3rd International Conference on Dynamics, Games and Science

DGS III 2014 - International Conference on Dynamics, Games and Science III

17 - 21 February 2014

University of Porto — Portugal

Keynote Speakers

Alberto Álvarez López, UNED, Spain
Alberto Pinto, University of Porto, Portugal
Athanasios Yannacopoulos, Athens University of Economics and Business, Greece
Bruno Oliveira, INESC TEC, Portugal
Carlos Braumann, University of Evora, Portugal
Charles Pugh, U.C. Berkeley, USA)
David Zilberman, University of California, USA
Diogo Pinheiro, Brooklyn College, USA
Elvio Accinelli, UASLP, Mexico
Filipe Martins, INESC TEC, Portugal
Flávio Ferreira, ESEIG, Polytechnic Institute of Porto, Portugal
Frank Riedel, Bielefeld University, Germany
Isabel Labouriau, University of Porto, Portugal
Jérôme Renault, Université de Toulouse, France
João Gama, University of Porto, Portugal
João Paulo Almeida, INESC TEC, Portugal
Jorge M. Pacheco, University of Minho
José Fernando Oliveira, University of Porto / INESC TEC, Portugal
José Martins, INESC TEC, Portugal
Marta Faias, NOVA University of Lisbon, Portugal
Mohammad Choubdar Soltan Ahmadi, University of Porto, Portugal
Nico Stollenwerk, University of Lisbon, Portugal
Onesimo Hernandez-Lerma, CINVESTAV-IPN, Mexico
Penelope Hernandez, University of Valencia, Spain
Rabah Amir, University of Arizona, USA
Renato Soeiro, University of Porto, Portugal
Robert MacKay, University of Warwick, UK
Rolf Jeltsch, ETH Zurizh, Switzerland
Sebastian van Strien, Imperial College London, UK
Tenreiro Machado, ISEP, Portugal

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Keynote Speakers
Thematic Sessions
Book of Abstracts
Conference Schedule

Welcome letter to the participants

The 3rd International Conference Dynamics, Games and Science 2014 - DGS III 2014, on the occasion of the 50th birthday of Alberto A. Pinto, aims to bring together world top researchers and practitioners from the fields of Artificial Intelligence, Data Analysis, Dynamical Systems, Game Theory, Mathematical Finance, Optimization and Stochastic Optimal Control, and its applications to such areas as Biology, Economics, Engineering, Energy, Natural Resources and Social Sciences.

The conference will close with a Pedro Nunes Lecture titled "A Geometric Approach to the Landau-Ramanujan Function of some Diophantine Equations", which will be delivered by Charles Pugh.
Pedro Nunes Lectures are organized jointly by the Portuguese International Center of Mathematics - CIM, and the Portuguese Mathematical Society - SPM.

Participants are welcome to submit survey/expository papers of their presentations to a forthcoming volume to be published by Springer: Modeling, Dynamics, Optimization and Bioeconomics II, edited by Alberto Pinto and David Zilberman. This volume will be based on peer review selected works, presented in this conference and in the Berkeley Bioeconomy Conference 2014.

We thank and wish all keynote speakers, thematic session organizers, invited speakers and participants a fruitful meeting,

The Organizing Committee

Venues

The International Conference, 17-21 February 2014 is hosted at the main building of the University of Porto, Portugal

Sponsors

These activities are enthusiastically supported and co organized by the Laboratory of Artificial Intelligence and Decision Support – Institute for Systems and Computer Engineering (LIAAD-INESC TEC), Fundação para a Ciência e a Tecnologia (FCT), in particular PEst program FCOMP-01-0124-FEDER-037281, and the "Dynamics and Applications" project PTDC/MAT/121107/2010 and FCOMP-01-0124-FEDER-020871, the University of Porto (Reitoria, Mathematics Department, Faculty of Science, IJUP, UP-USP program), Centro Internacional de Matemática (CIM) and Devscope.

