Exclusive partner

ICMAT
INSTITUTO DE CIENCIAS MATEMÁTICAS

Fundación BBVA

BOOK OF ABSTRACTS

BYMAT

Bringing Young Mathematicians Together

ICMAT, 7-9 May 2018 (Madrid, Spain)

www.icmat.es/congresos/2018/BYMAT/

GOBIERNO DE ESPAÑA · MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD · CSIC · UAM UNIVERSIDAD AUTÓNOMA DE MADRID · excelencia UAM CSIC · UNIVERSIDAD COMPLUTENSE MADRID · EXCELENCIA SEVERO OCHOA

Acknowledgments

First and foremost, the BYMAT Organizing Committee would like to express our heartfelt gratitude to everyone who has been a part of this conference. We never could have imagined that our modest initiative to gather young mathematicians to share ideas would lead to hundreds of people from all over the world taking an interest in the event! We really hope the conference met your expectations - it certainly exceeded ours and we're proud to have made so many new friends in such a short time.

While we can't mention everyone who contributed to the conference (it's a vast number!), we are especially indebted to the following people:

The Institute for Mathematical Sciences (ICMAT-CSIC-UAM-UC3M-UCM) and the Severo Ochoa programme provided great support and all its staff were enormously helpful. Most especially, Manuel de León and Patricia Benito provided invaluable advice and put us in touch with Fundación BBVA and many of the invited speakers. Our webmaster, Eduardo de Córdoba, worked tirelessly to accommodate all of our requests. Special thanks also go to Ágata Timón and Laura Moreno for their help and advice with everything related to promotions and advertising, and to our friends and colleagues who dealt with a large part of the logistics during the conference: they are Víctor Gallego, Manuel Lainz, Pablo Linares, Jesús Llorente, Alberto Redondo, Elena Salguero and David Trillo. Our logo was designed by Cristina Borreguero and translation for one of the workshops was provided by Clara Cantos.

The Fundación BBVA team were key to the success of the conference. We were able to offer travel grants, coffee breaks, promotional material, etc. thanks to their exclusive partnership. Their communication office staff, Silvia Churruca, Pablo Jáuregui and Mónica González Salomone, gave us incredible visibility. Laura Poderoso's swiftness deserves a mention. Rafael Pardo, the Director of the Fundación BBVA, made possible their exclusive partnership.

Of course, we must thank all of the speakers: parallel sessions, plenary talks, workshops and roundtable discussion. And last, but by no means least, our participants: thank you for your time and energy. Without you, the First BYMAT Conference would not have taken place!

Welcome

Welcome to the "1st BYMAT Conference: Bringing Young Mathematicians Together". This conference aims to:

- Strengthen the links between PhD students in mathematics across all disciplines.
- Provide an open space so researchers in the early stages of their career can present their work to peers of similar experience.
- Enhance the communication skills of young mathematicians.
- Encourage researchers of different institutions to start building a network of contacts soon into their careers.
- Showcase the broad range of career options available for a mathematics PhD graduate in and outside of academia.

Plenary Sessions

Mathematical theory of incompressible fluids.

Ángel Castro (ICMAT-CSIC)

Monday 7 9:30 • Assembly Hall

Abstract: In this talk we shall present some equations related with the motion of incompressible fluids. Our interest will be focus on the study of the formation of singularities. There will be neither proofs nor estimates just an overview of some classical results concerning the regularity of incompressible flows and an presentation of the kind of problems we are dealing with.

Connections between tensor norms and physical models

Carlos Palazuelos (ICMAT-UCM)

Monday 7 14:30 • Assembly Hall

Abstract: In this talk we will explain how the theory of tensor norms in Banach spaces appears naturally in the study of different physical models. This will motivate us to look at some problems in the theory of Banach spaces and in this talk we will present some recent results about them.

On primes of bad reduction for CM curves of genus 3

Elisa Lorenzo (Université de Rennes 1)

Tuesday 8 9:30 • Assembly Hall

Abstract: Elliptic curves (curves of genus 1) are behind many crypto-systems: we can find them in the Spanish electronic ID, in the encryption of WhatsApp conversations, in the security of bitcoins, etc. In this talk we will discuss the construction of useful curves of genus 3 for cryptography. Besides the multiple applications described before, in this talk we will mainly focus on the theoretical aspects of the construction of these curves.

Faster SVM hyper-parameter search via conjugate SMO

Alberto Torres Barrán (ICMAT-CSIC)

Wednesday 9 9:30 • Assembly Hall

Abstract: Conjugate Gradient Descent is a classic acceleration technique that is able to improve the convergence of Gradient Descent by adding a momentum term. In this work we review the classic optimization theory and explore adding the same momentum term to the SMO algorithm, which is the state-of-the-art solver for both non-linear SVC and SVR. Experiments comparing standard SMO and Conjugate SMO are carried out, both in terms of iterations and execution time. We also try to get insight on what type of problems the conjugate version is able to obtain a meaningful advantage. Finally we explore a hyper-parametrization setting, where we care not only about solving a single model but also about searching for the best C, gamma and epsilon values in a grid.

Canonical metrics in complex geometry

Mario García Fernández (ICMAT-UAM)

Wednesday 9 14:30 • Assembly Hall

Abstract: As in the case of smooth manifolds, complex manifolds are locally modelled on complex n-space and, consequently, they have no local invariants. A natural question is to ask whether a complex manifold admits a canonical metric, adjusted to the holomorphic structure and distinguished by natural conditions on the Ricci tensor, which endowes the manifold with a preferred shape. In this talk I will overview the history of this question, from the classical Uniformization Theorem on Riemann surfaces, to the modern theory of Kähler-Einstein metrics and Calabi-Yau manifolds, and its relation to the open classification problem of complex non-Kähler manifolds.

Transversal activities

Communication Skills Workshop

- Juan Gómez, Head of Communication and Public Relations, COTEC
- Translation provided by Clara Cantos Delgado

Project Management Workshop

- Victoria Ley (Head of the Coordination, Evaluation, and Scientific and Technical Monitoring - National Research Agency)

Roundtable discussion

- Miguel Domínguez (Marie Skłodowska-Curie fellow at ICMAT-CSIC)
- Marta Lamela, Data Scientist BBVA (Data & Analytics)
- Javier Martín Hernández (Aeroengy)
- Carlos Martín Vide (European Research Council Executive Agency, ERCEA)
- Carlos Vinuesa (I.E.S. Villa de Valdemoro)
- Moderator: Manuel de León (Research professor at ICMAT-CSIC)

Parallel Sessions

Monday 7

Assembly Hall

11:00 Aitor Couce Vieira (ICMAT): *Decision models for cybersecurity risk analysis*

11:25 Liu Si (ICMAT): *Affective decision making models with applications to social robotics*

11:50 Iván Giménez Palacios (Universitat de València): *Improving the efficiency and stability of iterative methods for solving nonlinear problems*

16:35 Pedro García Segador (Instituto Nacional de Estadística): *Sampling fuzzy measures uniformly. Approach through linear extensions.*

17:00 Ahbli Khalid (Ibn Zohr uiversity, faculty of sciences): *A generating function and formulae defining the first-associated Meixner-Pollaczek polynomials*

17:25 Alejandro Silva Bernárdez (Escuela Técnica Superior de Ingenieros Industriales): *Model-Based Evaluation of Signal Processing Algorithms for the Detection of Rub in Aeroderivative Ga*

Blue Room

11:00 Pablo Manuel Berná Larrosa (Universidad Autónoma de Madrid): *Some new advances in greedy approximation theory*

11:25 Pablo José Gerlach Mena (Universidad de Sevilla): *Algebraic structures and modes of convergence*

11:50 Diego Martínez (UC3M-ICMAT): *Amenability in (Semi)-Groups and Algebras*

12:15 Hernán Javier Cabana Méndez (ucm): *On a problem by V.I. Gurariy concerning subspaces of continuous functions*

16:35 Eva Primo Tárraga (Universitat de València): *Fourier Integral Operators on weighted modulation spaces*

17:00 Alberto Rodríguez Arenas (Universitat Politècnica de València): *Ergodic properties of the multiplication operator*

17:25 Aleksander Marcin Kubicki (Universidad de Valencia): *A quantitative no-programming theorem*

17:50 David García-García (GFM - Universidade de Lisboa): *Toeplitz matrices, Schur polynomials and group integrals*

Orange Room

11:00 David Iglesias López (Universidad de Murcia): *On discrete versions of Brunn-Minkowski type inequalities*

11:25 Manuel Mellado (Universidad Autónoma de Madrid): *Points in convex figures*

11:50 Antonio Luis Martínez Triviño (Differential Geometry): *Stable regions in a Euclidean ball of* $\mathbb{R}^3$

12:15 Erik Sarrión Pedralva (Universitat Jaume I): *Parabolicity of the Riemannian product of rotationally symmetric spaces*

16:35 Olga Pérez-Barral (Universidade de Santiago de Compostela): *Ruled hypersurfaces with constant mean curvature in complex space forms are minimal*

17:00 Antonio Bueno (Universidad de Granada): *Prescribed mean curvature surfaces in* $\mathbb{R}^{n+1}$

17:25 Jesús Castro Infantes (Universidad de Granada): *Minimal surfaces with finite total curvature in* $\mathbb{H}^2 \times \mathbb{R}$

17:50 José Antonio Sánchez Pelegrín (Universidad de Granada): *From the minimal to the maximal surface equation in certain ambient manifolds*

Red Room

11:00 Juan Carlos Felipe Navarro (BGSMath - Universitat Politècnica de Catalunya): *Liouville type results for fractional Schrödinger operators in 1D*

11:25 Tomás Sanz-Perela (Universitat Politècnica de Catalunya): *Integro-differential Allen-Cahn equations: the saddle-shaped solution*

11:50 Jorge Cayama (Universidad del País Vasco): *A pseudo-spectral method for the fractional Laplacian on R*

12:15 Marta de León Contreras (Universidad Autónoma de Madrid): *Weighted mixed-norm Sobolev estimates for solutions of some parabolic equations.*

