupled system of reaction-difusion of nonlocal type with multiplicative white noise. We improve the results obtained by Coayla-Ferreira-Magalhes for coupled systems. We prove the existence and uniqueness of strong solutions by the classic Faedo-Galerkin method, Itô formula and some technical ideas. An important result on the asymptotic behaviour of solution is presented.

PT15 - Multiscale entropy analysis of spontaneous blinking time series

Denny Garcia, School of Medicine of Ribeirão Preto / USP, Brazil
Carolina Pinto, Antonio Augusto Cruz, Universidade de São Paulo, Brazil.

Abstract. We compare the complexity of spontaneous blinking of healthy subjects and Graves orbitopathy patients. Using multiscale entropy algorithm which may provides a way to measure complexity over a range of scales, we observe no difference between groups on both time series analyzed, interblink intervals and amplitude. This finding leads to the conclusion that Graves'' orbitopathy doesn''t interfere the central control of spontaneous blinking.

PT16 - Periodic Quantum Walks

Thomas Bartlett, Federal University of Rio Grande do Sul, Brazil.

Abstract. In the Quantum Physics, the Quantum Walk is a model to a large number of settings in Quantum Information and in Solid State Physics [1]. One can think this model as a photon spreading in a linear crystal. The behavior of this photon in a homogeneous crystal is already known, but a lot of questions still remain in the inhomogeneous crystals [2 , 3]. Using a method created by Grimmett Janson Scudo [4], it is possible to prove the ballistic behavior of a periodic lattice and the probability density in the period two. The sketches of these proofs and perspectives of this model are presented in this poster.

PT17 - Cellular automata with inertia

Klaus Kramer, Marcos Gomes EleutÃ©rio da Luz, Marlus Koehler, UFPR, Brazil.

Abstract. Since cellular automata (CA) were created, they have been widely used in several areas of knowledge because they are systems that are easily and simply implemented in computers. In general, CA are made up of cell networks in which each cell assumes a numerical value that determines its state. Time is discrete and the state of each cell in a later period depends on the state of its neighbors in the previous period. The relation between these states is established by means of a specific dynamic rule (the updating rule). There are thousands of different rules for CA. In this study we will use a simple rule by which the state of a cell in time t+1 depends on the sum of the states of its neighbors in time t. We considered three states of which two (+1,-1) are active and compete dynamically, while one is passive (zero). We also defined an "internal state", the inertia, which is an original contribution in this work. This inertia, which can vary from zero to the maximum number of neighbors, gives to each cell the value of its resistance to changes in its state. The update rule says that the state of each cell will change its state if the value of inertia is less than the absolute value of sum of the neighbors of each cell, if is greater than zero, the state of the cell will not change. For the case which the state will change (absolute value of the sum is greater than the inertia), the change happen of this way: the state of the cell will change for +1 if the sum of its neighbors is greater than zero, for -1, if the sum is less than zero, and if the sum is equal to zero, the state of each cell will not change. We use a two-dimensional CA, and discuss how this inertia changes the dynamic properties. We study different aspects of this model, populations of the final configurations, convergence times. Generally, we find that the inertia can change quite significantly the dynamics and typical average behavior of the same CA.

PT18 - Pattern formation and non-local interaction: continuous versus discrete models

Daniel Escaff, Universidad de Los Andes, Chile.

Abstract. We present a discrete cellular automata model for population dynamics interaction. We consider competitive and cooperative interaction between individuals in a non-local way (i.e. interaction with distant neighbors). It is shown that the system exhibits pattern formation through an intermittence transition. To wit, a chaotic state begins to display burst of a spatially coherent structure. A comparison with pattern formation exhibited by continuous models is carried out.

PT19 - Model for neural signaling leap statistics

Martine Chevrollier, Universidade Federal da Paraiba, Brazil
Marcos Oriá, Universidade Federal da Paraíba, Brazil.

Abstract. We present a simple model for neural signaling leaps in the brain considering only the thermodynamic (Nernst) potential in neuron cells and the brain temperature. We numerically simulate connections between arbitrary localized neurons and analyze the frequency distribution of the reached distances. We observe a qualitative changing

between Normal statistics (with T=37 C, awaken regime) and Lévy statistics (T=35 C, sleeping period), characterized by rare events of long range connections.

PT20 - An evolutionay approach to the search for periodic and chaotic oscillations in Hodgkin-Huxley model

Diogo Soriano, University of Campinas, Brazil
Ricardo Suyama, UFABC, Brazil
Romis Attux, Universidade Estadual de Campinas, Brazil
João Romano, UNICAMP, Brazil.

Abstract. This work presents an analysis of the original Hodgkin-Huxley (HH) model in a non-smooth (rectangular pulses) excitation scenario and also a method to search for specific oscillating patterns in this dynamical system. The analysis is based on a classical qualitative method given by the bifurcation diagram and on the calculation of the system Lyapunov spectrum. This calculation was carried out by means of a modified algorithm particularly suited to deal with the non-smoothness and complexity of the state equations. The obtained Lyapunov exponents are then used to build a cost function for seeking pre-defined dynamical patterns that is optimized using the particle swarm optimization algorithm.

PT21 - Excitable Electronic Circuit as a Sensory Neuron Model

Bruno Medeiros, Universidade Federal de Pernambuco, Brazil
Mauro Copelli, UFPE, Brazil
Gabriel Mindlin, Universidad de Buenos Aires, Argentina.

Abstract. According to recent works in statistical physics, enhanced dynamic range in sensory systems can emerge as a collective phenomenon of many excitable elements, each of which with small dynamic range. This effect would allow the construction of high sensibility sensors, made of simple components. This work proposes a simple excitable electronic circuit as a basic element in the construction of a high sensibility electronic sensor.

PT22 - Pseudo-Anticipated Synchronization in a Biologically Plausible Model of a Ubiquitous Neuronal Motif

Fernanda Matias, Universidade Federal de Pernambuco, Brazil
Mauro Copelli, UFPE, Brazil
Claudio Mirasso, Universitat des Illes Balears, Spain.

Abstract. Two identical dynamical systems coupled in a master-slave configuration can exhibit anticipated synchronization if the slave also receives a delayed negative self-feedback. A recent series of papers have extended these results to a setup in which the dynamical system is nonautonomous (e.g. fed by noise) and models an excitable neuron (FitzHugh-Nagumo or Hodgkin-Huxley model). The fact that anticipated synchronization is verified also in this scenario opens new possibilities in neuronal modeling, specially regarding the bearing of collective dynamical phenomena on plasticity. The last decades

have witnessed a growing literature on spike-timing dependent plasticity (STDP), which acounts for the enhancement or diminution of synaptic weight [respectively long term potentiation (LTP) and long term depression (LTD)] depending on the relative timing between the spikes of the pre- and post-synaptic neurons. Experimental data strongly suggest that if the pre-synaptic neuron fires before (after) the post-synaptic neuron, the synapse between them will be strenghtened (weakened). The idea is that if anticipated synchronization leads to an inversion in the timing of the pre- and post-synaptic spikes, then by appropriately controlling this effect one could dynamically toggle between synaptic strengthening and weakening. This could be potentially linked with modelling of large-scale ascending feedback modulation from reward systems.

PT23 - Modelling immunisation against cytomegalovirus infection

Raymundo Azevedo, Marcos Amaku, Universidade de Sao Paulo, Brazil.

Abstract. Cytomegalovirus (CMV) infection may be the cause of mental retardation and deaf in newborns, infectious mononucleosis syndrome in young adults, and a threat for immunosupressed individuals. CMV infection presents distinct phases of transmission with a different age-dependence from other direct transmitted viral diseases. Seroprevalence data from CMV high incidence communities revealed that CMV infection occurs initially during the first three years of life, stabilizing until the beginning of adolescence, when seroprevalence increases again until everyone is seropositive after 30 years of age [1]. These observations suggest that the age-dependent force of infection, defined as the per capita rate at which susceptible individuals acquire infection, may be represented by a bimodal pattern. The increase in seroprevalence among teenagers may be related to sexual activity [2]. Thus, immunization strategies should consider infants and teenagers whenever the CMV vaccine is to be firstly introduced in a population. Human cytomegalovirus vaccines were tested revealing promising results, although efficacy is around 50% [3]. We have developed a mathematical model for CMV dynamics to evaluate the impact of vaccination in congenital cases and infection among individuals, estimating an age-dependent force of infection from seroprevalence data, and analysing the effects of different scenarios, departing from the current vaccine characteristics, varying age of vaccination, immunity waning and vaccine efficacy [4]. The model proposed has five variables dependent of age: proportion of susceptible, harbouring and incubating, infected, latent and vaccinated individuals. Our results pointed out that the optimal age for a single vaccination interval is from 2 to 6 months if there is no immunity waning. Congenital infection may increase if vaccine induced immunity wanes before 20 years. Thus, the best vaccination strategy is a combined scheduled: before one year of age plus a second dose at 10-11 years. Therefore, revaccination should be considered in the immunization calendar. References [1] L. N. B. Almeida, R. S. Azevedo, M. Amaku, E. Massad. Cytomegalovirus seroepidemiology in an urban community of São Paulo, Brazil. Rev Saude Publica Vol. 35, No. 2, pp. 124-129, 2001. [2] D. Coonrod, A. C. Collier, R. Ashley, T. DeRouen, L. Corey. Association between cytomegalovirus seroconversion and upper genital tract infection among women attending a sexually transmitted disease clinic: a prospective study. J. Infect. Dis. Vol.

177, pp. 1188-1193, 1998. [3] R. F. Pass, C. P. Zhang, A. Evans, T. Simpson, W. Andrews, M. L. Huang, L. Corey, J. Hill, E. Davis, C. Flanigan, G. Cloud. Vaccine prevention of maternal cytomegalovirus infection. N. Engl. J. Med. Vol. 360, No. 12, pp. 1191-1199, 2009. [4] R. S. Azevedo, M. Amaku. Modelling immunisation strategies with cytomegalovirus vaccine candidates. Not published.

PT24 - Modelling vaccination against bovine brucellosis

Marcos Amaku, Ricardo Dias, José Ferreira-Neto, Fernando Ferreira, Universidade de Sao Paulo, Brazil.

Abstract. Female bovines, due to their important role in the transmission and maintenance of brucellosis, were the target of the serological surveys of the Brazilian Program to Control and Eradicate Bovine Brucellosis and Tuberculosis. Based on information obtained in Brazilian states where the serological surveys were carried out and prevalences higher than 2% were observed, we have developed a compartmental model to simulate the dynamics of brucellosis in herds of female bovines, to analyse the effects of vaccination strategies. The model assumptions were: routine vaccination scheme; no vaccinated animals at time $t = 0$; homogeneous mixing for the transmission of brucellosis; and vaccination of newborn calves. The following results were observed: a) for low vaccination coverage (around 30%), the time to reduce the prevalence to 2%, adopted as a reference, may be long, approximately twice as long as the time observed for a higher coverage (90%); b) the time to reduce the prevalence to levels of 1% or 2%, adequate to start the eradication phase, may reach a decade; c) a high proportion of vaccinated females in calf-bearing age is reached after approximately 10 years of vaccination, because only newborns are vaccinated. We therefore recommend an intensification of the effort to vaccinate females, aiming at attaining high vaccination coverages. In addition, vaccination of adult animals (using, for instance, a rough Brucella abortus strain RB51 vaccine) may reduce the prevalence faster than observed in our simulations.

PT25 - Controlling the interaction between sugarcane borer and its parasitoid

Marat Rafikov, UFABC, Brazil.