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- Maurício Peixoto, IMPA, Brazil
- Michel Benaïm, University of Neuchatel, Switzerland
- Saber Elaydi, Trinity University, USA

Thematic Sessions

Bayesian Statistics
Organizer / Chairman: *Isabel Pereira*
Universidade de Aveiro, CIDMA

Speakers:
- Marília Antunes, CEAUL and DEIO-FCUL, University of Lisbon, *"Modelling the abundance of Culex pipiens in Portugal in a bayesian perspective"*
- Patricia de Zea Bermudez, CEAUL and DEIO-FCUL, University of Lisbon, *"Parameter Estimation of Bilinear Processes using Approximate Bayesian Computation"*
- Sandra Ramos, Polytechnic Institute of Oporto, CEAUL, *"Nonparametric Bayesian Models in Screening Problems"*
February 17th, 11:30-12:30, Room 2

Dispersive equations and mean-field models
Organizer / Chairman: *Edgard Pimentel*
CAMGSD-IST-UTL

Speakers:
- Edgard Pimentel, CAMGSD-IST-UTL, *"Regularity for mean-field games systems"*
- Mahendra Panthee, IMECC-UNICAMP, Brazil, *"Sharp local well-posedness of KdV type equations with dissipative perturbations"*
- Joaquim Correia, Universidade de Évora, *"Zero limit of dispersive-dissipative perturbed hyperbolic conservation laws"*
February 17th, 11:30-12:30, Room 3

Dynamic Equations on Time Scales
Organizer / Chairman: *Delfim F. M. Torres*
University of Aveiro

Speakers:
- Monika Dryl, University of Aveiro, *"Direct and Inverse Problems of the Calculus of Variations on Time Scales"*
- Artur M. C. Brito da Cruz, Escola Superior de Tecnologia de Setúbal, *"A time-scale fractional calculus"*
- Natália Martins, University of Aveiro, *"Extension of Noether's Second Theorem to Variational Problems on Time Scales"*
- Malgorzata Guzowska, University of Szczecin, *"Calculus of variations on time scales: applications to economic models"*
- Susana Pinheiro, University of Porto, *"On a stochastic logistic growth model with predation and power-type diffusion coefficient: dynamics and optimal harvesting"*
February 17th, 14:15-16:30, Room 2

Optimization and Dynamical Systems on Manifolds
Organizer / Chairman: *Fátima Silva Leite and Luís Machado*
Fátima Silva Leite (Department of Mathematics and Institute of Systems and Robotics (ISR), University of Coimbra) / Luís Machado (Department of Mathematics, University of Trás-os-Montes e Alto Douro (UTAD) and Institute of Systems and Robotics (ISR), University of Coimbra)

Speakers:
- Luís Machado, UTAD & ISR, *"Function approximation on the SPD manifold"*
- Sandra Ricardo, UTAD & ISR, *"Linearization of mechanical control systems"*
- Fernando Louro, , *"Explicit controllability of rolling spheres in higher dimension"*

- Fátima Pina, Department of Mathematics, University of Coimbra, *"Rolling the essential manifold"*
- Fátima Silva Leite, DMUC and ISR - University of Coimbra, *"Rolling motion of ellipsoids - constructive proof of controllability"*
February 17th, 14:15-16:30, Room 3

Applied Game Theory
Organizer / Chairman: *Joana Becker*
University of Porto

Speakers:
- Pedro Sousa, University of Porto, Faculty of Law and School of Criminology, *"Game Theory in Criminology – Discussions on the efficacy of crime deterrence instruments"*
- Saeed Banihashemi, Imam Hossein University, *"Application of games theory on international relations"*
- Victor Maia Senna Delgado, Universidade Federal de Ouro Preto, *"A study on the relationship between student allocation and proficiency in Belo Horizonte, Brazil"*
February 18th, 11:30-12:30, Room 2

Data Sciences
Organizer / Chairman: *João Gama*
INESC TEC

Speakers:
- Luis Moreira-Matias, Instituto de Telecomunicações, *"Time-Evolving O-D Matrix Estimation using high-speed GPS data streams"*
- Alexandre Faria de Carvalho, INESC TEC, *"Regression. A Perspective on Latent and Canonical Variables."*
- Vânia Maria Gomes de Almeida, INESC TEC, *"Finding Time Series Motifs in Wind Power Generation"*
February 18th, 11:30-12:30, Room 3