16:35 José Manuel Uzal (Universidade de Santiago de Compostela): *Periodic solutions of state-dependent impulsive differential equations*

17:00 Víctor Arnaiz (ICMAT): *The KAM theorem in the semiclassical limit*

17:25 Òscar Rodriguez (Universitat Politècnica de Catalunya): *Ejection-collision orbits in the RTBP*

17:50 Nada TASSI (University Mohammed 5. Rabat-Morroco): *Mathematical modeling and homogenization for nonlinear behavior of reinforced piezoelectric composites*

Grey Room 1

11:00 Daniel Wysocki (University of Warsaw): *Classification of three-dimensional real coboundary Lie bialgebras*

11:25 Alessandro Malusà (QGM – Aarhus University): *Higgs bundles, flat connections, and quantum operators for Chern-Simons theory*

11:50 Ángel González-Prieto (Universidad Complutense de Madrid): *Field theory and quantisation of Hodge structures*

12:15 Lucía Martín Merchán (Universidad Complutense de Madrid): *Spin(7) structures from an spinorial viewpoint*

16:35 Juan de Dios Diaz-Ramírez (Universidad de Cádiz): *Characterizing proportionally modular affine semigroups*

17:00 XUAN KIEN Phung (IRMA-University of Strasbourg, France): *Siegel's theorem for integral points on curves*

17:25 Eduard BALZIN (Ecole Polytechnique): *Families of categories in geometry, algebra, and homotopy theory*

17:50 Julia Ramos González (Universiteit Antwerpen): *Grothendieck categories as a bicategory of fractions of linear sites*

Tuesday 8

Assembly Hall

11:00 Antonio Jiménez Pastor (Research Institute for Symbolic Computation (RISC)): *Extending the holonomic universe: DD-finite functions and Automated identities proofs*

11:25 Alicia Quero de la Rosa (Universidad de Granada): *Numerical index with respect to an operator*

11:50 Miguel Monsalve López (UCM-ICMAT): *On Bishop type operators*

12:15 Antonio Zarauz Moreno (University of Almeria): *Geometric characterisations of* $\ell^1(\Gamma)$

Blue Room

11:00 Alejandro Tlaie Boria (Center for Biomedical Technology): *Is it complex to be a hub?*

11:25 Daniel Lear (ICMAT): *Global existence for the confined IPM equation*

11:50 Diego Alonso-Orán (Instituto de Ciencias Matemátcas): *The Incompressible Slice Model: local well-posedness and blow-up criterion*

12:15 Hamzah Bakhti (ENSET-UM5, Rabat-Morocco): *Mathematicla Modeling and Vibration Analysis of Thin Pipes Due to Pulsatile Flow: Application to Arterial Wall Vibration*

Orange Room

11:00 David Mosquera Lois (Universidade de Santiago de Compostela): *Integration against the Euler-Poincaré characteristic*

11:25 Hang Lu Su (ICMAT): *Thin Triangle Party!*

11:50 Víctor Manuel Jiménez Morales (ICMAT): *Characteristic distribution: An application to material bodies*

Red Room

11:00 Florian Heinrichs (Ruhr-Universität Bochum / Universidad Autónoma de Madrid): *Testing for weak stationarity of locally stationary time series*

11:25 Andrea Trucchia (BCAM (Basque Center for Applied Mathematics) and UPV-EHU, Campus de Leioa): *Surrogate-based analysis of turbulence and fire-spotting in wild-land fire modeling*

11:50 Yassin BELKOURCHIA (ENSET, Mohammed V University, Rabat, Morocco): *Optimization procedure and application to location optimization of piezoelectric actuators and sensors for active vibration control*

12:15 Hssaine Boualam (FST of Settat, Morocco): *Dual Algorithms Based on the Proximal Bundle Method for Solving Convex Minimax Fractional Programs*

Grey Room 1

11:00 Josue Tonelli Cueto (Technische Universität Berlin): *Computing the homology of closed semialgebraic sets*

11:25 Julio Aroca (ICMAT): *The diameter of some multicurve-based graphs*

11:50 Rodrigo Codorniu (Université de Nice-Sophia Antipolis): *The fundamental group scheme of certain fibered varieties*

12:15 Emily Quintero (Universidad de Alcalá): *Computing symmetries of ruled rational surfaces.*

Wednesday 9

Assembly Hall

11:00 María de Gádor Cabrera Padilla (Universidad de Almería): *A new approach on Lipschitz compact operators*

11:25 Miguel García-Bravo (ICMAT-UAM): *Continuous mappings between Hilbert infinite dimensional Hilbert spaces can be uniformly approximated by smooth mappings with no critical points*

11:50 Óscar Roldán Blay (Universitat de València): *The Riemann Mapping Theorem and extensions*

16:35 Carles Sáez Calvo (BGSMath - UB): *Finite groups acting on 4-manifolds*

17:00 Eduardo Fernández (ICMAT-UCM): *Loops of Legendrians in contact 3-manifolds.*

17:25 Francisco Javier Martínez Aguinaga (ICMAT-UCM): *Flexible horizontal knots.*

17:50 Juan Margalef (UC3M-CSIC): *Geometry, constraints and boundaries, it takes three to tango*

Blue Room

11:00 Simón Rodríguez Santana (ICMAT-CSIC): *Large Scale Automated Forecasting for Monitoring Network Safety and Security*

11:25 Víctor Gallego (ICMAT-CSIC): *From state-space models to Bayesian structural time series: assessing the effect of advertising expenditures upon sales*

11:50 Alberto Redondo (ICMAT-CSIC): *Malware Detection Using Hybrid Analysis*

12:15 Juan Manuel Espín López (Universidad de Murcia - Biometric Vox): *A PhD in the Private Sector. Spoofing attacks in ASV.*

16:35 ARNAB DEY SARKAR (IISER Bhopal): *Automorphism tower of some centreless Groups*

17:00 María CUMPLIDO (Université de Rennes 1 / Universidad de Sevilla): *Braids: a link between topology and algebra*

17:25 Rubén José Muñoz Alcázar (Universidad Rey Juan Carlos): *A brief introduction to linear Jordan algebras*

17:50 Guillermo Vera de Salas (Universidad Rey Juan Carlos): *Algebras and Superalgebras*

Multimedia Room

11:00 Rodrigo Mariño Villar (Universidade de Santiago de Compostela): *Weakly-Einstein Riemannian Manifolds*

11:25 Paz Albares Vicente (Universidad de Salamanca): *Integrability, the singular manifold and soliton solutions for Nonlinear Schrödinger Equations*

11:50 Eddygledson Souza Gama (Universidade Federal do Ceará, Universidad de Granada): *Translating Solitons of the Mean Curvature Flow Asymptotic to Hyperplane in* $\mathbb{R}^{n+1}$.

12:15 Jaime Santos Rodríguez (Universidad Autónoma de Madrid): *Curvature, measures and isometries.*

16:35 Ana Navarro Quiles (Universitat Politècnica de València (UPV)): *Random Variable Transformation technique to solve differential equations with uncertainty*

17:00 Ihsane SALLEH (ENSET, Rabat-Morocco): *Distribution functions of nonlinear stochastic differential systems with uncertain parameter*

17:25 Luca Maria Giordano (Universitat Autònoma de Barcelona / Università degli Studi di Milano): *Weak convergence of the solutions of some fractional spde's*

Red Room

11:00 Andre Macedo (University of Reading): *The Hasse norm principle*

11:25 francesca gatti (Universitat Politecnica de Catalunya): *The elliptic Stark conjecture*

11:50 Daniel Gil Muñoz (Universitat Politècnica de Catalunya): *Hopf Galois Theory: Generalizing Galois Theory with Hopf Algebras*

12:15 Marta Salguero García (Universitat de Barcelona): *A computational approach to Hopf-Galois theory*

16:35 Nikita Simonov (Universidad Autunoma de Madrid): *Quantitative a Priori Estimates for Fast Diffusion Equations with Caffarelli-Kohn-Nirenberg weights. Harnack inequalities and Hölder continuity*

17:00 Javier Martínez Perales (Basque Center for Applied Mathematics): *Sobolev-Poincaré inequalities for $p < 1$*

17:25 María Ángeles García-Ferrero (ICMAT): *Solutions to PDE with prescribed properties*

17:50 Stefano Buccheri (Sapienza Università di Roma): *Gradient behaviour for large solutions to semilinear elliptic problems*

Grey Room 1

11:00 EL HASSAN BEN-AHMED (Ibn Zohr University, Faculty of Sciences, Agadir, Morocco): *A stable numerical meshless method for modelling water flow in porous media*

11:25 Mauricio Misquero (Universidad de Granada): *Resonance tongues in the linear Sitnikov equation*

11:50 Daniel Eceizabarrena (BCAM - Basque Center for Applied Mathematics): *The Talbot effect and fractal aspects of Riemann's non-differentiable function*

12:15 Alexandru Iosif (Otto von Guericke Universitiy of Magdeburg): *Mass action networks with the isolation property*

16:35 Marc Calvo Schwarzwälder (Centre de Recerca Matemàtica): *Thermal transport equations and boundary conditions at the nanoscale*

17:00 Ismael Rodríguez-Cal (Technical University of Madrid (UPM)-Tecnologías Avanzadas Inspiralia): *NASAL-FLOW: an automatised fluid dynamics analysis of airflow in the human upper airways*

Parallel Sessions Abstracts

Integrability, the singular manifold and soliton solutions for Nonlinear Schrödinger Equations

Paz Albares Vicente (Universidad de Salamanca)

Wednesday 9 11:25 • Multimedia Room

Keywords: *Integrability, Singular manifold method, Darboux transformations, Nonlinear Schrödinger equations, Solitons, Rogue waves*

Abstract: The Painlevé property has been proved to be a powerful test for identifying the integrability as well as a good basis for the determination of many properties of a given (nonlinear) PDE. The singular manifold method, based on the Painlevé analysis, provides the Lax pair and the Bäcklund transformation for the PDE. Furthermore, by employing the Darboux transformation approach, an iterative algorithmic method to construct recursive solutions can be implemented. It will be illustrated by means of some examples, related to Nonlinear Schrödinger equations, in which solutions such as solitons and rogue waves will be thoroughly discussed.