Abstract. The increase in world demand for ethanol will bring an increase of the sugarcane planted in Brazil. One of challenges of the improvements in the farming and harvesting of cane is the biological pest control. Biological control is the use of living organisms to suppress pest populations, making them less abundant and thus less damaging than they would otherwise be. In this paper we consider the hostparasitoid relations between the sugarcane borer (Diatraea saccharalis) and its parasitoid. The nonlinear feedback control problem for nonlinear systems has been formulated in order to obtain the optimal pest control strategy only through the introduction of natural enemies. Numerical simulations for possible scenarios of biological pest control based on the LotkaVolterra models are provided to show the effectiveness of this method.

PT26 - A Discrete SIRS Model with Kicked Infection Probability

Luigi Renna, University of Salento, Italy, Italy.

Abstract. We propose a discrete-time version of a SIRS model which exhibits oscillations. We assumed both constant and variable population size (logistic) and seasonal variability introduced by means of a sequence of kicks, which change periodically the infection probability. The model accounts for the periodicity observed in the real epidemic diseases.

PT27 - Evolution and drug resistance: a computational study

Leonardo Maia, IFSC-USP University of Sao Paulo, Brazil.

Abstract. Evolution and drug resistance: a computational study I will describe the results of stochastic simulations of an idealized population of microorganisms subject to four types of mutations (deleterious, beneficial, resistance-activating and mutator-activating) and to the eventual introduction of a drug that kills every nonresistant strain. The first two kinds of mutation are usually studied in population dynamics research and directly affect fitness of individuals. The mutator-activating mutations activate idealized mutator alleles that increase the genomic mutation rate (on which depend all mutation rates) of their owners. There is also a carrying capacity to keep bounded the population size, since, depending on its fitness, each strain leaves a Poisson-distributed number of descendents to the next generation, what could lead to explosive growth. This model was originally described in "PJ Gerrish, JG Garcia-Lerma, Lancet Infect Dis 2003; 3: 28-32" and displays nontrivial dynamics. That authors described preliminary results that, under specific conditions, revealed mutator enrichment (i.e., an increase of relative frequency of mutator alleles) at the moment of drug introduction and suggested this could be related to efficient pathogen suppression, but promised further study to confirm this hypothesis and to systematically search for optimal control strategies. To the best of my knowledge, they never did such research and that is the aim of this work. Some of my results seem to be at odds with that article. I kept detailed records of dynamical characteristics of the populations not described in the original work that help understanding the phenomenon of mutator enrichment and searching for optimal pathogen suppression strategies. Besides that, by exploiting the flexibility of the computational model, I also studied the effects of horizontal transmission (in contrast with the vertical one, defined by heredity) and of some alternative dynamics.

PT28 - Solution for anomalous diffusion equation with source term

Marcelo Araujo, São Paulo State University, Brazil.

Abstract. In literature the phenomenon of diffusion has been widely studied, however for non-extensive systems which are governed by a stochastic nonlinear dynamics, there are few soluble models. The purpose of this paper is to present the solution of the non-linear Fokker-Planck equation for a model of potential with barrier considering a term of

absorption. Systems of this nature can be observed in various chemical or biological process and its solution enriches the studies of non-extensive systems exist.

PT29 - Dynamical Systems Analysis of a Cortical Neuron Model

Diogo Vieira, University of São Paulo, Brazil
Rodrigo Oliveira, George Mason University, USA
Antonio Roque, , Brazil.

Abstract. Neocortical neurons can be classified according to their electrophysiological properties into different cell classes. Here we show a reduced compartmental model of the fast repetitive bursting cell class and characterize its bursting dynamics using fast/slow analysis. We also show via a two-parameter sensitivity analysis a closed region in parameter space where bursting behavior is found.

PT30 - Upper and Lower solutions for fourth nonlinear boundary value problem

El-Haffaf Amir, University of Oran.Algeria, Algeria.

Abstract. We study the existence of a solution for: x""=f(t,x,x",x"")=0 x(0)=x"(0)=0 ; x"(1)=x""(1)=0

PT31 - Studying the topological stability of the $\lambda\Phi^4$ kink.

Hernan Piragua-Ariza, University of Campinas, Brazil.

Abstract. The lambda-phi4 kink is linearly and topologically stable. We study how extra energy perturbations are dissipated beyond the linear regime. We found that depending on the width, amplitude and energy of a Gaussian perturbation different scenarios are possible: radiation, oscillons creation, kink anti-kink pairs production and shock waves.

PT32 - Mathematical modeling and numerical simulations of a constrained double pendulum

Eduardo Mazzutti, Universidade Federal do ABC, Brazil
André Fenili, UFABC, Brazil.

Abstract. Mathematical modeling is very important in the study of the dynamic behavior of real systems. In this context, investigations on constrained systems have a wide range of applications in dealing with systems that interact with its environment. The objective of this study is the mathematical modeling of a double pendulum interacting with a mass-spring system. In the numerical simulation presented here is also possible to observe the intensity of the contact force.

PT33 - Influence of energy changes in breathers

Gabriel Slade, UNESP, Brazil.

Abstract. This work studies the dynamical behavior of breathers under the influence of energy changes. To create the breather we used the anti-continuous limit and studied its stability through the Floquet theory. Using the information entropy we calculated the effective number of oscillators with significant energy and determined if there is or not the formation of a spatially localized structure.

PT34 - Comparison between linear and nonlinear control for the double pendulum using the minimum energy criterion

Marcus Vinicius Bianchi dos Santos, Universidade Federal do ABC, Brazil
André Fenili, UFABC, Brazil.

Abstract. Control theory has been largely used in many different applications in engineering (control of temperature, aircraft stability,). This paper presents a comparison between a linear and a nonlinear control technique: LQR (Linear Quadratic Regulator) and nonlinear feedback or Computed Torque Control (CTC) respectively. The nonlinear system to be controlled is a robotic manipulator with two rigid links [3]. According to the numerical simulations, the application of linear control in a nonlinear plant like the one investigated here really limits the operation of the plant. The nonlinear law proposed applies better. The analysis of the control laws is done using a minimum energy criterion.

PT35 - Periodic, Chaotic, and Hyperchaotic States in Parameter-Spaces of a Four-Dimensional Chuas System

Cristiane Stegemann, Holokx Albuquerque, Paulo Rech, Universidade do Estado de Santa Catarina, Brazil.

Abstract. This work is a study of the hyperchaotic behavior present in a four-dimensional Chua''s circuit model with cubic nonlinearity. In this study we carry out numerical integration and evaluate the Lyapunov spectrum of the system model. We construct colorful parameter spaces with the first and the second positive Lyapunov exponent to show the periodic, chaotic, and hyperchaotic behaviors.

PT36 - Extreme fractal structures in chaotic mechanical systems: riddled basins of attraction

Sabrina Camargo, University of São Paulo, Brazil
Sergio Lopes, Ricardo Viana, Universidade Federal do Parana, Brazil.

Abstract. Riddling is an intrinsic phenomenon of dynamical systems which fulfill specific conditions and leads to basins of attraction that never exhibit a disk in the phase space. We say that a dynamical system has a chaotic attractor whose basin of attraction is riddled with "holes" belonging to the basin of another (non necessarily chaotic) attractor. Riddling means that every point in the basin of attraction of attractor A has pieces of the basin of attraction of attractor B arbitrarily nearby. Physical consequences can be very

serious in terms of predicting the final state of a given initial condition in a system which presents riddled basins

PT37 - Improving the forecasting capabilities in time series analysis

Henrique Carli, Luiz Guilherme Duarte, Luis Antônio da Mota, UERJ - Universidade do Estado do Rio de Janeiro, Brazil.

Abstract. For any observed system, physical or otherwise, one generally wishes to make predictions on its future evolution. Sometimes, very little is known about the system. If a time series is the only source of information on the system, prediction of the future values of the series requires a modelling of the system''s (perhaps nonlinear) dynamical law. In particular, one is interested on the forecasting capabilities of the global approach to time series analysis. This can be a very complex and computationaly expensive procedure. So, there is a clear demand for procedures that can, without increasing the degree of the global mapping, enhance the accuracy of such mappings.

PT38 - High Resolution parameter spaces for a forced Chua's Circuit

Emilson Ribeiro Viana Junior, Universidade Federal de Minas Gerais (UFMG), Brazil
Rero Marques Rubinger, Universidade Federal de Itajubá (UNIFEI), Brazil
Holokx Albuquerque, Universidade do Estado de Santa Catarina, Brazil
Alfredo Gontijo de Oliveira, Geraldo Mathias Ribeiro, Universidade Federal de Minas Gerais (UFMG), Brazil.

Abstract. The interest in codimension-two bifurcations in flows, when we vary simultaneously two of the systems parameters, have grown substantially in last years. This is due to the observation of complex periodic structures, immersed in chaotic regions, until recently just observed in discrete time maps. More recently, some works reported the existence of those periodic structures inside the chaotic phases in some systems described by continuous-time models. Regarding experimental data, few works reported those structures in two-dimensional parameter spaces with low-resolution. Therefore, the aim of this work is to report two high-resolution experimental parameter space for a chaotic circuit, in this case, a Chua´s Circuit. The Chua´s Circuit is forced by a voltage source d.c., in series with the Chua´s Diode. Such resolution in the parameter spaces was propitiated by the use of a 0.5 mV step d.c. voltage source as the new control parameter. The voltage Vdc change the equilibrium points, defined by the intersection of the "line charge" and the Chua´s I(V) curve. The voltage d.c. shifts the "line charge" vertically in the coordinated axe of this I(V) curve and the resistance R, present in the Chua´s Circuit, change the slope (-1/R) of the "line change". So we have different intersections points for different control parameters (Vdc,R). The two high-resolution codimension-two parameter-spaces presented in this work, one for the periodicity and one for the largest Lyapunov Exponent, show abundance of complex periodic structures. Those complex periodic structures organize themselves in a period-adding bifurcation cascade, as (period-2)-(chaos)-(period-3)-(chaos)-(period-4)- and so on ... , that accumulates in the chaotic region, for Vdc = 0.0000 V. Numerical investigations on the dynamical model of this forced circuit were also carried out to corroborate several new

features observed in those experimental high-resolution parameter-space. This forced circuit consists in a platform for the study of this intricate periodic networks formed by periodic self-similar structures surrounded by chaotic phases. Regarding chaos based communication systems, the knowledge of what exactly is embedded in the regions of chaos, in dynamical systems, is an important question since clean and extended domains of chaos are important for applications in secure communications.

PT39 - Biparametric Investigation of the Phase Space Structures of the General Standard Map in Dissipative Regime

Priscilla Silva, Intituto Tecnológico de Aeronáutica, Brazil
Maísa de Oliveira Terra, ITA, Brazil.

Abstract. Dynamics Days South America - 2010: extended abstract to be submitted as paper according to instructions.

PT40 - Generalizing The Logistic Map Through The q-Product

Robson Pessoa, Ernesto Borges, Universidade Federal da Bahia, Brazil.

Abstract. We investigate a generalization of the logistic map as $ x_{n+1}=1-ax_{n}\\otimes_{q_{map}} x_{n}$ ($-1 \\le x_{n} \\le 1$, $0

PT41 - Neural networks for emulation variational method for data assimilation in nonlinear dynamics

Helaine Furtado, INPE, Brazil
Haroldo Campos Velho, Elbert E. N. Macau, Instituto Nacional de Pesquisas Espaciais, Brazil.