Applications of Operations Research in Industry and Services
Organizer / Chairman: *José Fernando Oliveira*
University of Porto

Speakers:
- Teresa Bianchi-Aguiar, INESC TEC, Faculty of Engineering, University of Porto, *"Applying Optimization Methods in the practice of Shelf Space Management at a Portuguese Retail Chain"*
- Diana Yomali Ospina, INESC TEC, Faculty of Engineering, University of Porto, *"Coffee aggregate production planning"*
- Elsa Silva, INESC TEC, Faculty of Engineering, University of Porto , *"Integrated cutting and production planning in a home textile manufacturing company"*
- Sam Heshmati, INESC TEC, Faculty of Engineering, University of Porto, *"An Agent-based Approach to Schedule Crane Operations in Rail-Rail Transshipment Terminals"*
February 18th, 14:15-16:30, Room 2

Micro and macroeconomic implications of some dynamic models
Organizer / Chairman: *Alberto A. Álvarez López*
UNED

Speakers:
- Manuel J. Sánchez, UNED, *"Modern Forecasting of NOEM Models"*
- Ramón Miralles Rafart , UNED, *"A model of optimal taxation under uncertainty"*
- Eduardo Oliva, UNED, *"Statistical Properties of Coordination failures"*
- Alberto A. Álvarez-López, UNED, *"Adjusting Non-Durable and Durable Consumption Models with*

Habits"
February 18th, 14:15-16:30, Room 3

Oligopoly Theory
Organizer / Chairman: *Bruno Oliveira*
University of Porto, INESC TEC

Speakers:
- Flávio Ferreira, ESEIG, Polytechnic Institute of Porto, *"Patent licensing schemes in an international competition"*
- Electra Petracou, Department of Geography, University of the Aegean (Greece), *"Migration modelling: A socio-economic perspective"*
- Bruno Oliveira, University of Porto / INESC TEC, *"Cournot duopolies with R&D investment"*
February 19th, 11:30-12:30, Room 2

Dynamics, Computation and Combinatorics
Organizer / Chairman: *João Paulo Almeida*
LIAAD - INESC TEC and Instituto Politécnico de Bragança

Speakers:
- Mário Abrantes, Instituto Politécnico de Bragança, *"Reasoning in Contradictory Contexts with Logic Programming"*
- Inês Barbedo, CIDMA, Department of Mathematics, University of Aveiro and Instituto Politécnico de Bragança, *"Regular exceptional graphs and equitable partitions"*
- Maria F. Pacheco, CIDMA, University of Aveiro and Instituto Politécnico de Bragança, *"Determination of (0,2)-regular sets in graphs and applications"*
- João Paulo Almeida, LIAAD - INESC TEC and Instituto Politécnico de Bragança, *"Anosov diffeomorphisms and Tilings"*
- Carlos Balsa, Instituto Politécnico de Bragança, *"Inexact Subspace Iteration to Accelerate the Solution of Linear Systems with Multiple Right-Hand Sides"*
- Rui Gonçalves, LIAAD INESC TEC e Universidade do Porto, *"Modeling errors in temperature forecasts"*
- Luis M. Mesquita, Instituto Politécnico de Bragança, *"Modelling of Intumescent Coatings Kinetics and Dynamics of Swelling"*
- Luís António de Almeida Vieira, Center of Research of Mathematics of University of Porto (Portugal), *"Alternating Hadamard Series and Some Theorems on Strongly Regular Graphs"*
February 18th, 14:15-16:30, Room 2