The Incompressible Slice Model: local well-posedness and blow-up criterion

Diego Alonso-Orán (Instituto de Ciencias Matemátcas)

Tuesday 8 11:50 • Blue Room

Keywords: *Local well-posednesss, fluid mechanics, weather prediction*

Abstract: In atmospheric science, slice models (SM) are frequently used to study the behaviour of weather, and specifically the formation of atmospheric fronts, whose prediction is fundamental in meteorology. In this talk, we will present some results dealing with the local well-posedness of the incompressible slice model. Besides proving local existence and uniqueness we also construct a blow-up criterion. These results establish the potential applicability of the ISM equations in physically meaningful situations.

The KAM theorem in the semiclassical limit

Víctor Arnaiz (ICMAT)

Monday 7 17:00 • Red Room

Keywords: *KAM theorem, hamiltonian dynamics, quantum dynamics*

Abstract: The Kolmogorov-Arnold-Moser theory covers different classical results in dynamical systems about the persistence of quasiperiodic motions under small perturbations. On the other hand, the correspondence principle stablishes that the high energy behavior of quantum systems is governed by its classical counterpart. In this talk we state and prove a KAM theorem related to small perturbations of vector fields on the torus from the point of view of the related quantum system and the correspondence principle.

The diameter of some multicurve-based graphs

Julio Aroca (ICMAT)

Tuesday 8 11:25 • Grey Room 1

Keywords: *geometric group theory, infinite-type surfaces, graphs, diameter*

Abstract: In this talk, we will give an introduction to infinite-type surfaces, that is, whose fundamental group is not finitely generated. We will also see the theorems that allow us to classify them, using the space of ends topology. Next, we will show some graphs which can be defined on an infinite-type surface S. One example is a family based on multicurves introduced by Fossas-Parlier: graphs $\mathcal{G}_k(S)$, where $k \in \mathbb{N} \cup \{\infty\}$. All these graphs are connected, even if S is of infinite-type; and they have infinite diameter for all $k \in \mathbb{N}$. However, we will prove that the diameter of $\mathcal{G}_\infty(S)$ is less or equal than 3.

Mathematicla Modeling and Vibration Analysis of Thin Pipes Due to Pulsatile Flow: Application to Arterial Wall Vibration

Hamzah Bakhti (ENSET-UM5, Rabat-Morocco)

Tuesday 8 12:15 • Blue Room

Keywords: *Pipe Vibration; Pulsatile Flow; QDM; Laplace Transform; Hankel Transform;*

Abstract: In this work, a coupled numerical-analytic solution is elaborated of a fluid-structure model to analyse the vibro-behavior of thin pipes due to pulsatile flow. The pipe is modeled by planar beams theory of Bernoulli-Euler in longitudinal and transverse vibrations. The presented model is a solved by coupling the quadratic differential method to calculate the movement of the pipe wall, and, for the fluid, analytical solution is obtained using the Laplace and Hankel integral transforms for the case of uniderectional flow using the Oldroyd-B model of the fluid.

REFERENCES [1] M.P. Païdoussis, "Dynamics of tubular cantilevers conveying fluid", J. Mech. Engin. Sci. 12 (1970) 85:103. [2] A. Azrar, L. Azrar, A.A. Aljinaidi, "Numerical modeling of dynamic and parametric instabilities of single-walled carbon nanotubes conveying pulsating and viscous fluid", Composite Structures 125 (2015) 127:143. [3] H. Bakhti and L. Azrar, D. Baleanu, "Pulsatile Blood Flow in Constricted Tapered Artery Usin"

Families of categories in geometry, algebra, and homotopy theory

Eduard BALZIN (Ecole Polytechnique)

Monday 7 17:25 • Grey Room 1

Keywords: *category theory, algebraic geometry, homotopical algebra, families of categories*

Abstract: This talk will give a brief introduction to mathematical problems that can be studied with the use of the formalism of families of categories. Many examples of categorical families come from geometry, where one considers various category-valued stacks and takes the associated categories of sections. Another context is that of algebra: one can study the families naturally arising from monoidal categories M. The category of sections of such a family contains algebra objects in M. In many interesting examples the categorical family is equipped with weak equivalences, and one can ask if the category of sections is a good infinity-categorical invariant. We explain this problem in detail, responding positively to a conjecture of Hirschowitz and Simpson for the families resulting from category-valued stacks. If the time permits, we also explain an approach to a similar question in the setting of monoidal categories with weak equivalences.

Optimization procedure and application to location optimization of piezoelectric actuators and sensors for active vibration control

Yassin BELKOURCHIA (ENSET, Mohammed V University, Rabat, Morocco)

Tuesday 8 11:50 • Red Room

Keywords: *Coupled optimization ; Border correction procedure, Genetic algorithm, Sequential quadratic programming, Particle swarm optimization, Multi-piezoelectric actuators, Active control*

Abstract: This work focuses a new hybrid optimization procedure to finding the optimal location for a piezoelectric patch for active vibration control. This coupling is based on the genetic algorithm, the sequential quadratic programming and on the

particle swarm optimization. Two modified optimization criteria are used, ensuring good observability and controllability of the structure, and considering residual modes to limit the spillover effect. Two optimization variables are considered for each piezoelectric device: the location of its center and its orientation. Several simulations are presented for a plate for different boundary conditions

A stable numerical meshless method for modelling water flow in porous media

EL HASSAN BEN-AHMED (Ibn Zohr University, Faculty of Sciences, Agadir, Morocco)

Wednesday 9 11:00 • Grey Room 1

Keywords: *Radial basis function ; Partition of unity ; QR factorization ; Richards' equation ; Water flow.*

Abstract: Water flow in porous media is modelled by using the highly nonlinear Richards' equation. The nonlinearity is due to the soil properties described by the so-called hydraulic conductivity. Gardner model of the hydraulic conductivity is used here to linearize Richards' equation. The linearized equation is then solved by using radial basis function partition of unity method (RBFPUM). It is a local meshless method based on the spectral accuracy of radial basis function method and the locality of partition of unity principle. This combination often leads to a sparse system that yields an accurate solution provided that an optimal value of the so-called " shape parameter " is chosen. The stable RBF-QR algorithm is used locally to handle the instability issue in the flat limit ; and the local approximate solutions are patched up by using the principle of partition of unity. Numerical tests over infiltration problems in homogeneous soil are considered to validate the proposed method.

Some new advances in greedy approximation theory

Pablo Manuel Berná Larrosa (Universidad Autónoma de Madrid)

Monday 7 11:00 • Blue Room

Keywords: *Greedy bases, unconditional bases*

Abstract: In this talk we present two new results in the context of greedy-type bases in Banach spaces. The first one is related to the estimation of the greedy constant for the Haar basis in Lp, and the other one is related with the equivalence between almost-greedy bases and semi-greedy bases, notion introduced in 2003 by Dilworth, Kalton and Kutzarova.

Dual Algorithms Based on the Proximal Bundle Method for Solving Convex Minimax Fractional Programs

Hssaine Boualam (FST of Settat, Morocco)

Tuesday 8 12:15 • Red Room

Keywords: *Minimax fractional programs - Proximal point algorithm - Bundle methods - Quadratic programming.*

Abstract: In this work, we propose an approximating scheme based on the proximal point algorithm, for solving generalized fractional programs (GFP) by their continuous reformulation, also known to as partial dual counterparts of GFP. Bundle dual algorithms are then derived from this scheme. We prove the convergence and the rate of convergence of these algorithms. As for dual algorithms, the proposed methods generate a sequence of values that converges from below to the minimal value of (P), and a sequence of approximate solutions that converges to a solution of the dual problem. For certain classes of problems, the convergence is at least linear.

Gradient behaviour for large solutions to semilinear elliptic problems

Stefano Buccheri (Sapienza Università di Roma)

Wednesday 9 17:50 • Red Room

Keywords: *Large solutions, Semilinear elliptic equations, Gradient bounds.*

Abstract: Given $p > 1$ and f Lipschitz, under appropriate assumptions on the smoothness of the bounded domain $\Omega \subset \mathbb{R}^N$, $N \geq 1$, we give a precise description of the asymptotic behaviour of the gradient of the unique solution of

$$\begin{cases} -\Delta u + |u|^{p-1}u = f & \text{in } \Omega, \\ u = +\infty & \text{on } \partial\Omega. \end{cases}$$

In particular we show that there exists a corrector function S, finite sum of singular terms, such that

$$z := u - S \in W^{1,\infty}(\Omega).$$

Moreover we prove that

$$\forall\ \bar{x} \in \partial\Omega \qquad z(\bar{x}) = 0 \quad \text{and} \quad \lim_{\delta \to 0} \frac{z(\bar{x} - \delta\nu(\bar{x}))}{\delta} = 0,$$

where ν is the outward unit normal to $\partial\Omega$.

Prescribed mean curvature surfaces in $\mathbb{R}^{n+1}$

Antonio Bueno (Universidad de Granada)

Monday 7 17:00 • Orange Room

Keywords: *Mean curvature, Christoffel and Minkowski problems, Structure theorem.*

Abstract: We show that this theory extends the particular case when the mean curvature is constant, and also the theory of self-translating solitons of the mean curvature flow. Among other topics, we study the existence of closed examples, classification of rotationally symmetric surfaces and we give a structure theorem for properly embedded surfaces with one end. Joint work with José A. Gálvez and Pablo Mira.

On a problem by V.I. Gurariy concerning subspaces of continuous functions

Hernán Javier Cabana Méndez (ucm)

Monday 7 12:15 • Blue Room

Keywords: *general topology in a lineability problem*

Abstract: Using general topology and the Moore's Theorem for to resolve a problem poust by V.I. Gurariy about to make lineal spaces of continuous functions.