Abstract. Description of a physical phenomenon through differential equations presents errors involved, since the mathematical model is always an approximation of reality. For an operational prediction system, one strategy to improve the prediction is to add some information from the real dynamics into mathematical model. This aditional information consists of observations on the phenomenon. However, the observational data insertion should be done carefully, for avoiding a worse performance of the prediction.

Poster Session (PT_2)

PT42 - The Use the Flyby for Optimal Solutions

Denilson Paulo Santos, Antonio Prado, INPE, Brazil.

Abstract. The spacecraft propulsion system have passed for diverse evolutions, leaving combustion engines and arriving at ion propulsion. The necessity of more efficient rockets stimulated the research in this scope. In this work ΔV will be analyzed proceeding from an electric propellant acting in set with gravitational maneuvers. The optimization of maneuvers will be approached in interplanetary missions using solar electric propulsion and Gravity Assisted Maneuver attended to reduce the costs of the mission. The high

specific impulse of electric propulsion makes a Gravity Assisted Maneuver 1 year after departure convenient. Missions for several Near Earth Asteroids will be considered. The analysis suggests criteria for the definition of initial solutions demanded for the process of optimization of trajectories.

PT43 - Symmetry breaking effects in escape basin analysis

Sheila Assis, Instituto Tecnoçógico de Aeronáutica, Brazil
Maísa de Oliveira Terra, ITA, Brazil.

Abstract. Dynamics Days South America - 2010: extended abstract to be submitted according to instructions.

PT44 - Pre-Inflationary Oscillations of FRW Universes: Non-Linear Dynamics about Saddle-Center Points

Germano Amaral Monerat, Universidade do Estado do Rio de Janeiro, Brazil
Gil de Oliveira Neto, Universidade Federal de Juiz de Fora, Brazil
Eduardo Vasquez Corrêa Silva, Luiz Gonzaga Ferreira Filho, Universidade do Estado do Rio de Janeiro, Brazil.

Abstract. Successive phases of expansions and contractions of the Universe before its inflationary phase are described by the dynamics of Friedmann-Robertson-Walker (FRW) models with perfect fluid and scalar field non-minimally coupled to gravitation, in the non-linear neighborhood of a saddle-center fixed point.

PT45 - Magnetic field line escape: Comparison with mean free path

Caroline Martins, UNESP, Brazil
Marisa Roberto, ITA, Brazil
Iberê Luis Caldas, USP Instituto de Física, Brazil
Ricardo Egydio de Carvalho, Unesp/Rio Calro, Brazil.

Abstract. Plasma-wall interaction is one of the critical issues for development of an energy source based on nuclear fusion. Reversed magnetic shear in tokamaks improves the plasma confinement due to the formation of internal transport barriers. In this work, the length connection from a reversed field line is estimated and compared with the electron-ion collision mean free path. Magnetic surfaces are destroyed by resonant perturbations caused by an ergodic magnetic limiter. Recent work has shown that the connection length is comparable to the mean free path for tokamaks with divertors.

PT46 - Fully nonlinear maps and regular acceleration in magnetized relativistic systems

Meirielen Sousa, Fernanda Steffens, Universidade Mackenzie, Brazil
Renato Pakter, IF UFRGS, Brazil
Felipe Rizzato, UFRGS, Brazil.

Abstract. We develop and investigate a kicked model for the interaction of relativistic particles and electrostatic waves of arbitrary amplitudes, under the action of external magnetic fields. The model is adequate for physical settings where pulsed waves are employed, and allows a discrete map to be exactly obtained. In contrast to the standard case, the present map is nonlinear in the wave amplitude and displays a series of peculiar properties. Among these properties we discuss the relation involving fixed points of the maps and accelerator regimes.

PT47 - Numerically Induced Chaos as a Consequence of Reduced Descriptions of the Nonlinear Schroedinger Equation

Glaucius de Oliveira, Universidade Federal de Mato Grosso do Sul, Brazil.

Abstract. Usually numerically induced chaos in the Nonlinear Schroedinger Equation (NLS) is understood in terms of its homoclinic structure. We offer an alternative approach, where chaos is seen as a consequence of a reduced description of the NLS model.

PT48 - Kicked Hall Systems: Generic Super-Weak Chaos on a Universal Stochastic Web

Itzhack Dana, Moti Ben-Harush, Bar-Ilan University, Israel.

Abstract. \\documentclass[aps,pre,twocolumn]{revtex4-1} \\usepackage{amssymb,amsmath,amsthm} \\usepackage[dvips]{graphicx} \\usepackage{verbatim} \\setcounter{MaxMatrixCols}{10} \\begin{document} \\title{KICKED HALL SYSTEMS: GENERIC SUPER-WEAK CHAOS ON A UNIVERSAL STOCHASTIC WEB} \\author{\\textit{Moti Ben-Harush^{1}, \\underbar{Itzhack Dana}^{2}}\\\\ {\\ }\\\\ %\\affiliation{ \\fontsize{9pt}{10pt} \\textrm{^{1}Department of Physics, Bar-Ilan University, Ramat-Gan 52900, Israel, chaya992@gmail.com\\\\ ^{2}Department of Physics, Bar-Ilan University, Ramat-Gan 52900, Israel, dana@mail.biu.ac.il}} \\fontsize{10pt}{10pt} \\begin{abstract} %\\bigskip %\\maketitle \\noindent \\textbf{Keywords:} Chaos in Hamiltonian Systems, Kicked Hall Systems, Super-Weak Chaos, Stochastic Webs, Ballistic Motion. \\end{abstract} \\maketitle \\noindent A new realistic Hamiltonian system is introduced, the {\\bf \\em \\textquotedblleft kicked Hall system\\textquotedblright }. This is a charged particle in a uniform magnetic field (in the z-direction) and in a uniform electric field (in the y-direction), periodically $\\delta$-kicked in time by a cosine potential with strength K in the x-direction. The electric-field strength is measured by a dimensionless parameter $\\beta $. In the absence of an electric field ($\\beta =0$) and under certain resonance conditions (e.g., precisely four kicks in one cyclotron period, as assumed in this work), it is well known [1,2] that the system exhibits a \\emph{global} (unbounded) chaotic diffusion in the velocity plane for \\emph{arbitrarily weak chaos} (i.e., arbitrarily small K). This diffusion takes place on a \\emph{stochastic web} [1] with square symmetry. The web structure and the diffusion rate \\emph{strongly} depend on the value of a \\emph{conserved} coordinate $x_{\\mathrm{c}}$ of the cyclotron orbit center [2-6]. In particular, for $K\\ll 1$ and for very special values of $x_{\\mathrm{c}}$, the web thickness and the diffusion rate are \\emph{much smaller} than those for generic $x_{\\mathrm{c}}$ [4-6]. This phenomenon was first discovered as a classical fingerprint of the \\emph{quantum antiresonance} in the $\\beta =0$ system [4,5]. We shall refer to this rare

phenomenon for $\\beta =0$ as {\\bf \\em ``super-weak chaos''}.\\newline For $\\beta \\neq 0$, $x_{\\mathrm{c}}$ is not conserved but vary linearly in time (Hall effect). We derive, for generic rational values of $\\beta /(2\\pi)$, an exact expression of the effective integrable Hamiltonian $H_{\\rm eff}$ for the system up to (and including) second order in K; this Hamiltonian describes in an average sense the basic phase-space structure in the weak-chaos regime. We find that, except of essentially just two rational values of $\\beta /(2\\pi)$, the first-order term of $H_{\\rm eff}$ \\emph{always vanishes} while the second-order term is \\emph{always independent} on the initial value $x_{ \\mathrm{c}}^{(0)}$ of $x_{\\mathrm{c}}$, leading to a stochastic web with a simple \\emph{``universal''} web skeleton. As in work [6] (for $\\beta =0$), the vanishing of the first-order term of $H_{\\rm eff}$ precisely implies super-weak chaos which, however, now occurs on the universal web skeleton in a \\emph{much more generic} fashion that in the $\\beta =0$ case.\\newline For the two exceptional rational values of $\\beta /(2\\pi)$, the leading-order term of $H_{\\rm eff}$ is either linear or quadratic in K and \\emph{depends} on $x_{\\mathrm{c}}^{(0)}$. We show that this term implies in both cases \\emph{ballistic motion} in velocity for generic $x_{\\mathrm{c}}^{(0)}$, with a stochastic web arising only for special \\textquotedblleft critical\\textquotedblright\\ values $x_{\\mathrm{cc}}^{(0)}$ of $x_{\\mathrm{c}}^{(0)}$. The ballistic-transport rate vanishes like $|x_{ \\mathrm{c}}^{(0)}-x_{\\mathrm{cc}}^{(0)}|$ as $x_{\\mathrm{c}}^{(0)}$ approaches $x_{\\mathrm{cc}}^{(0)}$.\\newline These results suggest that quantum antiresonance should arise in quantized kicked Hall systems under much more generic conditions than in the $\\beta =0$ case, considered in works [4,5]. It would be also very interesting to study the quantum manifestations of the coexistence of ballistic motion and stochastic webs in the two exceptional rational values of $\\beta /(2\\pi)$.\\newline It should be remarked that the kicked Hall system is completely equivalent to a kicked harmonic oscillator with a \\emph{modulated} kicking potential. The quantized ordinary kicked harmonic oscillator was experimentally realized using atom-optics techniques with Bose-Einstein condensates [7]. Thus, the quantized kicked Hall system, with all its expected new quantum-chaos phenomena, should be experimentally realizable in a similar fashion. Such an experimental realization of the expected new phenomena is most interesting and important for the field of atom optics [8].\\newline \\fontsize{8pt}{8pt}
\\noindent \\textbf{References} \\vskip 6pt \\fontsize{8pt}{8pt} \\rm{\\noindent [1] G.M. Zaslavskii, M.Yu. Zakharov, R.Z. Sagdeev, D.A. Usikov, and A.A. Chernikov, Sov. Phys. JETP {\\bf 64}, 294 (1986).} \\vskip 6pt \\noindent [2] I. Dana and M. Amit, Phys. Rev. E, {\\bf 51}, R2731 (1995). \\vskip 6pt \\noindent [3] I. Dana and T. Horesh, Lecture Notes in Physics {\\bf 511}, 51 (1998). \\vskip 6pt \\noindent [4] I. Dana, Phys. Rev. Lett. {\\bf 73}, 1609 (1994). \\vskip 6pt \\noindent [5] I. Dana and D.L. Dorofeev, Phys. Rev. E {\\bf 72}, 046205 (2005). \\vskip 6pt \\noindent [6] S. Pekarsky and V. Rom-Kedar, Phys. Lett. A {\\bf 225}, 274 (1997). \\vskip 6pt \\noindent [7] G.J. Duffy, A.S. Mellish, K.J. Challis, and A.C. Wilson, Phys. Rev. A \\textbf{70}, 041602(R) (2004). \\vskip 6pt \\noindent [8] C.S. Adams, M. Sigel, and J. Mlynek, Phys. Rep. {\\bf 240}, 143 (1994). \\end{document}

PT49 - Describing a phase transition in the dynamics of a particle moving in a time-dependent potential

Diogo Costa, Mário Silva, UNESP - Campus de Rio Claro, Brazil
Juliano de Oliveira, UNESP-IGCE, Brazil
Edson Denis Leonel, Universidade Estadual Paulista, Brazil.