Dynamics
Organizer / Chairman: *Renato Soeiro*
INESC TEC, University of Porto

Speakers:
- Mohiniso Hidirova, Centre for the development of software and hardware program complexes at Tashkent University of Informational Technologies, Uzbekistan, *"Regulatorika of excitable media"*
- Agustin Perez-Barahona, INRA and Ecole Polytechnique (France), *"Environmental Pollution and Biodiversity: Light Pollution and Sea Turtles in the Caribbean"*
- Marek Lampart, Dept. of Applied Mathematics & IT4Innovations, Technical University of Ostrava, *"Nontrivial dynamics of Laplacian-type coupling systems"*
- Juliana Pimentel, IST - Universidade de Lisboa, *"Asymptotic behavior of a non-dissipative scalar parabolic PDE"*
February 18th, 14:15-16:30, Room 3

Dynamic Games
Organizer / Chairman: *Ricardo Cruz*

INESC TEC, University of Porto

Speakers:
- Mohammad Choubar, INESC TEC, University of Porto, *"Stationary Sunspot Equilibrium as Limit of Expectations Coordination Failures"*
- Miguel Arantes, University of Porto, *"Look a STress"*
- Ricardo Cruz, INESC TEC, University of Porto, *"Testing universality in complex systems"*
- Filipe Martins, INESC TEC, *"Optimal Stochastic Control of Life Insurance and Investment strategies"*
- Renato Soeiro, INESC TEC, University of Porto, *"A social Bayesian game"*

February 19th, 11:30-12:30, Room 2

Nonlinear time series models applied to economics
Organizer / Chairman: *Diana Mendes, Vivaldo Mendes*
ISCTE-IUL

Speakers:
- Ana Maria Guedes, ISCAP, IPP, *"Is the Iberian Electricity Market Chaotic? Characterization and Prediction with Nonlinear Methods"*
- Pedro Fortes Ferreira, ISCTE-IUL, TBA, *"A New Mixed Method to Select Non-Linear Complex Time Series"*
- Telma Gonçalves, ISCTE-IUL, TBA, *"Nonlinear Fiscal Multiplier: Evidence From Portugal"*
- Diana Mendes, ISCTE-IUL, *"Volatility and Risk Estimation with Nonlinear Methods"*
- Monica Isfan, INE, *"Forecasting Financial Time Series by Using Artificial Neural Networks"*

February 20th, 14:15-16:30, Room 2

Knowledge Discovery
Organizer / Chairman: *Orlando Gomes*, ISCAL-IPL, and *Luís Cavique*, Universidade Aberta

Speakers:
- Jorge Santos, Univ. Évora, *"Discovering Clusters with Data Envelopment Techniques"*
- Armando Mendes, Univ. Açores, *"Decision Support in an e-Government Environment"*
- Luís Cavique, Univ. Aberta, *"A Data Analysis Graph Based Algorithm"*
- Orlando Gomes, ISCAL, *"Sentiment Cyclicality"*

February 21th, 11:30-12:30, Room 2

Philosophy, Science and Social Science
Organizer / Chairman: *António Machuco Rosa*, University of Portó, and *Joaquim M. C. Correia*, University of Evora

Speakers:
- Sofia Miguens, University of Porto, *"What should we believe? Epistemological questions and research on cognition"*
- João Alberto Pinto, University of Porto, *"To lie or not to lie"*
- J.C. Tiago de Oliveira, DMAT-UE & CFCUL, *"Bata satas batas baua - a cooperant's apology (Invited Talk)"*
- António Machuco Rosa, University of Porto, CETAC Media, *"Dynamical Systems and Sacrificial Crisis in Anthropology"*
- Carlos J.S. Alves, Dep. Matemática, Instituto Superior Técnico, Univ. Lisboa, *"Causation and emergence, finite and infinite settings"*
- Joaquim M.C. Correia, DMat e CIMA, ECT, UÉvora & CAMGSD-IST, *"Modelling with PDEs"*

February 21th, 11:30-12:30, Room 3

Complexity and nonlinear dynamics
Organizer / Chairman: *Carlos Ramos*

Universidade de Évora

Speakers:

- Luis Bandeira, Universidade de Évora, *"On certain infinite dynamical systems"*
- Carlos Ramos, Universidade de Évora, *"Regulatory systems"*
- Ricardo Severino, Universidade do Minho, *"On the cellular automata classification"*