A new approach on Lipschitz compact operators

María de Gádor Cabrera Padilla (Universidad de Almería)

Wednesday 9 11:00 • Assembly Hall

Keywords: *Lipschitz operator, Lipschitz-free Banach space, Lipschitz-free compact operator*

Abstract: In this talk, we develop a theory for compact Lipschitz operators between pointed metric spaces that runs parallel to the well-known theory for compact linear operators between Banach spaces. With this aim, we introduce the notions of Lipschitz-free compact operators and Lipschitz-free weakly compact operators. We give their corresponding versions of Schauder's theorem and Gantmacher's theorem and include the Davis–Figiel–Johnson–Pełczyński factorization theorem for Lipschitz-free weakly compact operators. Furthermore, we establish the relations between several classes of Lipschitz operators. The main tool that allows us to get these results is a linearization process for Lipschitz mappings through the Lipschitz-free Banach space over a pointed metric space. This is a joint work with Antonio Jiménez Vargas (University of Almería).

Thermal transport equations and boundary conditions at the nanoscale

Marc Calvo Schwarzwälder (Centre de Recerca Matemàtica)

Wednesday 9 16:35 • Grey Room 1

Keywords: *Heat transfer, Thermal conductivity, Nanotechnology, Guyer-Krumhansl, Phonon Hydrodynamics*

Abstract: Advances in manufacturing processes have brought us to the stage where reliable nanoscale devices are now commonplace. However, in most current and predicted applications of nanostructures, there is a strong concern over the management of heat. The ability to successfully manipulate heat can be vital to device performance and a lack of thermal regulation can lead to melting and device failure. In addition, experiments have shown that at sufficiently short length or time-scales Fourier's law breaks down. The Guyer-Krumhansl (GK) equation is an extension to the classical Fourier law that is particularly appealing from a theoretical point of view because it provides a link between kinetic and continuum models and is based on well-defined physical parameters. In this talk I will present a predictive model for the effective thermal conductivity of nanowires with different cross-sections based on the GK equation and specific boundary conditions.

Minimal surfaces with finite total curvature in $\mathbb{H}^2 \times \mathbb{R}$

Jesús Castro Infantes (Universidad de Granada)

Monday 7 17:25 • Orange Room

Keywords: *Minimal surfaces, total curvature,* $\mathbb{H}^2 \times \mathbb{R}$

Abstract: In this talk we study minimal surfaces in $\mathbb{H}^2 \times \mathbb{R}$. There aren't compact minimal surfaces in $\mathbb{H}^2 \times \mathbb{R}$. Minimal surfaces with finite total curvature are well known. It is known that the total curvature has to be a multiply of -2π. The first examples are vertical geodesics planes which have total curvature 0. The next possible value is -2π, and the only example is a Scherk minimal graph over an ideal quadrilateral. In this talk we classify minimal surfaces with total curvature -4π embedded, describing its topology and the asymptotic behaviour of its ends.

A pseudo-spectral method for the fractional Laplacian on R

Jorge Cayama (Universidad del País Vasco)

Monday 7 11:50 • Red Room

Keywords: *Fractional Laplacian, Pseudo-spectral methods, Fourier transform.*

Abstract: We develop a pseudo-spectral method to solve initial-value problems associated to PDEs involving the fractional Laplacian operator acting on the whole real line. After a suitable representation of the operator, we perform the change

of variable x = Lcot(s), L ¿ 0, to transform the real line R into the interval [0, Pi], where a Fourier expansion of u(x(s)) can be applied. We approximate the fractional Laplacian by means of the midpoint quadrature rule, improving the results with Richardson's extrapolation. This method deals accurately and efficiently with problems posed on R, and avoids truncating the domain (which requires introducing artificial boundary conditions). In order to illustrate its applicability, we have simulated the evolution of the following non-local Fisher-KPP and ZFK-Nagumo models.

The fundamental group scheme of certain fibered varieties[1]

Rodrigo Codorniu (Université de Nice-Sophia Antipolis)

Tuesday 8 11:50 • Grey Room 1

Keywords: *Algebraic Geometry, Fundamental group scheme, Rationally connected, Finite Torsors, Homotopy exact sequence*

Abstract: In this talk we are going to explore the problem of describing the fundamental group scheme of a variety fibered over an elliptic curve with rationally connected fibers. Recently, M. Antei and I. Biswas have proven [1] that the fundamental group scheme of a rationally connected variety is finite. We will discuss different tools that could help to get a complete description, such as the homotopy exact sequence [3] and new developments in the theory of finite torsors [2].

References

[1] Marco Antei and Indranil Biswas, On the fundamental group scheme of rationally chain-connected varieties, Int. Math. Res. Not. IMRN (2016), no. 1, 311-324. MR 3514065.

[2] M. Antei, I. Biswas, M. Emsalem, F. Tonini, and L. Zhang, Nori fundamental gerbe of essentially finite covers and Galois closure of towers of torsors, ArXiv e-prints (2017).

[3] Lei Zhang, The homotopy sequence of Nori's fundamental group, J. Algebra 393 (2013), 79-91. MR 3090059.

Decision models for cybersecurity risk analysis

Aitor Couce Vieira (ICMAT)

Monday 7 11:00 • Assembly Hall

Keywords: *risk analysis, cybersecurity, influence diagram, decision support*

[1]This thesis work is been made under the direction of C. Pauly (LJAD) and the co-direction of M. Antei (Universidad de Costa Rica). It is fully funded by the National Commission for Scientific and Technological Research of Chile (CONICYT)

Abstract: We introduce our work on cybersecurity risk analysis models that address aspects not well covered by popular risk analysis methods. Specifically: risk analysis during incidents, adversarial threats, multi-objective risk analysis and risk transfer (insurance). Our work focuses on applying and adapting previous advancements in quantitative and adversarial risk analysis modelled through influence diagrams.

Braids: a link between topology and algebra

María CUMPLIDO (Université de Rennes 1 / Universidad de Sevilla)

Wednesday 9 17:00 • Blue Room

Keywords: *braid theory, artin groups, parabolic subgroups, curves on a disk, mapping class groups*

Abstract: The group of braids with n strands can be seen topologically, as the mapping class group of the n-punctured disk or the configuration space of n points in the complex plane, and algebraically, as an Artin-Tits group of spherical type. Normally, the results that we have for the braid group can be generalized to the others Artin-Tits groups of spherical type. However, the results are sometimes proven using techniques related to the topological definition of braids. That is why we need to improve our knowledge about parabolic subgroups of Artin-Tits groups of spherical type, which are the analogous of curves in the n-puncture disk. In this talk, we will explain this analogy and new results about them, namely that the intersection of parabolic subgroups is a parabolic subgroup.

Weighted mixed-norm Sobolev estimates for solutions of some parabolic equations.

Marta de León Contreras (Universidad Autónoma de Madrid)

Monday 7 12:15 • Red Room

Keywords: *semigroup theory, harmonic analysis, singular integrals*

Abstract: In this talk we want to show weighted and mixed-weighted Sobelev-type estimates and a.e. convergence results of singular integrals for some parabolic equations

$$\partial_t u = Lu + f, \ in \ \mathbb{R}^{n+1} \ or \ (0,\infty)\times\mathbb{R}^n,$$

where L is a second order differential operator such as the laplacian, the harmonic oscillator $\Delta - |x|^2$, or the Bessel operator $\Delta_\mu = \partial_x^2 + (1/4-\mu^2)x^{-2}$, $\mu > -1$. The content of the talk is based on the papers [PST] and [BdLC]. The semigroup language is an essential tool along these works.

[BdLC] J. J. Betancor and M. De Leòn-Contreras, Parabolic Equations Involving Bessel Operators and Singular Integrals, to appear in *Integr. Equ. Oper. Theory*(2018)

[PST] Li Ping, P.R. Stinga and J.L. Torrea, On weighted mixed-norm Sobolev estimates for some basic parabolic equations, *Commun. Pure Appl. Anal.* **16** (2017), 855-882.

Automorphism tower of some centreless Groups

ARNAB DEY SARKAR (IISER Bhopal)

Wednesday 9 16:35 • Blue Room

Keywords: *Computation of tower height of centreless group and some other simple group*

Abstract: The automorphism tower of a group is obtained by computing its automorphism group, the automorphism group of that group and so on, iterating transfinitely. Each group maps into the next using inner automorphisms and one takes a direct limit at limit stages. The question is whether the process ever terminates in a fixed point, a group which is isomorphic to its automorphism group by the natural map. It is proved that every group has a terminating automorphism tower. In this talk we will discuss about the terminating height of automorphism tower of some groups. Later on I shall compute automorphism tower height of some simple groups too. Automorphism tower has some highly set-theoretic aspects in various fields and it helps in modelling of groups.

Characterizing proportionally modular affine semigroups

Juan de Dios Diaz-Ramírez (Universidad de Cádiz)

Monday 7 16:35 • Grey Room 1

Keywords: *affine semigroup*

Abstract: Joint work with J.I. García-García and A. Vigneron-Tenorio. The main goal of this communication is to improve the knowledge of the affine semigroups called proportionally modular affine semigroups (see [García-García, J.I.; Moreno-Frías, M.A.; Vigneron-Tenorio, A. *Proportionally modular affine semigroups.* J. Algebra Appl. 17 (2018), no. 1, 1850017, 17 pp.]). A such semigroup is the set of nonnegative integer solutions of an inequality of the form $f(x) \bmod b \leq g(x)$, where $f(x_1, \ldots, x_n) = \sum_{i=1}^{n} f_i x_i$, $g(x_1, \ldots, x_n) = \sum_{i=1}^{n} g_i x_i$ with $g_1, \ldots, g_n, f_1, \ldots, f_n \in \mathbb{Z}$ and $b \in \mathbb{N}$. We give a geometrical characterization of these kind of semigroups. Moreover, some ideas about the obtention of algorithms which allow us to check if an affine semigroup is a proportionally modular affine semigroup are presented.