Abstract. Some dynamical properties for a classical particle confined in an infinitely deep box of potential containing a periodically oscillating square well are studied. The dynamics of the system is described by a two dimensional non-linear area preserving mapping for the variables energy and time. The phase space is mixed and the chaotic sea is described using scaling arguments. Thus, critical exponents are obtained near a transition from integrability to non-integrability. The formalism is robust and can be extent to many different kinds of mappings.

PT50 - Properties of a Arithmetic Code for Geodesic Flows

Daniel Chaves, UNICAMP, Brazil.

Abstract. The knowledge of the properties of a set of code sequences is a first step in the study of the characteristics of a code. With the purpose of applying the geometric and algebraic properties of the hyperbolic manifolds to analyze dynamical systems, through the symbolic sequences that code the geodesics of a hyperbolic manyfold, we determine two characteristics of the set of symbolic sequences.

PT51 - Intrinsic stickiness in open integrable billiards: border effects

Marcelo Silva Custódio, Universidade Federal do Paraná, Brazil
Marcus Beims, Federal University of Parana, Brazil.

Abstract. Rounding border effects at the escape point in the rectangular billiard are analyzed via the escape times statistics and emission angles. The escape point of the billiard is assumed to have a semicircular form and generates stickiness and self-similar structures for the escape times and emission angles inside backgammon like stripes. These stripes are born at the boundary between two different emission angles and are related to Arnold tongues. As the rounding effects increase, backgammon stripes start to overlap and the escape times statistics obeys the power law decay and anomalous diffusion is expected. We show that tiny rounded borders (around 0.1% from the whole billiard) are enough to generate sticky motion. For larger rounded borders the escape times dynamics becomes chaotic.

PT52 - Ratchet current in the Tokamap with mixed phase space

Adriane Schelin, University of Sao Paulo, Brazil
Iberê Luis Caldas, USP Instituto de Física, Brazil
Karl H. Spatschek, Heinrich-Heine-Universität Düsseldorf, Germany.

Abstract. Based on the tokamap, we investigate characteristic features of magnetic field lines and zeroth-order guiding-center particle motion in the whole body of a magnetically

confined plasma, e.g. a tokamak plasma. We show that the tokamap exhibits a poloidal transport that can be regarded as a Hamiltonian ratchet. The observed mean velocity is in agreement with the value predicted by the so-called sum rule for Hamiltonian ratchet currents.

PT53 - Chaotic Transport in Plasmas with Magnetic Shear

Wilson Luiz Façanha, University of São Paulo - Institute of Physics, Brazil
Iberê Luiz Caldas, Instituto de Física da USP, Brazil.

Abstract. An important problem in the study of plasma confinement in tokamaks is the anomalous particle transport that occur as a result of drift waves in the plasma edge. This effect can be explained by the chaotic particle transport. The influence of the eletric field profiles in the formation of convective cells and transport barriers due to nonlinear interactions between the poloidal flow and the resonant waves are studied by means of an Hamiltonian model. The model consists of an equilibrium eletrostatic potential and an equilibrium magnetic field ({\\it B_{\\varphi}} and {\\it B_{\\theta}}) perturbed by two drift waves of different wave numbers. Sheared flows and the magnetic shear also plays an important role on the chaotic particle transport and we show results for the transport with and without the magnetic shear. Using a set of canonical transformations it is possible to obtain simplified equations of motion in the form of action-angle variables and, using those equations, we can obtain area-preserving Poincaré maps which we use to study the particle transport.

PT54 - Shadowing of Trajectories in the Standard Map

Sandro Pinto, State University of Ponta Grossa, Brazil
Samyr Abdulack, Universidade Estadual de Ponta Grossa, Brazil.

Abstract. Standard map belongs to a class of important dynamical systems called Hamiltonian systems. They present the important feature of conservation of volume in phase space. In particular, phase space of standard map do not present hyperbolic structure. In this way, we study the question about validity of numerical solutions in this system. To accomplish this, we study unstable periodic orbits and manifolds in standard map in order to know where tangencies ocurr making the glitches possible.

PT55 - Characterising the common behavior close to stickiness in Hamiltonian systems

Cesar Manchein, Marcus Beims, Federal University of Parana, Brazil
Jan M. Rost, Max Planck Institute for the Physics of Complex Systems, Germany.

Abstract. The stickiness effect present in the mixed phase space of conservative systems is difficult to detect and to characterize, in particular for high dimensional phase spaces. In the quasi-regular regime the sticky motion influences the distribution of the finite time Lyapunov exponents qualitatively. This influence was quantified in the work [1] with four variables: the variance (and the higher cummulants, skewness and kurtosis) and the normalized number of occurencies of the most probable finite time Lyapunov

exponent. We study systematically standard maps (symplectic systems, but not Hamitonian) beginning with the uncoupled two-dimensional case up to coupled maps of dimension $d=20$. Using {\\Red the} four variables we find that the effect of the sticky motion on the distributions of Lyapunov exponents is equal in different unstable directions above a threshold K_{d} of the nonlinearity parameter K for the high dimensional cases $d=10,20$. In this work, we study and compare two Hamiltonian chains with global and local couplings with the symplectic chain of the Ref. [1]. Basically we use the chains of standard maps with the same number of sites used in [1]. The main subject is the investigation of how the stickiness effect was distributed in different dimensions and the existence of a kind "common behavior" for small nonlinearities. As the nonlinearity increases, we clearly identify the transition from quasi-regular to totally chaotic motion which occurs simultaneously in all unstable directions. The results show that the statistical variables used are a sensitive probe for sticky motion in high dimensional systems. [1] Manchein C., Beims M. W., and Rost J.-M., Footprints of sticky motion in the phase space of higher dimensional symplectic systems. Submitted to publication.

PT56 - Chaotic Dynamics in Fusion Plasmas

Júlio Fonseca, University of São Paulo, Brazil.

Abstract. In the present work, we describe a model for the study of particles transport at the plasma edge. The plasma is confined in a Tokamak, and the transport is affected by drift waves, which are mostly responsible for the escaping of particles, an important problem for understanding of fusion plasmas. The Hamiltonian formalism provides the basic equations of mo- tion, which are dependent on the form of a electric potential function. This function is characterized by an equilibrium potential perturbed by drift waves. Defined the equilibrium potential, a map is constructed from the equations of motion. Finally, numerical results are presented for some sets of pa- rameters.

PT57 - Hyperbolic kaleidoscopes and chaos in Hele-Shaw cells

Adriana Tufaile, Alberto Tufaile, University of São Paulo, Brazil
Gérard Liger-Belair, University of Reims, France

Abstract. The goal of this work is to describe the existence of chaotic scattering in liquid bridges observed in Hele-Shaw cells. We discuss some aspects of the patterns obtained by the light scattering in a cavity formed by three spherical shells, and compared them to the case of hyperbolic kaleidoscopes using the Poincaré disk model. The analogy between chaotic scattering in dynamical systems and light scattering in foams (liquid bridges) is based on the fact that, in both cases, there is a surface in which light rays bounce back and forth for a certain number of iterations, as the same way as those observed in a chaotic repeller. This work was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), and Instituto Nacional de Ciência e Tecnologia de Fluidos Complexos (INCT-FCx).

PT58 - Frozen orbits around the Europa satellite

Jean Paulo dos S. Carvalho, UNESP/FEG, Brazil
Antonio Elipe, Universidad de Zaragoza, Spain
Rodolpho Vilhena de Moraes, UNESP/FEG, Brazil
Antonio Prado, INPE, Brazil.

Abstract. The dynamics of orbits around a planetary satellite, taking into account the gravitational attraction of a third-body and the non-uniform distribution of mass of the planetary satellite is studied. The conditions to get frozen orbits are presented. Low-altitude, near-polar orbits are very desirable for scientific missions to study the satellites, such as the Jupiter''s moon Europa. However, previous research has shown that a spacecraft in a low-altitude, near-polar orbit around Europa will have an impact in a relatively short time. Here, using a double-averaged analytical model, we found orbits with constant orbital element in average. Using an approach with the simple-averaged problem, frozen orbits valid for long periods of time are found. A comparison between the averaged models, simple and double, is presented.

PT59 - Chirikov diffusion in the region of the (3556) Lixiaohua asteroid family

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Gleidson da Silva, Universidade Cidade de São Paulo/UNICID, São Paulo, Brazil, Brazil
Sylvio Ferraz-Mello, Instituto de Astronomia, Geofisica e Ciencias Atmosfericas, USP, São Paulo, Brasil, Brazil.

Abstract. In recent papers several authors have investigated the dynamics of the asteroids families with the goal of evaluate its age (Kneević et al. 2004, Tsiganis et al. 2007, Kneević 2007, Novaković et al. 2009a, Novaković et al. 2009b). In general, in these studies the authors have considered families located in regions crossed by two-body and three-body mean-motion resonances (MMR). Nesvorný and Morbidelli (1998, 1999) showed that asteroid family dynamics in the three-body mean-motion resonances is governed by stable chaos. In fact, in the Nesvorný-Morbidelli model, these resonances are formed by a multiplet of resonances the components of which have different intensity and overlap themselves. In this case, the overlapping produces the long-term dynamical evolution in eccentricity and inclination, but not in semi-major axis. Cachucho et al., (2010) using Chirikov (1979) diffusion theory and Nesvorný-Morbidelli model, evaluated the diffusion in eccentricity and semi-major axis of the (490) Veritas asteroid family (see Fig. 1). Chirikov diffusion theory allows explaining the mechanism that governs the long-period motion of system. Indeed, the long-period diffusion in eccentricity is produced by the contribution of weaker resonances belonging to the multiplet. Fig.1 shows the diffusion coefficient in semi-major axis (top panels) and eccentricity (bottom panels) for (490) Veritas asteroid family obtained using a Hadjidemetriou-type sympletic map for times 106, 107 and 108 Mys, respectively. The brighter regions indicate the higher diffusion values. For 108 Myrs the diffusion in semi-major axis is lower than for eccentricity. In this communication, we evaluate the diffusion in Lixiaohua asteroid family and also estimate its age using Chirikov diffusion theory and Nesvorný-Morbidelli model. Chirikov diffusion theory is applied considering only three-body MMR which are identified

in Nesvorny and Morbidelli (1998), and in Novaković et al. (2009b). Moreover, the theoretical diffusion is obtained using the procedure given in Cachucho et al. (2010). The computational code was developed and estimations of diffusion were obtained using the Hadjidemetriou-type sympletic map for times up to 108

PT60 - Asteroseismology of rapidly rotating stars and optical billiards

Sonia Pinto de Carvalho, Universidade Federal de Minas Gerais, Brazil.

Abstract. O abstract poderá ser encontrado no extended abstracts a ser submetido.

PT61 - Dynamic Valid Models for the conservative Hénon-Heiles System

Saulo Bastos, Eduardo Mendes, Universidade Federal de Minas Gerais, Brazil.

Abstract. In this work the discretization of the Hénon-Heiles system obtained by applying the Monaco and Normad-Cyrot method is investigated. In order to obtain dynamically valid models, several approaches covering from the choice of terms in the difference equation originated from the discretization process to the increase of the discretization order are analysed. As a conclusion it is shown that one can obtain discretized models that preserve both the symmetry and the stability of their countinuous counterpart, even for large discretization steps.

PT62 - Nontwis Bouncing Ball Mapp

Tiago Kroetz, Instituto de Fisica / USP, Brazil
Marisa Roberto, ITA, Brazil
Iberê Luis Caldas, USP Instituto de Física, Brazil.