February 21th, 14:15-15:15, Room 2

Fluid Dynamics and Numerical Semigroups

Organizer / Chairman: *Sara Fernandes*
Universidade de Évora

Speakers:

- Marilia Pires, Universidade de Évora, *"A traceless variant of the Johnson-Segalman viscoelastic model"*
- Denise Torrão, Universidade de Évora, *"On the enumeration of the set of saturated numerical semigroups of a given genus"*
- Sajjad Hossain, Universidade de Évora, *"Flows of Oldroyd-B Fluids in 2D Geometries"*

February 21th, 15:30-16:30, Room 2

Statistical and mathematical models in plant ecology and forestry

Organizer / Chairman: *Luís Silva*
CIBIO/InBIO, Universidade dos Açores, Departamento de Biologia

Speakers:

- Joana R. Vicente, CIBIO/INBIO, *"Applications of ecological models to assess biological invasions, rare species conservation, and habitat quality of forest ecosystems in a rapidly changing world"*
- Luís Silva, CIBIO/INBIO, *"Using Bayesian inference to determine plant community assemblages and indicator species"*
- Abílio Pereira Pacheco, FEUP, *"The Forest of Forking Paths: an integrated landscape intra-annual optimization model, considering escape and suppression costs"*
- Ana Sofia Lino Vaz, Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto (CIBIO)/InBIO, *"Disentangling tree assemblages towards point patterns analysis: Implementing spatially explicit models in forest habitats"*
- Brigite Botequim, Instituto Superior de Agronomia, *"Tools for creating fire-resistant landscapes in Portuguese ecosystems"*
- Lurdes Silva, CIBIO/INBIO, *"Development of biomass estimation models for management of exotic woodland in the Azores"*
- Lara Silva, CIBIO/INBIO, *"Species distribution models in forestry"*

February 21th, 14:15-16:30, Room 3

Regular exceptional graphs and equitable partitions

Inês Barbedo [1,*], Domingos M. Cardoso and Paula Rama
[1] CIDMA, Department of Mathematics, University of Aveiro and Instituto Politécnico de Bragança
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We propose a recursive technique to construct families of regular graphs, where graphs are extended by (k,t)- regular sets . The process of extending a graph is reduced to the construction of the incidence matrix of a combinatorial 1-design, and these extensions induce a partial order. We apply this new technique to construct all regular exceptional graphs, considering the fact that regular excepcional graphs admit an equitable partition which mantains the (k,t)-regular set introduced along a chain of graphs obtained recursivelly and several rules to reduce the production of isomorphic graphs. Based on this recursive construction we present an algorithm and the Hasse diagram of the poset.

Determination of $(0,2)$-regular sets in graphs and applications

Maria F. Pacheco [1,*] , Domingos Cardoso and Carlos Luz
[1] CIDMA, University of Aveiro and Instituto Politécnico de Bragança
*pacheco@ipb.pt

A (k,τ)- regular set in a graph is a subset of vertices inducing a k-regular subgraph and such that each vertex not in the set has exactly τ neighbours in it. We will present a new algorithm for the determination of $(0,2)$- regular sets as well as its application to the determination of maximum matchings in arbitrary graphs.

Anosov diffeomorphisms and Tilings

João Paulo Almeida [1,*] and Alberto A. Pinto
[1] LIAAD - INESC TEC and Instituto Politécnico de Bragança
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Inspired in the works of Y. Jiang and A. Pinto and D. Sullivan, A. Pinto et al. introducedthe notion of golden tiling and proved the existence of a natural correspondence between golden tilings, smooth conjugacy classes of Anosov diffeomorphisms with invariant measure absolutely continuous with respect to Lebesgue measure and solenoid functions. Here we extend their result and introduce the notion of γ-tiling. Like the golden tilings, the γ-tilings record the infinitesimal geometric structure determined by the dynamics of an Anosov diffeomorphism G along the unstable leaf that is invariant under the action of G. The properties of γ-tilings are defined using a decomposition of natural numbers that we call γ-Fibonacci decomposition. The main contribution of this work consists in understanding the way how this γ-Fibonacci decomposition encodes the combinatorics determined by the Markov partition of G along the unstable leaf. Our goal is to exhibit a natural correspondence between γ-tilings, smooth conjugacy classes of Anosov diffeomorphisms with invariant measure absolutely continuous with respect to Lebesgue measure and solenoid functions.