The Talbot effect and fractal aspects of Riemann's non-differentiable function

Daniel Eceizabarrena (BCAM - Basque Center for Applied Mathematics)

Wednesday 9 11:50 • Grey Room 1

Keywords: *Talbot effect, Riemann's non-differentiable function, fractal, multifractal*

Abstract: The Talbot effect is a microscopic optic phenomenon generated by the diffraction of light. Discovered in 1836, it describes the pattern that light forms after going through a periodic grating, and more particularly, the repetition of the image of the grating itself. While the effect can be roughly deduced by means of the wave and Helmholtz equations, it is by means of the Schrödinger equation that we can most successfully model it. This phenomenon has a visually clear fractal structure. One way to interpret it is to consider the integral of the time trajectory of the origin, the result being a version of the very famous Riemann's non-differentiable function, known to be a multifractal. We present some known results of this fractality and the main analytic tools needed, as well as some ongoing working lines.

A PhD in the Private Sector. Spoofing attacks in ASV.

Juan Manuel Espín López (Universidad de Murcia - Biometric Vox)

Wednesday 9 12:15 • Blue Room

Keywords: *speaker recognition, spoofing, attacks, phd, IA, maths*

Abstract: In this talk, I would like to speak about my work during the PhD. A PhD that, we may say, arises in a particular and somewhat unusual way, in the sense that it starts by the end and goes backwars. After some time in the company, we decided that it would be a good opportunity for me to start a PhD, at the same time and being combined with my work in the company. In this way, in 2016 we decided to start a PhD, under the tutelage of a PhD already in the company, an expert in mathematical models and, with two faculty staff of the University of Murcia (a lecturer expert in machine learning techniques, and a professor expert in Maths). My PhD focuses on improvements and/or artificial intelligence based assistance to this technology. In particular, I am focusing on the development and evaluation of several algorithms that may be used to detect attacks to a speaker recognition. In summary, my PhD mixes: private sector, mathematics and computer science.

Liouville type results for fractional Schrödinger operators in 1D

Juan Carlos Felipe Navarro (BGSMath - Universitat Politècnica de Catalunya)

Monday 7 11:00 • Red Room

Keywords: *nonlocal equations, integral operators, Schrödinger operator, fractional Laplacian, Liouville type result*

Abstract: This talk will be devoted to present some Liouville type results and their applications. First, we will introduce the concept and the motivations for studying such results. Then, we will explain some of the most relevant Liouville type results. Finally, we will present two original Liouville type results for nonlocal Schrödinger operators in 1D driven by a uniformly elliptic integro-differential operator with translation invariant and even kernel. While the first result applies for positive solutions in $\mathbb{R}$, the second one is for odd solutions that are positive in $(0, +\infty)$. The proof of these results is based on a recent work of Hamel, Ros-Oton, Sire and Valdinoci. In this sense, apart from that work, it is the first time a result of this kind is proven without using the so-called local extension problem. One direct consequence of these results is the nondegeneracy of layer and ground state solutions for certain nonlinear equations.

Loops of Legendrians in contact 3-manifolds.

Eduardo Fernández (ICMAT-UCM)

Wednesday 9 17:00 • Assembly Hall

Keywords: *Contact Topology, Legendrian*

Abstract: The theory of Legendrian submanifolds plays a central role in Contact Topology. In this talk we focus our attention in the 3-dimensional case, more speci cally in the contact manifolds $(\mathbb{R}^3; \xi_{std})$ and $(\mathbb{S}^3; \xi_{std})$. The starting point is the introduction of the so called classical invariants of Legendrian submanifolds. It turns out that these invariants are actually formal invariants. Following the formal viewpoint we are able to introduce new invariants for loops of Legendrian sub- manifolds. As an application we show that the natural action of the contactomorphism group in the space of Legendrians of $(\mathbb{S}^3; \xi_{std})$ induces a homotopy injection on certain connected components. This allows us to exhibit new examples of non trivial loops of Legendrians which are trivial in the smooth category. This is a join work with Francisco Javier Martínez-Aguinaga (ICMAT-UCM) and Francisco Presas (ICMAT).

From state-space models to Bayesian structural time series: assessing the effect of advertising expenditures upon sales

Víctor Gallego (ICMAT-CSIC)

Wednesday 9 11:25 • Blue Room

Keywords: *bayesian structural time series, dynamic linear model, spike and slab prior*

Abstract: First, we will review the basics of state-space models and dynamic linear models. Then, we propose a robust implementation of the Nerlove–Arrow model using a Bayesian structural time series model to explain the relationship

between advertising expenditures of a country-wide fast-food franchise network with its weekly sales. Thanks to the flexibility and modularity of the model, it is well suited to generalization to other markets or situations. Its Bayesian nature facilitates incorporating *a priori* information (the manager's views), which can be updated with relevant data, via the spike and slab prior. This aspect of the model will be used to present a strategy of budget scheduling across time and channels.

Translating Solitons of the Mean Curvature Flow Asymptotic to Hyperplane in $\mathbb{R}^{n+1}$.

Eddygledson Souza Gama (Universidade Federal do Ceará, Universidad de Granada)

Wednesday 9 11:50 • Multimedia Room

Keywords: *Mean Curvature Flow, Translating Soliton,tilted grim reaper cylinder, vertical hyperplane.*

Abstract: In this lecture we will talk about a characterization of vertical hyperplanes and the family of tilted grim reaper cylinders as the only translating solitons in $\mathbb{R}^{n+1}$ which are C^1-asymptotic to two half-hyperplanes outside a non-vertical cylinder. Moreover, we will conclude that the vertical hyperplanes are unique examples of translating solitons in $\mathbb{R}^{n+1}$, for $n < 7$, such that are C^1-asymptotic to two half-hyperplanes outside a vertical cylinder.

Sampling fuzzy measures uniformly. Approach through linear extensions.

Pedro García Segador (Instituto Nacional de Estadística)

Monday 7 16:35 • Assembly Hall

Keywords: *linear extensions, posets, fuzzy measures, random generation*

Abstract: A classical problem in the theory of non-additive measures consists in generating a fuzzy measures at random in the general set of fuzzy measures $\mathcal{FM}(X)$ or in some restricted subfamily. In general, these sets determine convex polytopes in the Euclidean space. This way, the problem is transformed into generating points in a convex polytope. However, this problem is not easy to solve in general, and particular solutions for each kind of problem are needed. On the other hand, many of the polytopes that appear in the study of fuzzy measures are order polytopes. Therefore, we can use the combinatorial structure of the poset behind these polytopes to sample inside them. We introduce, the so called, Bottom- Up algorithm and the BU-feasible posets as a new approach to deal with this problem. Moreover, we use this idea to compute the exact number of linear extensions for some families of posets.

Continuous mappings between Hilbert infinite dimensional Hilbert spaces can be uniformly approximated by smooth mappings with no critical points

Miguel García-Bravo (ICMAT-UAM)

Wednesday 9 11:25 • Assembly Hall

Keywords: *Hilbert space, Morse-Sard theorem, approximation, critical points, diffeomorphic extraction*

Abstract: In the talk I will present the following new result about approximation: *Let E be an infinite-dimensional, separable Hilbert space. Then for every continuous mapping $f : E \to E$ and for every continuous positive function $\varepsilon : E \to (0, +\infty)$, there exists a map $\psi : E \to E$ of class C^∞ such that $\|f(x) - \psi(x)\| \leq \varepsilon(x)$ and $d\psi(x)$ is surjective for all $x \in E$ (i.e., ψ has no critical points).* The proof relies on a new result about extractibility of sets from the Hilbert space. Namely that given a closed subset X in l_2 that is locally contained subspaces of infinite codimension in E, given an open set U such that $X \subseteq U$ and given an open cover $\mathcal{G}$, then there exists a C^∞-diffeomorphism from $l_2 \setminus X$ onto l_2 which is the identity outside U and refines $\mathcal{G}$. This is joint work with D. Azagra and T. Dobrowolski.

Solutions to PDE with prescribed properties

María Ángeles García-Ferrero (ICMAT)

Wednesday 9 17:25 • Red Room

Keywords: *PDE, global approximation, parabolic equations, hot spots*

Abstract: Combining robust local construction of solutions to PDE with appropriate global approximation theorems, we can obtain solutions to PDE with prescribed geometric or topological properties. This technique has been used in many contexts involving elliptic equations. In this talk I will show global approximation theorems for parabolic equations and their application to prove the existence of solutions of the heat equation with local hot spots with prescribed behavior. This is a joint work with A. Enciso and D. Peralta-Salas.

Toeplitz matrices, Schur polynomials and group integrals

David García-García (GFM - Universidade de Lisboa)

Monday 7 17:50 • Blue Room

Keywords: *Toeplitz matrices, Schur polynomials and group integrals*

Abstract: We will briefly describe the relation between the three objects in the title, as well as some generalizations. This includes applications to combinatorics, operator theory, and the Selberg integral. Joint work with Miguel Tierz, arVix:1706.02574.

The elliptic Stark conjecture

francesca gatti (Universitat Politecnica de Catalunya)

Wednesday 9 11:25 • Red Room

Keywords: *elliptic curves, Birch and Swinnerton-Dyer conjecture, p-adic L-functions*

Abstract: Let E be an elliptic curve defined over $\mathbb{Q}$ and let $\rho : \mathrm{Gal}(H/\mathbb{Q}) \to GL_n(L)$ be an Artin representation of dimension 4. We can attach to these datas a complex L-function $L(E, \rho, s)$ which is holomorphic and satisfies a functional equation with center of symmetry $s = 1$. On the other hand, the set of H-rational points $E(H)$ of E has a structure of finitely generated abelian group. An equivariant version of Birch and Swinnerton-Dyer (BSD) conjecture predicts that the order of vanishing of $L(E, \rho, s)$ at $s = 1$ would be equal to the rank of the ρ-part of the group $E(H) \otimes L$. There is a p-adic analogous of the function $L(E, \rho, s)$, and the elliptic Stark conjecture (by Darmon, Lauder and Rotger) predicts, in a situation of rank 2, that a special value of this p-adic L-function would be equal to a regulator of points belonging to the ρ-part of $E(H)$, divided by the logarithm of a unit.