Abstract. The bouncing ball problem consists of a particle under action of a uniform gravitational field which suffers repeated inelastic impacts on a sinusoidally vibrating plate at the floor as shown in figure 1. This problem was first studied by Holmes [1] and investigated by many other authors, theoretically (e.g. [2]) and experimentally (e.g. [3]). The particle motion between consecutive impacts is integrable, however the instant of the impacts can not be obtained analytically. The resulting map presents a transcendental equation that must be solved at each iteration in order to find the instant of impacts [4]. We modify the simplified bouncing ball system considering the effect of a ceiling at the height L from the floor. A investigation of the modified bouncing ball model was made by Leonel in [6]. For the unperturbed case the movements still periodic, but the dependence between the frequencies and impact velocity have a discontinuity. This discontinuity occurs for the impact velocity in which the kinetic energy on the floor is equal to the gravitational potential energy at height L. We refer to this value as discontinuity velocity. It separates the dynamics of the system in two regimes: the movements with impacts only at the inferior limit and with impacts at both limits.

PT63 - A Study Via Parameter Spaces of The Tokamap

Alan Celestino, Holokx Albuquerque, Lúcio M. Tozawa, Universidade do Estado de Santa Catarina, Brazil.

Abstract. The stability of the magnetic confinement of plasma inside tokamaks is an important problem that has been tackled using mapping techniques. In this work, we studied the map proposed by Balescu et. al., the tokamap, with an approach that isn"t commonly used in plasma physics, the parameters space. The results were compared with those obtained by other authors via the traditional phase space approach.

PT64 - Estimating hyperbolicity of chaotic bidimensional maps

Cesar Manchein, Federal University of Parana, Brazil
Matteo Sala, Roberto Artuso, Università degli Sudi dellInsubria, Italy.

Abstract. In this work we applied to bidimensional chaotic maps the numerical method proposed by Ginelli et al. [1] that allows to calculate in each point of an orbit the vectors tangent to the (stable/unstable) invariant manifolds of the system, i.e. the so called covariant Lyapunov vectors (CLV); through this knowledge it is possible to calculate the transversal angle between the manifolds and, through statistics, quantify the degree of hyperbolicity. We started by testing the Hénon and Lozi attractors for specific values of parameters, and then focused on hyperbolicity of the Chirikov-Taylor map (Standard map) for parameter values such that islands exist; in their neighborhood chaotic orbits experience transients of regular motion, i.e. stickiness, that is known to be directly associated with tangencies (i.e. zero angle) between the manifolds [2]. Hence statistics of angles can be also used in conservative systems to test whether an orbit is sticky or not.

PT65 - Scaling in the Helimac Plasma Electrostatic Turbulence

Camilo Neto, São Paulo University, Brazil.

Abstract. \\documentclass[10pt,twocolumn]{article} \\usepackage{DDays2010} \\title{\\uppercase{Scaling in the Helimac Plasma Electrostatic Turbulence}} \\author[1]{ \\underline{Camilo Rodrigues Neto}} \\author[2]{Dennis Toufen} \\author[3]{Zwinglio O. Guimarães Filho} \\author[4]{Iberê Luiz Caldas} \\author[5]{Kenntle W. Gentle} \\affil[1]{EACH, University of São Paulo, São Paulo, Brazil, camiloneto@usp.br} \\affil[2]{IFUSP, University of São Paulo, São Paulo, Brazil, dennis@dfn.if.usp.br} \\affil[3]{Equipe DSC/PIIM, Université de Provence, Marseille, zwinglio@if.usp.br} \\affil[4]{IFUSP, University of São Paulo, São Paulo, Brazil, ibere@if.usp.br} \\affil[5]{FRS, University of Texas at Austin, USA, k.gentle@mail.utexas.edu} \\begin{document} \\maketitle \\Keywords{Applications of Nonlinear Sciences; Fluid Dynamics, Plasma and Turbulence; Time series analysis.} \\\\ %\\section{Basic information} The knowledge of the electrostatic plasma turbulence in the tokamak edge is essential to improve the plasma confinement \\cite{horton99, wootton91, wagner93}. With this motivation, properties of the turbulent fluctuations have been investigated for different devices through different kinds of numerical analyses \\cite{newref1, newref2, newref3, newref4, Baptista}. In this work, we focus on the plasma edge turbulence in Helimac time series \\cite{new14, new15},

investigating for dynamical and scaling properties of the fluctuating floating electrostatic potential measured by Langmuir probes. The aim of the multifractal analysis performed by wavelet transform modulus maxima \\cite{muzy91, arneodo95} methods was to provide insights on the self affine scaling exponents and the presence of different kinds of structures in the plasma edge and its dependence with the radial position and bias voltage. The Hurst exponents were used to obtain the monofractal characteristics of the electrostatic fluctuations \\cite{newref4, newref5}. The results are compared with those obtained for random test time series with the same Hurst exponents and data length to statistically verify the multifractal behavior. A previous investigation already presented evidence of multifractality for the fluctuating floating potential in the Tokamak Chauffage Alfvén Brésilien TCABR, published on \\cite{nosso2008}, and in this work we proceed with a similar approach. %\\section*{REFERENCES} \\begin{thebibliography}{. . .}
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PT66 - Intermittent onset of turbulence in the damped and forced regularized-long-wave equation

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Sergio Lopes, Ricardo Viana, Universidade Federal do Parana, Brazil.

Abstract. In this work we study an intermittent transition from temporal chaos to turbulence in a spatially extended system: the damped and forced regularized-long-wave equation. We solve the system in Fourier space via the Pseudo-spectral method and explain the transition through the two-state on-off intermittency mechanism. We believe

our work contributes to the understanding of the long-standing problem of the onset of turbulence.

PT67 - Evidence of Transport Barrier in Tokamak Discharge with High MHD Activity

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Francisco Alberto, Zwinglio Guimarães-Filho, Universidade de São Paulo, Brazil
Iberê Luis Caldas, USP Instituto de Física, Brazil
Yu. Kurznetsov, Ivan Nascimento, Universidade de São Paulo, Brazil

Abstract. We analyze the transport of particles in the plasma edge of TCABR tokamak caused by the plasma turbulence. This transport depends on the high MHD activity and is modified by altering the plasma flow velocity due to the toroidal magnetic field and the radial electric field. In this work, we report evidence of a transport barrier in the radial position with a shearless in the drift flow velocity radial profile.

PT68 - Log-Poisson Cascade Description of Turbulent Velocity Gradient Statistics

Michael Kholmyansky, Tel Aviv University, Israel
Luca Moriconi, Universidade Federal do Rio Janeiro, Brazil
Rodrigo Pereira, Universidade Federal do Rio de Janeiro, Brazil
Arkady Tsinober, Tel Aviv University, Israel.

Abstract. The Log-Poisson phenomenological description of the turbulent energy cascade is evoked to discuss high-order statistics of velocity derivatives and the mapping between their probability distribution functions at different Reynolds numbers. The striking confirmation of theoretical predictions suggests that numerical solutions of the flow, obtained at low/moderate Reynolds numbers can play an important quantitative role in the analysis of experimental high Reynolds number phenomena, where small scales fluctuations are in general inaccessible from direct numerical simulations.

PT69 - Entrainment and mixing in fountains in stratified media

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Cecilia Cabeza, Universidad de la Republica, Uruguay
Gustavo Sarasúa, Italo Bove, Instituto de Fisica, Facultad de Ciencias, Uruguay, Uruguay
Gabriel Usera, IMFIA_-Facultad de Ingenieria, Uruguay, Uruguay
Arturo Marti, Universidad de la Republica, Uruguay.

Abstract. We present experimental results about the interaction between turbulent fountains and stratified media. When a fluid is injected in a linear stratified fluid with density smaller than that of the jet, firstly, the jet reaches a maximal height, and then, due to the effects of mixing and friction this height is stabilized at certain value. The upward flow not only reduces its momentum but also entrains environmental fluid reducing its density to an intermediate value and forming a front of cold fluid which intrudes horizontally on the environment. Using visualization and velocimetry techniques we find that the maximum and intrusion heights depend on the turbulent fluctuations of the jet and the effect of high levels of turbulence is to reduce these heights. We study quantitatively the mixing and entrainment between the jet and environment.

PT70 - Defects decay and pattern switching on 1-D Swift-Hohenberg equation

Felipe Magalhaes, Ronald Dickman, Universidade Federal de Minas Gerais, Brazil.

Abstract. The Swift-Hohenberg equation (SHE) is a well known model for pattern formation. It was conceived as a representation of Rayleigh-Bérnard convection. We study the dynamics of defects in the pattern of the one-dimensional SHE with periodic boundary conditions via numerical integration. We observe a power-law decay of the number of defects with time and a linear depedence of the deacy exponent with the critical wavelength.

PT71 - Stationary shapes of rotating magnetic fluid droplets

Sérgio Lira, Universidade Federal de Pernambuco, Brazil
José Miranda, UFPE, Brazil
Rafael Oliveira, University of California, USA.

Abstract. An effectively two-dimensional (2D) version of the problem of rotating fluid droplets can be examined when a fluid drop is placed in the spatially confined environment of a rotating Hele-Shaw cell. The rotating Hele-Shaw problem is a variation of the traditional viscosity-driven Saffman-Taylor instability, in wich a cell composed of two narrwolly spaced parallel plates rotates, and the competition between centrifugal and capillary forces results in interface destabilization and pattern formation.

PT72 - Evidence of self-organized criticality behavior in TCABR plasma edge

Gustavo Zampier, Universidade Federal do Rio Grande do Norte, Brazil
Antonio Batista, Universidade Estadual de Ponta Grossa, Brazil
Zwinglio Guimarães-Filho, Universidade de São Paulo, Brazil
Kelly Iarosz, Universidade Estadual de Ponta Grossa, Brazil
Iberê Luis Caldas, USP Instituto de Física, Brazil
Ricardo Viana, Sergio Lopes, Universidade Federal do Paraná, Brazil
Ivan Nascimento, Universidade de São Paulo, Brazil.

Abstract. Electrostatic turbulence is the main cause of anomalous particle transport at the plasma edge in tokamaks. Despite the recent theoretical and experimental progress on the understanding of this turbulence a complete description of the observations has not yet been achieved. Thus, understanding this turbulence behavior is still necessary to complete the plasma edge description and to improve plasma confinement in tokamaks. In some recent studies, analyzes of the electrostatic fluctuations from confined magnetically plasmas have been described by their space and time self-organized similarity behavior (SOC). The concept of SOC brings together the ideas of self-organization of nonlinear dynamics systems with the often observed near-critical behavior. The several distinct parading are available for transport of mass or other quantities across plasma confined by a magnetic field. Avalanches events in plasma confined are a key ingredient in the theory of self-organized criticality (SOC) and an intuitive analyses of avalanche is based on modeling of sandpile. In this work we investigate the plasma edge turbulence in the tokamak TCABR and identify evidence of

self-organized criticality behavior of the experimental fluctuating floating electrostatic potential measured by Langmuir probes in the plasma edge and scrape-off layer. The self-organized criticality behavior of the plasma edge is studied using fluctuations data from TCABR measured by Langmuir probe. We looke for possible evidence of SOC in the plasma transport.

PT73 - Noise-induced intermittency in a mean-field dynamo

Pablo Muñoz, Abraham Chian, National Institute for Space Research (INPE), Brazil
Erico Rempel, ITA, Brazil.