Inexact Subspace Iteration to Accelerate the Solution of Linear Systems with Multiple Right-Hand Sides

Carlos Balsa [1,*]
[1] Polytechnic Institute of Bragança
*balsa@ipb.pt

We analyze the convergence and propose some strategy to monitor an inexact subspace iteration type of algorithm called BlockCGSI. This algorithm is purely iterative and combines the block

Conjugate Gradient (blockCG) algorithm with the Subspace Iteration. We proceed to an inner-outer convergence analyze and exploit the possibility of reducing the total amount of computational work by controlling the accuracy during the solution of linear systems at each inverse iteration.The proposed method can be adequate for large scale problems where we need to solve consecutively several linear systems with the same coefficient matrix (or with very close spectral properties) but with changing right-hand sides. The BlockCGSI algorithm can be used to compute some spectral information, which is then used to remove the effect of the smallest eigenvalues in two different ways: either by building a Spectral Low Rank Update (SLRU) preconditioner that basically adds the value 1 to these eigenvalues, or by performing a deflation of the initial residual in order to remove part of the solution corresponding to the smallest eigenvalues. Both techniques can reduce substantially the total number of iterations and computational work in each subsequent runs of the Conjugate Gradient algorithm.

Modeling errors in temperature forecasts

Rui Gonçalves [1,*]

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A random variable with a symmetry coefficient and kurtosis coefficient close to 0 and 3, respectively, is called nearly Gaussian. In order to find out if a random variable is nearly Gaussian we start first to test for Gaussianity. For that purpose one can use several goodness-of-fit tests. For the modelling of nearly Gaussian variables one should consider other symmetrical distributions or, to consider a simple data transformation. If a set of data is nearly Gaussian then, a power transformation $Y = X^c$, where $c = (2k+1)/(2j+1)$, with c close to 1, can transform the data to Gaussianity. This transformation should be bijective and is related to the well-known Box-Cox transformation. Hence, if the transformed data Y is approximately Gaussian then $X = Y^{(1/c)}$ will be the power transformation of a Gaussian variable. We can obtain a mathematical formula for both first order ordinary moment and Kurtosis of a zero mean Gaussian variable. This property of the Gaussian distribution allows relating the Kurtosis coefficient to the value of the exponent $1/c$. Therefore, for each nearly Gaussian data set, it is possible to identify an exponent that transforms it to Gaussianity. We apply this method to model the errors of predicted maximum and minimum temperatures in the city of Porto on the year 2011.

Modelling of Intumescent Coatings Kinetics and Dynamics of Swelling

Luis M. Mesquita [1,*], Paulo A.G. Piloto [1] and Mário A.P. Vaz [2]

[1] Polytechnic Institute of Bragança

[2] University of Porto

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Intumescent coatings are reactive fire protection materials used to protect structural elements, increasing the fire resistance time and the structural integrity of the building for a standard period of time. During the fire exposure the intumescent paint start to decompose, beginning to melt, bubble and to swell, forming a multi-cellular charred layer which decreases the heat transfer from the fire to the substrate. The process is highly non-linear and geometrically characterized by a free boundary, in contact with the fire gases, and a moving boundary, that divides the char and the virgin layers, which may be considered a generalized Stefan problem.The intumescent coating behaviour is based on the energy and mass conservation equations for the gas and solid fractions, and the transport of gas through the porous char by empirical Darcy's law. The numerical method is based on an approximation by finite differences with local and adaptive space refinement (r-h), with a decoupled time evolution of the energy and mass equations by the method of lines (MOL).The methodology is applied to the one-dimensional two-phase Stefan problem and the viscid Burger equation. The results presented shows the mesh adaptation to the solution, increasing or decreasing the number of nodes with the "error" estimation. Also a comparison of expansion and temperature between