Algebraic structures and modes of convergence

Pablo José Gerlach Mena (Universidad de Sevilla)

Monday 7 11:25 • Blue Room

Keywords: *Lineability, algebrability, modes of convergence*

Abstract: Recently, several authors have obtained results about the existence of algebraic structures in certain sequence spaces. For instance, in [A] it is proved the maximal-dense-lineability of sequences convergent to zero in measure but not pointwise almost everywhere in $[0, 1]$. In this talk we are going to present some results in this line. In particular, we focus our attention on sequences in $L_0([0, 1])$ and in $L_0([0, +\infty))$ with several and appropiated modes of convergence. Results presented here are part of a joint work with M.Carmen Calderón-Moreno and José Antonio Prado-Bassas (Universidad de Sevilla).

[A] G. Araújo, L. Bernal-González , G. A. Muñóz-Fernández, J. A. Prado-Bassas y J. B. Seoane-Sepúlveda, *Lineability in sequence and function spaces.*

Hopf Galois Theory: Generalizing Galois Theory with Hopf Algebras

Daniel Gil Muñoz (Universitat Politècnica de Catalunya)

Wednesday 9 11:50 • Red Room

Keywords: *Hopf Algebra, Hopf Galois Structure, Regular Subgroup*

Abstract: Classical Galois Theory attaches a Galois group to each Galois extension of fields to describe the structure of the extension. Hopf Galois theory arises from replacing the Galois group and the classical evaluation action by what we call a Hopf Galois structure: a Hopf algebra together with an action compatible with the algebra structure of the upper field. This generalization allows us to describe non-necessarily Galois extensions and implies a significant difference with respect to the classical theory, which is that several Hopf Galois structures can be attached to the same extension. In the separable case, the description of Hopf Galois structures translates into a group-theoretical question.

Improving the efficiency and stability of iterative methods for solving nonlinear problems

Iván Giménez Palacios (Universitat de València)

Monday 7 11:50 • Assembly Hall

Keywords: *iterative methods, methods with memory, dynamical analysis*

Abstract: The problem of finding a simple zero α of a function $f : D \subseteq \mathbb{R} \to \mathbb{R}$ yields frequently to the use of an approximating scheme. Newton's method is the best known one-step method of finding α. Based on this method, extensive research has developed over the years, not only of one-step, but also of multi-step schemes. In addition to these, so-called memory methods have emerged in recent years. That is, iterative schemes in which we use two or more previous iterations. In this paper, we construct a method with memory from one without memory, and we analyze its convergence and stability.

Weak convergence of the solutions of some fractional spde's

Luca Maria Giordano (Universitat Autònoma de Barcelona / Università degli Studi di Milano)

Wednesday 9 17:25 • Multimedia Room

Keywords: *spde's, fractional Brownian motion, weak convergence*

Abstract: We define a stochastic version of a 1–dimensional non-linear wave and heat equation

$$(Lu^H)(t,x) = \left(\frac{\partial}{\partial x^2}u^H\right)(t,x) + b(u^H(t,x)) + W^H(t,x),$$

defined for $(t, x) \in [0, T] \times \mathbb{R}$. The operator $L = \partial/\partial t$ for the heat equation, and $L = \partial/\partial t^2$ for the wave equation. The function b is a Lipschitz-continuous function, and the noise term W^H is white noise in the time variable t, and a fractional Brownian motion of Hurst parameter H in the space variable x. We discuss the problem of weak continuity with respect to the parameter H: explicitly, we want to show whether $u^H \xrightarrow{d} u^{H_0}$ if $H \to H_0$. The convergence is in distribution. We discuss the techniques used in the linear case $b = 0$, and we see some partial results about the more general case b Lipschitz-continuous, including the existence and uniqueness of a solution for the equation, which to our knowledge was not previously known.

Field theory and quantisation of Hodge structures

Ángel González-Prieto (Universidad Complutense de Madrid)

Monday 7 11:50 • Grey Room 1

Keywords: *TQFT, Hodge theory, character varieties, E-polynomial*

Abstract: Topological Quantum Field Theories are powerful categorical tools that provide deep insight into the behaviour of topological invariants. In this talk, we will discuss some aspects of TQFTs, including duality properties and their classification. We will also give a general construction procedure as a combination of a field theory and a quantisation. Using this method, we will construct a lax monoidal TQFT that computes the mixed Hodge structure on the cohomology of representation varieties. Joint work with M. Logares and V. Muñoz.

Testing for weak stationarity of locally stationary time series

Florian Heinrichs (Ruhr-Universität Bochum / Universidad Autónoma de Madrid)

Tuesday 8 11:00 • Red Room

Keywords: *CUSUM-test, local stationarity, functional data, block multiplier bootstrap*

Abstract: In the field of time series analysis, stationarity is a common assumption imposed on the underlying stochastic process since a huge amount of literature is available to investigate stationary time series. However, techniques based on stationarity may induce misleading results in applications where the assumption is not fulfilled, which is possible in many real data examples. Thus, it is important to determine whether the assumption of stationarity can be justified. In this talk, a test on weak stationarity for functional data is presented. This test generalises classical change point tests based on the CUSUM principle in the sense that consistency is not only proven against the alternative of one single change, but against smooth

changes (in the sense of local stationarity). Further, a block multiplier bootstrap is introduced to approximate quantiles of the test statistic's limiting distribution.

On discrete versions of Brunn-Minkowski type inequalities

David Iglesias López (Universidad de Murcia)

Monday 7 11:00 • Orange Room

Keywords: *Brunn-Minkowski inequality, Borell-Brascamp-Lieb inequality, cardinality of sum sets*

Abstract: Relating the volume with the Minkowski addition of compact sets K, L of R^n, one is led to the famous Brunn-Minkowski (B-M) inequality: $vol(K+L)^{1/n} \geq vol(K)^{1/n} + vol(L)^{1/n}$. B-M inequality is one of the most powerful results in Geometry and beyond: its most general analytic version, the Borell-Brascamp-Lieb inequality, and since compactness can be weakened to Lebesgue measurability, allowed it to move in much wider fields. In this talk we will move to the discrete setting, i.e., we will work with finite sets A, B of integer points and with the cardinality. First we will survey the known discrete versions of B-M inequality: the ones by Ruzsa (1994) and Gardner&Gronchi (2001), where the classical structure is lost. Then we will present a new discrete B-M inequality which keeps its usual form, $|A+B|^{1/n} \geq |r(A)|^{1/n}+|B|^{1/n}$, but where one set is replaced by a 'reduction' $r(A)$ of it. We will also show a new discretization of the Borell-Brascamp-Lieb inequality.

Mass action networks with the isolation property

Alexandru Iosif (Otto von Guericke Universitiy of Magdeburg)

Wednesday 9 12:15 • Grey Room 1

Keywords: *applied algebra, algebraic systems biology, chemical reaction networks, toric varieties*

Abstract: Mass action networks with the isolation property are chemical reaction networks with nice algebraic and combinatorial properties. We prove that the Zariski closure of the positive steady state variety of a mass-action network with the isolation property is a toric variety. This is joint work with Carsten Conradi and Thomas Kahle.

Characteristic distribution: An application to material bodies

Víctor Manuel Jiménez Morales (ICMAT)

Tuesday 8 11:50 • Orange Room

Keywords: *Groupoids, smooth distributions, constitutive theory of material bodies*

Abstract: Associated to each material body $\mathcal{B}$ there exists a groupoid $\Omega(\mathcal{B})$ consisting of all the material isomorphisms connecting the points of $\mathcal{B}$. The uniformity character of $\mathcal{B}$ is reflected in the properties of $\Omega(\mathcal{B})$: $\mathcal{B}$ is uniform if, and only if, $\Omega(\mathcal{B})$ is transitive. Smooth uniformity corresponds to a Lie groupoid and, specifically, to a Lie subgroupoid of the groupoid $\Pi^1(\mathcal{B},\mathcal{B})$ of 1-jets of $\mathcal{B}$. We consider a general situation when $\Omega(\mathcal{B})$ is only an algebraic subgroupoid. Even in this case, we can cover $\mathcal{B}$ by a material foliation whose leaves are transitive. The same happens with $\Omega(\mathcal{B})$ and the corresponding leaves generate transitive Lie groupoids (roughly speaking, the leaves covering $\mathcal{B}$).

Extending the holonomic universe: DD-finite functions and Automated identities proofs

Antonio Jiménez Pastor (Research Institute for Symbolic Computation (RISC))

Tuesday 8 11:00 • Assembly Hall

Keywords: *computer algebra, symbolic computation, differential equations, holonomic, d-finite, linear algebra*

Abstract: Holonomic functions (formal power series satisfying linear differential equations with polynomial coefficients) have been studied from an algorithmic perspective since last century. Several algorithms exist already to compute symbolically with them. This talk present an extension of that class of functions (DD-finite functions) and their algorithms and how this approach can help proving (automatically) some identities for special functions.

A generating function and formulae defining the first-associated Meixner-Pollaczek polynomials

Ahbli Khalid (Ibn Zohr uiversity, faculty of sciences)

Monday 7 17:00 • Assembly Hall

Keywords: *Coherent states, Associated Meixner-Pollaczek polynomials, Generating function, Bargmann-type integral transform.*

Abstract: While considering nonlinear coherent states with anti-holomorphic coefficients $\bar{z}^n/\sqrt{x_n!}$, we identify as first-associated Meixner-Pollaczek polynomials the orthogonal polynomials arising from shift operators which are defined by the sequence $x_n = (n+1)^2$. We give a formula defining these polynomials by writing down their generating function. This also leads to construct a Bargmann-type integral transform whose kernel is given in terms of a Ψ_1 Humbert's confluent hypergeometric function.