Abstract. Mean-field dynamo is currently used to model the solar magnetic cycle. In particular, stochastic low-dimensional mean-field dynamo models are useful to study the onset of the intermittency induced by noise, that is important to understand how stochastic perturbations can change the global dynamics of the system, and help to understand in a simpler manner relevant features of solar activity such as the Maunder-type minima. We study a six-dimensional nonlinear mena-field model with additive noise, looking for changes in the dynamics using the previous work by Lai et al. [1]. We focus our study in a p-13 periodic window. We show that a random attractor undergoes a transition to a more chaotic state as the amplitude of noise increases. This transition is characterized by the growth of the maximum Lyaounov exponent, and an algebraic scaling law of \\lambda_max near the onset, in agreement with the finding of Lai et al. [1]. Further details of the noise-induced intermittency in a mean-field dynamo will be presented. [1] Y.-C. Lai, Z. Liu, L. Billings and I. B. Schwartz, ``Noise-induced unstable dimension variability and transition to chaos in random dynamical systems'''', Physical Review E Vol. 67, pp. 26210-26214, 2003

PT74 - On the Plasma Turbulence Control in the Texas Helimak

Dennis Toufen, USP - University of São Paulo, Brazil.

Abstract. The presence of electrostatic turbulence at the plasma edge is one of the important causes for excessive particle transport and consequent weakening of plasma confinement in toroidal magnetic field. This work uses data of the Texas Helimak experiment to explore the variations of some plasma characteristics, as a function of the radial electric field profile, and their consequences on turbulence and confinement. The analyses of the power spectra indicate that the plasma becomes less turbulent for negative bias values. The same conclusion is obtained from temperature profile analyses; shots with negative bias present higher temperatures. These two results indicate that the confinement is improved by negative external bias.

PT75 - Variations on the geomagnetic field dipole and the fluctuation dissipation theorem

Breno Silva, Universidade de Sao Paulo, Brazil.

Abstract. We use fluctuation dissipation theorem to interpret observed variations on geomagnetic field reversal frenquency. Our analysis in based on a stochastic model for

the geomagnetic field described by a multiplicative noise driven ordinary differential equation with a bi stable potential.

PT76 - Percolation model for wildland fire spread dynamics

Rodolfo Almeida, Elbert E. N. Macau, Instituto Nacional de Pesquisas Espaciais, Brazil.

Abstract. A stochastic cellular automata model for wildland fire spread under flat terrain and no-wind conditions is proposed and its dynamics is characterized and analyzed. Each cell is characterized by one of the three states that are: vegetation cell, burning cell and burnt cell. The dynamics of fire spread is modeled as a stochastic event with an effective fire spread probability S which is a function of three probabilities: the proportion of vegetation cells across the lattice, the probability of a burning cell become burnt, and the probability of the fire spread from a burning cell to a neighbor vegetation cell. A set of simulation experiments are performed to analyze the effects of different values of the three probabilities in the fire pattern. The effective fire spread probability is obtained from Monte-Carlo simulations and a critical line that separate the set of parameter or which a fire can propagate from those for which it cannot is obtained.

PT77 - A Phase transition in a two dimensional Hamiltonian map

Juliano de Oliveira, UNESP-IGCE, Brazil.

Abstract. The transition from integrability to non-integrability for a two dimensional Hamiltonian mapping exhibiting mixed phase space is considered. The phase space of such mapping show a large chaotic sea surrounding KAM islands and limited by a set of invariant tori. The description of the phase transition is made by the use of scaling functions for average quantities of the mapping averaged along the chaotic sea. The critical exponents are obtained via extensive numerical simulations. Given the mapping the critical exponents that characterize the scaling functions are obtained. Therefore classes of universality are defined.

PT78 - Energy Gain induced by crisis

Celso Abud, Universidade de São Paulo, Brazil.

Abstract. The time-dependent annular billiard is studied in the framework of inelastic collisions. We considered strong dissipation to show a boundary crisis event and we have obtained an incredible energy gain due to it. This mechanism happens because of the cretion of attractors in appropriated regions of the phase space.

PT79 - Zonal flow influence in the generation of instability in four wave interaction

Jose Danilo Szezech Junior, Universidade de Sao Paulo, Brazil.

Abstract. In tokamaks radial particle transport is induced by electrostatic drift turbulence at the plasma edge. This turbulence is much affected by the plasma zonal flow. The relation between drift waves and zonal flow has been investigated to better understand the transport and the turbulence. To reduce the transport and improve the plasma

confinement, turbulence control can be achieved by conveniently varying the radial electric field that gives rise to the zonal flow. In this context, we analyse the coupling between drift waves and zonal flow. This can be properly handled by a four-wave (three waves plus a zonal flow) interaction model with quadratic nonlinearities and linear growth/decay rates used to investigate the occurrence of drift-wave turbulence in the tokamak edge plasma. For that we consider numerical solutions of the generalized Charney-Hasegawa-Mima equation in the presence of a zonal flow linear growth/decay rates.

PT80 - Detrended fluctuation analysis applied to cortical spreading depression: the malnutrition effect

Rosangela Nascimento, UFRPE, Brazil
Luiz Araújo, UFS, Brazil
Renato Moraes, Catão Barbosa, UFRPE, Brazil
Rubem Guedes, UFPE, Brazil
Romildo Nogueira, Universidade Federal Rural Pernambuco, Brazil.

Abstract. Detrended Fluctuation Analysis (DFA) has been applied to the Cortical Spreading Depression (CSD) in well-nourished rats (1). Here we applied the DFA to study the fluctuations dynamics induced by spreading depression in the electrocorticogram (ECoG) in malnourished rats. The scaling exponents (α) from the DFA were calculated for ECoG record in the followings time intervals: before CSD or control, immediately before CSD, characterized by burst, during and post-CSD. Our results show that the malnourished animal presents persistent long-term correlations for all intervals. The DFA scaling values showed only significant difference in the burst exponent period in relation to the others periods. The malnourished animals present a lower correlation than observed for well-nourished.

PT81 - Detrended fluctuation analysis and parabolicity index in aged rats with status epilepticus elicited by pilocarpine acutely

Renato Moraes, UFRPE, Brazil
Lúcia Amorim, UFRN, Brazil
George Chaves, Leandro Aguiar, Catão Barbosa, Walter Santos, UFRPE, Brazil
Romildo Nogueira, Universidade Federal Rural Pernambuco, Brazil.

Abstract. The electrical activity of the brain has been studied by scientists specialized in different areas of the knowledge and particularly neurophysiologists. Amongst the several neurological disorders, epilepsy has drawn the most attention because this disorder can affect the lifes quality of an individual even under treatment. In this paper we applied the nonlinear dynamic analysis to the electrocorticogram (ECoG) from old epileptic rats using parabolicity index (b), which is a parameter derivative from the Detrended Fluctuation Analysis (DFA). Epilepsy has higher probabilities of occurrence in children than others ages, but only a few works have been realized with old animals. Are they more resistant even when the status epilepticus is induced by pilocarpine? To addresses this issue we determined the DFA α exponent and based in this α values we calculated the parabolicity

index (b) aiming to detect a difference between normal and with status epilepticus elicited by pilocarpine acutely in aged rats.

PT82 - Quantification of Chirp-like Structures of EEG Time-Series

Alexandre Casagrande, Günther Gerhardt, Universidade de Caxias do Sul, Brazil.

Abstract. In this paper we introduce a procedure based on Matching Pursuit with Gabor-chirping dictionary and apply it to the spectral decomposition of a whole-night EEG signal from a group of nine young normal subjects. It was thus possible to identify sleep spindles (SS) and quantify them not only in frequency but also in modulation of this frequency. We identified a slowing pattern for these elements that should be explained in terms of their thalamocortical generating mechanism.

Poster Session (PT_3)

PT83 - A novel cell-coupling leading to nonlocal interactions

David Ciro, Boris Rodríguez, Universidad de Antioquia, Colombia.

Abstract. We present a chain of current controlled voltage sources (CCVS) with inductive coupling as a new way to produce nonlocal interactions in arrays of nonlinear cells. It is shown further that the resulting interactions present strong dependence to the choice of boundary conditions and finally the inversion of dispersion relations with respect to usual systems is discussed.

PT84 - Community detection in a sociodynamic model of conflict

Diego Ortiz, Universidad de Los Andes, Venezuela.

Abstract. We develop an agent-based model for the formation of structures (coalitions or clusters) in social dynamics. Rules of interactions between agents are inspired by the mechanism of "pay-or-else", which is typical in the dynamics of social conflicts and power relations. The transfer of resources between agents determines evolving compromises between them, which are characterized through a connectivity matrix. Thus, the states of the agents coevolve with their connectivity, allowing the formation of clusters of strongly coupled elements that are interpreted as coalitions. The topological properties of the resulting structures are characterized. Similarly, the statistical dynamical properties of the model are investigated. We find power law behaviors in the probability distributions of sizes of conflicts and of their duration, and intervals of inactivity or peace. These results agree with the historical data on conflicts and with the statistical behavior observed in other non-equilibrium physical systems.

PT85 - Automatic optimization of an experiment in noise-enhanced propagation

Mauro F. Calabria, Roberto Deza, Universidad Nacional de Mar del Plata (UNMdP), Argentina.

Abstract. A system is implemented for data acquisition and digital control of experiments, to optimize the propagation of a low-frequency periodic signal through a chain of

unidirectionally coupled bistable units, subject to uncorrelated additive noises. By means of a genetic algorithm and a proprietary code that commands a set of digital potentiometers, the input signal-to-noise ratio (SNR) and the commutation threshold are optimized independently for each unit, to achieve maximum coherence (measured indirectly as a Hamming distance) between the response of the last unit and the input signal. The studied system can be regarded as an abstraction of the synaptic transmission between neurons.

PT86 - Synchronization conditions for a bandlimited discrete-time chaotic system

Renato Fanganiello, Mackenzie Presbyterian University, Brazil.

Abstract. Over the last couple of decades, many methods for synchronizing chaotic systems have been proposed with communications applications in view. Unfortunately their performances have been disappointing in face of the nonideal character of usual channels linking transmitter and receiver, that is, due to both noise and signal propagation distortion. Here we consider a discrete-time master-slave system that synchronizes despite channel bandwidth limitations by introducing a digital filter that limits the spectral content of the feedback loop responsible for producing the transmitted signal. We provide an analytical demonstration that synchronization is not affected when identical, linear, time-invariant, Finite Impulse Response (FIR) filters are included in both the transmitter and receiver subsystems. Furthermore, we numerically investigate for which filters orders and cut-off frequencies it is possible to obtain chaotic signals.

PT87 - Synchronization in perturbed complex networks with star coupling configuration

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Cesar Cruz, Scientific Research and Advances Studies Center of Ensenada, Mexico.

Abstract. In this paper, the robust synchronization problem for coupled perturbed hyperchaotic nodes is addressed. In particular, we study the fragility of complete synchronization in complex dynamical networks with star coupling configuration. In particular, this study is based on the network synchronization in different topologies of hyperchaotic nodes. We show that different collective behaviors are obtained when a perturbation in the nodes is considered, for example partial and approximate synchronization of the nodes in the networks.

PT88 - Empirical Stabilization of Transient Time-Series in an Electrochemical System

Raphael Nagao, Elton Sitta, Hamilton Varela, University of São Paulo, Brazil.

Abstract. Experimentally obtained time-series in oscillatory electrochemical systems are often found to vary slowly in time, even when all controllable parameters are kept constant. This slow drift normally makes the long term analysis a complex task. Herein we introduce an empirical method to stabilize transient time-series and it has been tested for the electro-oxidation of methanol on a platinum surface. Typical stabilization in the oscillatory period amounts about 5 to 20 times with respect to the non-stabilized system has been achieved.

