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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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Regular exceptional graphs and equitable partitions

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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

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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

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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

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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

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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

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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