A quantitative no-programming theorem

Aleksander Marcin Kubicki (Universidad de Valencia)

Monday 7 17:25 • Blue Room

Keywords: *Quantum information theory, quantum computation, no-go theorems, geometric functional analysis, local Banach space theory*

Abstract: The no-programming theorem prohibits the existence of a Universal Programmable Quantum Processor. This statement has several implications in relation to quantum computation, but also with other proper tasks of quantum information processing. Nonetheless, it is well known that even when the strict model is not implementable, it is possible to conceive it in an approximate sense with nite resources. Unfortunately, the minimal resources necessary for this aim are still not completely understood. Here, we investigate quantitative statements of the theorem. We deduce lower and upper bounds on the dimension of the memory of such a hypothetical machine in terms of the accuracy of the setting and the size of the input on which the computation is carried. The proofs exploit a new connection between quantum channels and embeddings between Banach spaces which allows us to use classical tools from geometric Banach space theory in a clean and simple way.

Global existence for the confined IPM equation

Daniel Lear (ICMAT)

Tuesday 8 11:25 • Blue Room

Keywords: *Fluid dynamics, PDE's, Analysis.*

Abstract: In this talk, we consider a physical scenario to prove global existence of smooth solutions with bounded density and finite energy for the inviscid IPM equation. The result is proved using the stability of stratified solutions, combined with an additional structure of our initial perturbation, which allows us to get rid of the boundary terms in the energy estimates. Key aspects of the proof are the linear decay, Duhamel's principle and "bootstrap" arguments.

The Hasse norm principle

Andre Macedo (University of Reading)

Wednesday 9 11:00 • Red Room

Keywords: *Algebraic Number Theory, Local-Global principles, Hasse norm principle*

Abstract: Given an extension L/K of number fields, we say that the Hasse norm principle holds for L/K if every element of K^* which is a local norm everywhere is in fact a global norm from L^*. In this talk, I'll start by presenting Hasse's classic

norm theorem for cyclic extensions. I'll outline Tate's description of the knot group (an object measuring the failure of the Hasse norm principle) for Galois extensions and present the main tools to determine this group in the non-Galois case. If time permits, I'll also talk about the weak approximation property on the associated norm one tori and how it relates to the Hasse norm principle.

Higgs bundles, flat connections, and quantum operators for Chern-Simons theory

Alessandro Malusà (QGM – Aarhus University)

Monday 7 11:25 • Grey Room 1

Keywords: *Chern-Simons, flat connections, Higgs bundles*

Abstract: In SL(n,C)-Chern-Simons theory, the character variety of a genus g closed, oriented surface represents the space of its classical solutions. For the sake of quantisation, it is interesting to associate differential operators to smooth functions on this character variety. In this presentation I propose a way to obtain such operators via differential-geometric constructions, combined with the correspondence with the moduli space of Higgs bundles.

Geometry, constraints and boundaries, it takes three to tango

Juan Margalef (UC3M-CSIC)

Wednesday 9 17:50 • Assembly Hall

Keywords: *Hamiltonian mechanics, physics*

Abstract: Constrains appear quite naturally in many interesting physical systems such as EM, gravity or parametrized systems. If we are interested in quantizing such systems, it seems necessary to have a precise Hamiltonian formulation. The Dirac's algorithm addresses this problem quite nicely when no boundaries are present, but... boundaries are also very natural! Through some examples I will show the limits of the Dirac's algorithm in the presence of boundaries and introduce a generalization, called GNH algorithm, that can tackle these systems.

Weakly-Einstein Riemannian Manifolds

Rodrigo Mariño Villar (Universidade de Santiago de Compostela)

Wednesday 9 11:00 • Multimedia Room

Keywords: *Critical metric, Einstein and weakly-Einstein metrics, locally conformally flat*

Abstract: The purpose of this communication is to give a classification of locally conformally flat weakly-Einstein manifolds, showing that either the scalar curvature is constant (and thus (M, g) is locally a product $N_1^m(c) \times N_2^m(-c)$ of equally-dimension manifolds of constant opposite curvature) or otherwise (M, g) is locally a Robertson-Walker warped product $\mathcal{I} \times_f N(c)$ for some specific warping function f and fiber $N(c)$ of constant curvature. Furthermore, a four-dimensional locally conformally flat manifold is weakly-Einstein if and only if the scalar curvature vanishes. As a consequence one has explicit examples of connected weakly-Einstein manifolds with non-constant $\|R\|^2$, in opposition to the Einsteinian situation.

Spin(7) structures from an spinorial viewpoint

Lucía Martín Merchán (Universidad Complutense de Madrid)

Monday 7 12:15 • Grey Room 1

Keywords: *Spin(7) structures, spinors*

Abstract: The group Spin(7) appears on Berger's list as an exceptional holonomy group of simply connected, irreducible and non-symmetric Riemannian manifolds. Spin(7) holonomy, which occurs on 8-dimensional manifolds, is homotopically obstructed by the presence of a Spin(7) structure. Manifolds admitting Spin(7) structures are spin and their spinorial bundle has section which determines the structure. The purpose of this talk is to introduce the spinorial description of Spin(7) structures. It is based on the author's work: http://arxiv.org/abs/1803.08734.

Amenability in (Semi)-Groups and Algebras

Diego Martínez (UC3M-ICMAT)

Monday 7 11:50 • Blue Room

Keywords: *Amenability, semigroups, algebras, Følner sequence*

Abstract: Amenability in groups is a well studied field, leading to countless possible definitions. We shall see how some of those translate into the semigroup and algebra cases, and how these relate to each other. Of particular interest to us will be the Følner and mean characterizations.

Flexible horizontal knots.

Francisco Javier Martínez Aguinaga (ICMAT-UCM)

Wednesday 9 17:25 • Assembly Hall

Keywords: *Distributions, h-Principle, Topology, knots.*

Abstract: In this talk we will review some facts about horizontal knots in non-integrable distributions (Contact, Engel) and we will introduce some recent flexibility results obtained in a joint work with A. del Pino.

Sobolev-Poincaré inequalities for $p < 1$

Javier Martínez Perales (Basque Center for Applied Mathematics)

Wednesday 9 17:00 • Red Room

Keywords: *Poincaré inequalities, Poincaré-Sobolev inequalities, $p < 1$, improvement, reverse Hölder*

Abstract: It is not difficult to see that Poincaré-Sobolev inequality is no longer true when $p < 1$. In 1994, S. Buckley and P. Koskela proved a substitute of Poincaré-Sobolev inequality in the case $p < 1$ for John domains which basically consists on taking a majorant of the gradient satisfying certain weak reverse Hölder inequality for some cubes contained in the corresponding John domain. A very natural example of this situation is the Hardy-Littlewood maximal function of the gradient, whose p-th power is a Muckenhoupt A_1 weight (as $p < 1$) and thus satisfies a reverse Hölder inequality on any cube of $\mathbb{R}^n$. We present a different way to prove this result by using the very general theory given by Bruno Franchi, Carlos Pérez and Richard L. Wheeden and then sharp

Stable regions in a Euclidean ball of R3.

Antonio Luis Martínez Triviño (Differential Geometry)

Monday 7 11:50 • Orange Room

Keywords: *Stable, Isoperimetric, CMC.*

Abstract: Ros and Vergasta classified the stable sets in a ball when the border is a minimal surface or it's verify the following relation between length and area $L \geq 2A$. However, Barbosa proved that this relation is always true in a stable set thank's to a Nunes's inequality. For this reason, if we keep this reasoning, then we can show that the stable sets in a ball are spheres, ecuatorial disks and spherical cap. Main Bibliography: G.Wang and C. Xia. Uniqueness of stable capillary hypersurfaces in a ball, arXiv: 1708.06861v1,2017. E. Barbosa, On stable CMC hypersurfaces with free-boundary in a Euclidean ball, arXiv: 1607.00038,2016. A.Ros and E.Vergasta, Stability for hipersurfaces of constant mean curvature with free boundary, Geom.Dedicata 56 (1995),19-33.

Points in convex figures

Manuel Mellado (Universidad Autónoma de Madrid)

Monday 7 11:25 • Orange Room

Keywords: *Convex figures, descriptive geometry*

Abstract: For any figure F in a plane, bounded and including its border, we define the Soifer's function or Soifer's number of F, $S(F)$, as the minimum integer m such that given any m points of F at least three of them form a triangle with area less than or equal to a quarter of the area of F. When F is convex, $S(F)$ can take only the values 5 or 6. In this talk, we will show $4leqS(F)leq6$. As an original result, we prove $S(H) = 5$ when H is a regular hexagon.

Resonance tongues in the linear Sitnikov equation

Mauricio Misquero (Universidad de Granada)

Wednesday 9 11:25 • Grey Room 1

Keywords: *N-body problem, Sitnikov problem, Hill's equation, Resonance tongues*

Abstract: We deal with a Hill's equation, depending on two parameters $e \in [0, 1)$ and $\Lambda > 0$, that has applications to some problems in Celestial Mechanics of the Sitnikov-type. Due to the nonlinearity of the eccentricity parameter e and the coexistence problem, the stability diagram in the (e, Λ)-plane presents unusual resonance tongues. Half of them collapse into a curve of coexistence, whereas the remaining ones have no pockets and are very thin. Unlike most of the literature, the study is made from a global point of view in the whole range of $e \in [0, 1)$. Indeed, we found an interesting behavior: almost all the tongues concentrate in a small Λ-interval $[1, 9/8]$ as $e \to 1^-$. We apply our diagram to the study of stability and symmetric periodic solutions of a Sitnikov N-body problem.

On Bishop type operators

Miguel Monsalve López (UCM-ICMAT)

Tuesday 8 11:50 • Assembly Hall

Keywords: *Functional analysis, spectral theory, invariant subspaces.*

Abstract: We will discuss some spectral properties of the so-called "Bishop type operators" and will analyze their implications concerning the lattice of invariant subspaces. This is a joint work with Eva A. Gallardo Gutiérrez (UCM-ICMAT).