PT89 - Kinetic instabilities during glycerol electro-oxidation on platinum

Cristiane Oliveira, Universidade de São Paulo, Brazil.

Abstract. Instabilities in electrochemical systems can be subdivided into two classes. One class includes purely chemical instabilities, i.e., instabilities which arise from chemical kinetics. Among the electrochemical systems, oxidation of small organic compounds, mainly C1 molecules, at noble metal (usually Pt) is the most explored reaction in oscillatory conditions. In this communication, we reported a study of the glycerol (G) electro-oxidation on Pt in alkaline media. Main results lie on the presence of mixed mode oscillations under galvanostatic control, which cannot be described from the same mechanistic point of view those simple periodic oscillations.

PT90 - Spatial patterns in oscillator lattices with non-local coupling: application to an activator-inhibitor auto-catalytic model

Fábio A. S. Silva, Universidade Federal do Paraná, Brazil
Ricardo Viana, Sergio Lopes, Universidade Federal do Parana, Brazil.

Abstract. Spatial patterns are found in many places in Nature, from the colors of animals skin to neural networks. Turing was one of the pioneers in the study of the pattern formation. He introduced a theory in which heterogeneous spatial patterns are formed from an initial stable homogeneous pattern. His theory is based on reaction-diffusion equations governing the dynamics of two reacting chemical species, called activator and inhibitor. In this work we proved to be possible the formation of patterns starting from a nonlocal interaction which the coupling intensity between cells decays in a power low fashion with the lattice distance. Additionally we applied the analytical results to a model of chemical reaction, known as model of Meinhardt-Gierer, and through computer simulations we verified our results.

PT91 - Supersymmetric Langevin Dynamics To find Reaction Paths

Edgar Landinez, Universidade Estadual de Campinas, Brazil.

Abstract. The dynamics of complex systems is often driven by rare but important events. Well-known examples include chemical reactions, diffusion in solids and nucleation in phase transitions. The origin of the rare-event problem typically lies in the disparity between the thermal energy scale and typical energy barriers of the systems. We present a family of algoritmhs proposed for others in recent years that allows one to find reaction pathways without prior knowledge of the final state or the requirement of specifying an initial path. The method is based on an analogy between the formalism of the Fokker Planck equation and supersymmetric quantum mechanics. In practice, the approach is exploited using Langevin stochastic dynamics modified to get the reaction paths. Here we present some simple example toy models to show how this occurs. The supersymmetric

Langevin dynamics method permits a natural exploration of unknown metastable states as well as reaction mechanisms.

PT92 - Degree Distribution and Nestedness in Bipartide Networks from Community Ecology

Gilberto Corso, Universidade Federal do Rio Grande do Norte, Brazil
Aderaldo Araujo, Instituto Federal de Educação, Ciência e Tecnologia, Ceará, Brazil
Adriana Almeida, UFRN, Brazil.

Abstract. Degree Distribution and Nestedness in Bipartide Networks from Community Ecology

PT93 - Measuring Asymmetry in Insect-plant Networks

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Gilberto Corso, Universidade Federal do Rio Grande do Norte, Brazil.

Abstract. Measuring Asymmetry in Insect-plant Networks, an open question in community ecology.

PT94 - Growth dynamics for protein association network: Comparing Model Simulation and Data

Ricardo Ferreira, Universidade Federal do Rio Grande do Sul, Brazil.

Abstract. While exhibiting interesting topological properties, protein association networks play important roles in biology, ranging from protein function inference, to the understanding of the evolution of such networks\\cite{ni}. Some models had been proposed to obtain further insight in the origins of the proteins network''s properties\\cite{barabasi,vazquez}. These models try to reproduce the scale-free degree distribution, and focus on the degree of a node to choose his duplication rate or attachment probability. Using the networks of the last STRING database\\cite{string} update, we have found that these models do not fully explain the topological properties of protein association networks, especially the degree distribution, which is not a simply scale-free distribution. In this work we seek the network growth model that correctly reproduces features observed in protein association networks extracted from the STRING database.

PT95 - Different Methods to generate Scale-Free Networks and their effects on the Network Shape

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Marcos Amaku, Universidade de Sao Paulo, Brazil
Raul Ossada, Universidade de São Paulo, Brazil
Fernando Ferreira, Universidade de Sao Paulo, Brazil.

Abstract. A well-known method to generate a scale-free network is the preferential attachment, in which links are added to nodes based on their degree. In this approach, one first generates a network and then evaluates the power-law distribution

resulting from it. We developed a method that takes the opposite way to generate a scale-free network, inspired by Kalisky (2004).

PT96 - Self-organization and pattern formation in coupled Lorenz oscillators under a discret symmetric transformation

Alejandro Carrillo, Boris Rodríguez, Universidad de Antioquia, Colombia.

Abstract. We present a spatial array of Lorenz oscillators, with each cell lattice in the chaotic regime. This system, shows spatial ordering due to self-organization of chaos synchronization after a bifurcation. It is shown that an array of such oscillators transformed under a discrete symmetry group, does not maintain the global dynamics, altough each transformed unit cell is locally identical to its precursor.

PT97 - Identifying abnormal nodes in protein-protein interaction networks

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Abstract. Identifying outlier nodes is an important task in complex network mining. We analyze the problem of identifying outliers in a network structure and propose an outlier measure by using the random walk distance measure and the dissimilarity index between pairs of vertices. The method determines a "view" to the whole network for each node (the distance measure) and infers that outliers are those nodes whose view differs significantly from majority of the nodes. This perspective, incorporate both local and global information of the network and can give more general outlier detection results. We have applied the method to artificial and real networks and interesting results have been obtained. Particularly, we analyzed the results to applying the method to the yeast protein-protein interaction network and observed that the outlier proteins are those related to metabolism and cell cycle and DNA processing.

PT98 - Functional Phase Synchronization Structures in Mice Neural Networks

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Abstract. Cultured neural networks derived from cortical mice neurons in vitro exhibit interesting functional clusters (cliques) when synchronization data is projected on the real space and in a multi-dimensional synchronization space. These structures that can be interpreted as the networks information processing modules are persistent over long time periods of more than 24 hours.

PT99 - Estimating Chaos Control Parameters from Time Series

Roberto Santos, Centro Universitário da FEI, Brazil
Júlio Graves, Instituto Tecnológico de Aeronáutica, Brazil.

Abstract. We present a simple method to analyze time series, and estimate the parameters needed to control chaos in dynamical systems. Application of the method to a system described by the logistic map is also shown. Analyzing only two 100-point time series, we achieved results within 2% of the analytical ones. With these estimates, we show that OGY control method successfully stabilized a period-1 unstable periodic orbit embedded in the chaotic attractor.

PT100 - Analysis of the Ginzburg-Landau equation with non-local coupling

Kenzo Sasaki, Universidade Federal do Paraná, Brazil
Sergio Lopes, Universidade Federal do Parana, Brazil.

Abstract. The small amplitude Ginzburg-Landau equation, which appropriately describes fields with non-local coupling is studied numerically in the Benjamin-Feir unstable limit. We have found that by changing the reduced system size and its coupling, different behaviors emerge, particularly a metastable one on which small perturbations make the system come back to its chaotic saddle.

PT101 - Electrical implementation of a complete synchronization dynamic system

Cristhiane Goncalves, University of São Paulo, Brazil.

Abstract. This work presents an electrical implementation of a complete synchronization system, proposing a master/slave synchronization of two identical particle-in-a-box electronic circuits, exhibiting a rich chaotic behavior. This behavior was experimentally observed, and also emulated. Just a few works in literature describe experimental measurements of chaotic systems.

PT102 - Synchronization of fireflies using a model of Ligth Controlled Oscillators

Cecilia Cabeza, Nicolas Rubido, Sandra Kahan, Arturo Marti, Universidad de la Republica, Uruguay.

Abstract. Natural systems often present spontaneous synchronicity; for example, fireflies flashing in unison or cardiac cells firing in synchrony. Those are distributed systems with decentralized control and fault-tolerance, the same features researchers seek in communication systems. Synchronicity can also be used to coordinate sampling across multiple nodes in a sensor network and is especially important in applications with high data rates. Basically, synchronization consists in an adjustment of rhythms among self-sustained oscillators due to a weak coupling that may act in different manners. This phenomenon has achieved great importance in the last years due to the fact that it is manifested in systems of very different nature such as physical, chemical, biological and electrical. Furthermore, phenomena involving synchronization in complex networks or synchronization in time-delayed systems have been intensively studied in recent years.

We constructed an electronic model of fireflies using a light-controlled oscillator (LCO), whose free-run duty cycle can be modified and adjusted manually on the spot, and on which quantitative measurements of periods and phase differences may be performed with the required precision. Furthermore, this device allow us to connect an arbitrary number of LCOs in order to study the synchronization times for different kinds of links. Finally, we solved the model numerically finding that it reproduces our different experimental results with three interacting LCOs in different configuration.

PT103 - Mutual information and synchronism on a network of four chaotic circuits

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Abstract. Four Chaotic Chuas circuits were built with bidirec- tional coupling composed by a operational amplifiers buffers and series resistors and connected in the form of a network in order to study synchronism and information transmission. Such networks can simulate at some extent the behavior of neural networks and be used to understand some mechanisms associated with information transmission. The coupling strength is an inverse function of these coupling resistances. The four circuits were set with parameters of double-scroll attractors with parameters differing not more than 1 % . The coupling of circuits was carried out in a linear and cir- cular form. The coupling resistances were precision resistive metal wire potentiometers with 10 turns and reaching up to 100kohm. The voltage across the capacitor close to the Chua''s diode was measured from each circuit and assigned as Xi vari- able. Synchronization was identi¯ed by a plot of Xi versus Xj with j not equal to i. For a full synchronization the graph consists of a tipical Y=X line. The synchronization was inves- tigated as a function of the coupling strength, i.e. the coupling resistance. The dependence is considered for all allowed com- binations of i and j, considering both the linear and circular coupling.

PT104 - Statistical Study Of Nonlinear Return Maps In Regular And Chaotic Conditions

Ghasem Asadi Cordshooli, Islamic Azad University, Iran.

Abstract. There are some different approaches to identifying chaotic systems based on statistical methods according to some concepts like Markov chain, correlation dimension, inverse time plot, scattering and so one. In this paper a new statistical method is introduced that helps us to understand if the system is chaotic or not.

PT105 - The initial inhomogeneity and halo formation in intense charged particle beams

Luciano Camargo Martins, Universidade Estadual de Santa Catarina, Brazil
Roger Nunes, Universidade Federal de Pelotas, Brazil.

Abstract. Although undesired in many applications, the intrinsic spurious spatial inhomogeneity that permeates real systems is the forerunner instability which leads high-intensity charged particle beams to its equilibrium. In general, this equilibrium is reached in a particular way, by the development of a tenuous particle population around the original beam, conventionally known as the halo. In this way, the purpose of this work is to analyze the influence of the magnitude of initial inhomogeneity over the dynamics and over the equilibrium characteristics of initially quasi-homogeneous mismatched beams. For that, all beam constituent particles, which are initially disposed in an equidistant form, suffer a progressive perturbation through random noise with a variable amplitude. Dynamical and equilibrium quantities are quantified as functions of the noise amplitude, which indirectly is a consistent measure of the initial beam inhomogeneity. The results have been obtained by the means of full self-consistent N-particle beam numerical simulations and seem to be an important complement to the investigations already carried out in prior works.

PT106 - Spatiotemporal Features of a Coupled Map Lattice

Romeu Szmoski, Rodrigo Pereira, Sandro Pinto, State University of Ponta Grossa, Brazil.

Abstract. We investigate the spatiotemporal dynamics of a coupled map lattice from viewpoint of the features experimentally observed in neural networks. The temporal evolution is characterized by Lyapunov exponents whereas the spatial patterns are analyzed from clustering and locking-time, which is the time for the lattice to achieve the equilibrium state. We also calculate the entropy per network element as a measure of information capacity of the network. We observe that the CML has similar features to neural networks one for weak coupling strengths.

PT107 - Transient dynamics and synchronization regions of pulse-coupled piecewise linear oscillators in T^2.

Nicolas Rubido, Cecilia Cabeza, Sandra Kahan, Arturo Marti, Universidad de la Republica, Uruguay.

Abstract. Synchronization times and stable states of pulse-coupled Light-Controlled Oscillators (LCOs) are obtained for different coupling configurations and intensities as a function of the initial conditions. Transients detection methods are compared in terms of their efficiency to detect synchronization times, emerging the phase return-map as the best candidate. Scaling laws that restric the transient dynamics are obtained, based, on dimensional considerations. A qualitative study of different oscillatory regimes and the topology of the orbits is performed.

PT108 - Study of the attractor structure in an agent-based sociological model

André Timpanaro, Carmen Prado, University of São Paulo, Brazil.

Abstract. In the last decade, econophysics and sociophysics models have attracted the attention of physicists, due to the current availability of great amounts of data and computing power. The Sznajd model simulates the propagation of opinions in a society, using an agent-based approach. It has been successfully employed in modeling some properties and scale features of both proportional and majority elections, but its stationary states are always consensus states. Seeking to explain more complicated behaviours in an unified way, we have modified the bounded confidence idea, found in other opinion models, to allow for complex opinion interactions. The attractor structure of the resulting model can be solved in a mean-field approach and Monte Carlo simulations in a Barabasi-Albert network show great similarities with the mean-field, for the tested cases of 3 and 4 opinions.

PT109 - An electronics syrinx to explore mechanisms of birdsong production

Ezequiel Arneodo, Departamento de Física, FCEN, Universidad de Buenos Aires, Argentina.

Abstract. Songbirds are the best-suited animal model to study general mechanisms underlying complex, learned motor behavior, as it is birdsong. While much effort focuses on neural control, we highlight the relevance of the interplay between the central mechanisms of motor control and the highly nonlinear peripheral biomechanical systems. The avian vocal organ is capable of generating a large variety of acoustic signals, which range from simple whistles to highly complex sounds. The parallels found between the avian and the human vocal organs motivate a comprehensive understanding of the mechanisms of song production, in order to shed some light on the production of sound in humans. In this work we build an electronic birdsong synthesizer by implementing the model in a Digital Signal Processor (DSP). This device is capable of reading physiological recordings, integrating the mathematical equations representing the avian vocal organs behavior, and synthesizing song in real time.

PT110 - Parameter Modulation in the Hénon Map

Gabriela Casas, Paulo Rech, Universidade do Estado de Santa Catarina, Brazil.

Abstract. In this paper we investigate an effect caused by using the output of one Hénon map to modulate the parameters of a second Hénon map. More specifically, here we show through numerical simulations that multistability can be controlled by the above-mentioned modulation.

PT111 - Characterization of hyperchaotic states in parameter-space

Marcos Correia, Paulo Rech, Universidade do Estado de Santa Catarina, Brazil.

Abstract. This paper proposes a numerical method to characterize hyperchaotic regions in the parameter-space of continuous-time dynamical systems. The method considers the second largest Lyapunov exponent as a measure of hyperchaotic motion, to construct

two-dimensional parameter-space color plots. Different levels of hyperchaos in these plots are represented by a continuously changing yellow-red scale. As an example, a particular system modeled by a set of four nonlinear autonomous first order differential equations is considered.

PT112 - Lyapunov Exponent Diagram for a Driven Chaotic Oscillator with Complex Variable

Julio D'Amore, Holokx Albuquerque, Universidade do Estado de Santa Catarina, Brazil.

Abstract. We report a numerical study carried out on a driven complex variable oscillator of the form z + f(z,z) = Aexp(iΩt), where the polynomial f(z,z) is a quadratic function. We numerically calculated the largest Lyapunov exponent and constructed a colorful two-dimensional diagram showing the periodic and chaotic regions for the pair of parameters (A, Ω), as a function of the largest Lyapunov exponent. In that diagram we show the coexistence of limit cycles, chaotic attractors and 2-tori.

PT113 - Numerical Bifurcation Analysis of the Watt Governor System

José Vieira, Holokx Albuquerque, Universidade do Estado de Santa Catarina, Brazil.

Abstract. We report a numerical bifurcation study of the Watt governor system. Through the largest Lyapunov exponent, we constructed a two-dimensional parameter space of the system, and observed the existence of self-similar periodic structures in localized regions of the parameter space. We also show that some of those structures organize themselves in a new type of bifurcation cascade.

PT114 - On The Effect of a Parallel Resistor in The Chua's Circuit

Flavio Prebianca, Santa Catarina State University, Brazil
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Rero Marques Rubinger, Universidade Federal de Itajubá (UNIFEI), Brazil
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Abstract. A numerical and experimental bifurcation study in the Chuas circuit with parallel resistor is reported. Through the largest Lyapunov exponent, we constructed a two-dimensional parameter space of the model. We also implemented the experimental circuit to show the similarities between the model and the experimental data. With that modification we discuss the effect of a parallel resistor in the dynamics of a Chuas circuit.

PT115 - High-resolution phase diagrams of a generic electrochemical oscillatior

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Abstract. Most electrochemical systems are known to present complex kinetics in some parameter range. Examples range from electrodissolution of metals to electrocatalytic oxidation of small organic molecules. Specifically for the case of fuel cell relevant

reactions such as the catalytic electro-oxidation of hydrogen and small organic molecules, oscillatory dynamics seems to be the rule rather than the exception. To date, the vast majority of numerical studies in those systems is focused on the investigation of some calculated time series and covers relatively small parameter regions. We report in this work a detailed numerical investigation of a generic electrochemical oscillator consisting of a minimal (3 ODEs) continuous-time autonomous model. The analysis was carried out by means of an in-depth investigation of the high-resolution phase diagrams in a two-parameter plane. Computation of Lyapunov exponents provided a detailed discrimination of chaotic and periodic domains and revealed the existence of intricate structuring of periodic domains embedded in a chaotic background. Shrimp-like periodic regions previously observed in other distinct systems were also clearly detected here, which corroborate the universal nature of the occurrence of such structures. In addition, we have also found a structured period distribution within the order region.

PT116 - The method of separation of variables for the Frobenius-Perron operator for a class of two dimensional chaotic maps

Jose Luevano, Universidad Autonoma Metropolitana, Unidad Azcapotzalco, Mexico.

Abstract. Analytical expressions for the invariant densities for a class of discrete two dimensional chaotic systems are given. The method of separation of variables for the associated Frobenius-Perron equation is introduced. Hence, a two dimensional chaotic system can be decoupled in two chaotic one dimensional systems. These systems are related to nonlinear difference equations which are of the type $x_{n+2}=T(x_{n})$. The function T is a chaotic map of an interval whose chaotic behaviour is inherited to the two dimensional one. The efficacy of the method appears to be independent of the hyperbolicity of the map T, i.e. if the map display full chaos or intermittency. We work out in detail some examples, including some three and higher dimensional cases, in order to expose the method.

PT117 - Transport Properties in an open system

Marla Heckler, Universidade Federal do Rio Grande do Sul, Brazil
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Sandra Prado, Universidade Federal do Rio Grande do Sul, Brazil.

Abstract. We study the conductance fluctuations of Mesoscopic Systems for which semiclassical approximations are useful tools. These systems can exhibit integrable, chaotic or mixed dynamics in the classical limit. Our numerical results, using open maps, indicate a strong relation between the conductance and the underlying classical dynamics.

PT118 - The electronic bouncing ball circuit in a communication system

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Cleber Oliveira, State University of Londrina, Brazil
José Carlos Pizolato Junior, Universidade Estadual de Londrina, Brazil.

Abstract. In the literature there are several electronic circuits which can be used to generate chaotic signals for applications in communication systems. Some examples are the Chua´s circuit, the Lorenz-based chaotic circuit, the chaotic Rössler circuits and the particle in a box electronic circuit. In this work, the electronic bouncing ball circuit is applied in a communication system. In this case, the error feedback synchronization between two coupled chaotic systems (transmitter and receiver) is used to implement a security communication system. The scheme proposed was simulated and the results were discussed.

PT119 - Cryptography with chaos using Chua's attractor

Cleber Oliveira, State University of Londrina, Brazil
José Carlos Pizolato Junior, Universidade Estadual de Londrina, Brazil.

Abstract. Chaotic systems have been applied in data cryptography due to the random behavior obtained through algebraically simple functions. This paper aims to investigate the efficiency of Chua''s chaotic system appliance in an algorithm of information cryptography.

PT120 - Acoustic signal characterization of a ball milling machine model

J. Alexis Andrade-Romero, Jesus Franklin Andrade Romero, Universidade Federal do ABC, Brazil
Mauricio Améstegui Moreno, Universidad Mayor de San andrés, Brazil.

Abstract. An improvement estimation procedure for the resistance to degradation, in a ball milling machine of smaller scale, is presented. More precisely, is proposed a pattern identification strategy of the acoustic signal for estimating the resistance percentage, using a simplified chaotic model and the continuous wavelet transform.

PT121 - Statistical Study of logistic Map Orbits In None Chaotic And Chaotic Orbits

Roja Norouzie, University of Kermanshah, Iran.

Abstract. The average and standard deviation plots of the orbits are plotted versus different initial values for some selected control parameters. For the control parameters which the system bifurcates, there is a similarity between the average and the standard deviation plots. The plots loss their smoothness when the bifurcation proceeds. At the start of chaotic state, the curves have a vertical symmetry line.

PT122 - Asymptotic approach for the nonlinear equatorial long wave interactions

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Abstract. In the present work we use an asymptotic methods to obtain the long wave approximation as a limiting case of a more general equation that includes the equatorial $\\beta$-plane shallow water equation. The transformation of one regime to another is

controled by an external parameter ``$\\delta$''. The $\\delta \\to 1$ limit correspond to the shallow-water equation, whereas $\\delta \\to 0$ refers to the long wave approximation regime. Any value in between correspond to intermediate states. We use small but finite values of $\\delta$ with the aim of not to filtering out any of the waves while keeping long wave like effects. With this approach we have studied the nonlinear energy exchange. It was verified in both theoretical framework and in numerical experiments that the period of the energy modulations associated with the nonlinear triad interactions increases as $\\delta$ decreases.

PT123 - Scaling properties for a family of stadium-like billiards with parabolic boundaries

André Livorati, UNESP - Rio Claro, Brasil, Brazil.

Abstract. Some chaotic properties of a family of stadium-like billiards with parabolic focusing components, which is described by a two-dimensional nonlinear area-preserving map, are studied. Critical values of billiard geometric parameters corresponding to a sudden change of the maximal Lyapunov exponent are found. It is shown that the maximal Lyapunov exponent obtained for chaotic orbits of this family is scaling invariant with respect to the control parameters describing the geometry of the billiard.

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