Integration against the Euler-Poincaré characteristic

David Mosquera Lois (Universidade de Santiago de Compostela)

Tuesday 8 11:00 • Orange Room

Keywords: *Euler-Poincaré characteristic, Euler integration, sensor networks, fiber bundles*

Abstract: The aim of this talk is to develop an integration theory against the Euler-Poincaré characteristic. Several families of topological spaces and definitions of the Euler characteristic for them are introduced, mainly a combinatorial and a (co)homological definition. Integration against Euler-Poincaré characteristic is defined and several properties are discussed. Finally, applications of the theory are presented, both in the context of target enumeration in sensor networks and in Geometry and Topology. Particularly, alternative proofs of the Riemann-Hurwitz formula and of the characteristic of a fiber bundle are presented.

A brief introduction to linear Jordan algebras

Rubén José Muñoz Alcázar (Universidad Rey Juan Carlos)

Wednesday 9 17:25 • Blue Room

Keywords: *Jordan algebras, linear Jordan algebras, non-associative algebras*

Abstract: In this talk we describes the historical need that give origin to (linear) Jordan algebras, giving way to the current definition of this kind of algebras. Thereafter, we will talk about the classic examples of Jordan algebras and end by stating a classification theorem for simple Jordan algebras given by Zelmanov.

Random Variable Transformation technique to solve differential equations with uncertainty

Ana Navarro Quiles (Universitat Politècnica de València (UPV))

Wednesday 9 16:35 • Multimedia Room

Keywords: *Random Variable Transformation technique, First Probability Density Function, Uncertainty, Random Differential Equation*

Abstract: Differential equations have been demonstrated to be useful tools to modelling numerous phenomena of interest in many disciplines. These models usually depend on some parameters in its formulation, such as the coefficients or the initial conditions. These quantities are really obtained by experiments, then measurement errors are involved. In addition, there are some random external factors that can affect to the system. This circumstance make more advisable to consider these inputs as random variables or stochastic processes rather than deterministic constants or functions. The main objective of this talk is to show the capability of the Random Variable Transformation method to solve, from a probabilistic point of view, differential equations with uncertainty in its formulation. From this technique

the first probability density function of the solution stochastic process has been obtained in particular problems. To conclude, several illustrative examples will also be included.

Ruled hypersurfaces with constant mean curvature in complex space forms are minimal

Olga Pérez-Barral (Universidade de Santiago de Compostela)

Monday 7 16:35 • Orange Room

Keywords: *Complex space form, complex projective space, complex hyperbolic space, ruled hypersurface, constant mean curvature, minimal hypersurface.*

Abstract: A classical theorem of Catalan states that the only ruled minimal surfaces in the Euclidean 3-space are planes and helicoids. This result has been extended in several directions in the context of spaces of constant curvature. In particular, Barbosa and Delgado proved that there are no ruled hypersurfaces with nonzero constant mean curvature in nonflat space forms other than the 3-sphere. The aim of this talk is to present the complex analog of this result: ruled hypersurfaces with constant mean curvature in nonflat complex space forms (that is, in complex projective and hyperbolic spaces) are minimal. Therefore, by a classification result by Lohnherr and Reckziegel such hypersurfaces are Clifford cones, bisectors or Lohnherr hypersurfaces. This is a joint work with Miguel Domínguez Vázquez [arXiv:1802.09341].

Siegel's theorem for integral points on curves

XUAN KIEN Phung (IRMA-University of Strasbourg, France)

Monday 7 17:00 • Grey Room 1

Keywords: *integral points, Siegel's theorem, elliptic curves*

Abstract: The well-known classical Siegel's theorem states that if C is an affine algebraic curve such that the genus of C is at least 1 or C has at least 3 points at infinity, then the set of integral points of C is finite. In this expository talk, I will discuss various available modern methods and tools ranging in different domains of mathematics for the proof of this beautiful theorem with an emphasis on the case of elliptic curves.

Fourier Integral Operators on weighted modulation spaces

Eva Primo Tárraga (Universitat de València)

Monday 7 16:35 • Blue Room

Keywords: *Fourier, Integral Operators, modulation spaces, Gabor frames*

Abstract: In this talk we will study Fourier integral operators on weighted modulation spaces. To do this we use the matrix representation of Fourier integral operators with respect to a Gabor frame. We will arrive to suffices conditions for the continuity and compactness. And we will see some cases where the condition for the compactness is necessary too.

Numerical index with respect to an operator

Alicia Quero de la Rosa (Universidad de Granada)

Tuesday 8 11:25 • Assembly Hall

Keywords: *numerical range, numerical radius, numerical index*

Abstract: The numerical index of a Banach space is a constant relating the behavior of the numerical range with that of the usual norm on the Banach algebra of all bounded linear operators on the space. Recently, Ardalani introduced new concepts of numerical range and numerical radius of one operator with respect to another one, which generalize in a natural way the classical concepts of numerical range and numerical radius. The aim of this talk is to study basic properties of these new concepts, present some examples and provide results on the stability of the numerical index with respect to an operator by some operations like absolute sums and vector-valued function spaces.

Computing symmetries of ruled rational surfaces.

Emily Quintero (Universidad de Alcalá)

Tuesday 8 12:15 • Grey Room 1

Keywords: *Ruled Surface, Symmetry Detection, Rational Parametrization, Algebraic Surfaces,*

Abstract: We present an algorithm to compute the symmetries of a ruled surface, defined by means of a rational parametrization. The algorithm proceeds by reducing the problem to the parameter space, taking advantage of the fact that any symmetry of the surface corresponds to a birational parametrization in the parameter space whose structure can be predicted. Essentially, we use the fact that any symmetry f of the object has an associated transformation φ in the parameter space, that inherits some of the properties of the symmetry it is associated with: computing the associated transformation φ leads, in turn, to the symmetry f itself. However, in order to do this one needs to guess the structure of the associated transformation φ. This is easy to do for curves, but not for surfaces, and requires to make use of the properties of the surface (in our case, of the fact that it is ruled).

Grothendieck categories as a bicategory of fractions of linear sites

Julia Ramos González (Universiteit Antwerpen)

Monday 7 17:50 • Grey Room 1

Keywords: *Grothendieck categories, topos theory, linear sites, bicategories of fractions*

Abstract: Let k be a commutative ring. We prove that the 2-category Grt_k of Grothendieck abelian k-linear categories with colimit preserving k-linear functors and k-linear natural transformations is a bicategory of fractions in the sense of Pronk of the 2-category $\mathsf{Site}_{k,\mathsf{cont}}$ of k-linear sites with k-linear continuous functors and k-linear natural transformations. In complete analogy, we prove that the conjugate-opposite 2-category of the 2-category Topoi_k of Grothendieck abelian k-linear categories with k-linear geometric morphisms and k-linear morphisms between them is a bicategory of fractions of the 2-category Site_k of k-linear sites with k-linear morphisms of sites and k-linear natural transformations. In addition, we explain how the first statement can be potentially used to make the tensor product of Grothendieck categories from our previous work into a bi-monoidal structure on Grt_k.

Malware Detection Using Hybrid Analysis

Alberto Redondo (ICMAT-CSIC)

Wednesday 9 11:50 • Blue Room

Keywords: *Malware Detection, Machine Learning, Adversarial Risk Analysis*

Abstract: Malicious software in the form of Trojans, Worms or Adware constitute a huge threat to security affecting millions of hosts yearly. Current malware detection methods are frequently classified many times into three categories: static, dynamic and hybrid. In static methods, the files are classified based on features extracted from the executable. Dynamic methods are carried out in a separate learned environment such as a sandbox or a virtual machine. Analysis is based on system calls executed by the malware. Hybrid analysis methods, combine static and dynamic analysis techniques getting advantage from both approach. In this work, we present a hybrid analysis approach which obtains static features from malware files such as operation codes, registers, API calls or files entropy, and we combined with dynamic features extracted through an Open Source Software called Cuckoo Sandbox. We implement several classification algorithms and describe the results obtained with this approach.

Ejection-collision orbits in the RTBP

Òscar Rodriguez (Universitat Politècnica de Catalunya)

Monday 7 17:25 • Red Room

Keywords: *regularization, ejection-collision orbits, bifurcations*

Abstract: As it is well known, for any value of the mass parameter $\mu \in (0, 0.5]$ and sufficiently restricted Hill regions, there are exactly four ejection-collison orbits. We check their existence and extend numerically these four orbits for $\mu \in (0, 0.5]$ and for less restrictive values of the Jacobi constant. We consider n-ejection-collision orbits, we explore them numerically for $\mu \in (0, 0.5]$ and suitable values of the Jacobi constant and we discuss the appearing bifurcations. This is joint work with Mercè Ollé and Jaume Soler

Ergodic properties of the multiplication operator

Alberto Rodríguez Arenas (Universitat Politècnica de València)

Monday 7 17:00 • Blue Room

Keywords: *mean ergodic operator, power bounded operator, multiplication operator, weighted Banach space, continuous function*

Abstract: Multiplication operators on weighted Banach spaces and locally convex spaces of continuous functions and on sequences have been thoroughly studied. We characterize when continuous multiplication operators on a weighted Banach space and on a weighted inductive limit of Banach spaces of continuous functions and on Köthe echelon and co-echelon spaces are power bounded, mean ergodic or uniformly mean ergodic. The behaviour of the operator on weighted inductive limits depends on the the properties of the defining sequence of weights and it differs from the Banach space case.

Large Scale Automated Forecasting for Monitoring Network Safety and Security

Simón Rodríguez Santana (ICMAT-CSIC)

Wednesday 9 11:00 • Blue Room

Keywords: *Forecasting, Real time predictive analytics, Network monitoring, Dynamic models, Bayesian methods.*

Abstract: Real time large scale streaming data pose major challenges to forecasting, in particular defying the presence of human experts to perform the corresponding analysis. We present here a class of models and methods used to develop an automated, scalable and versatile system for large scale forecast- ing oriented towards safety and security monitoring. Our system provides short and long term forecasts and uses them to detect safety and security issues in relation with multiple internet connected devices well in advance they might take place.

NASAL-FLOW: an automatised fluid dynamics analysis of airflow in the human upper airways

Ismael Rodríguez-Cal (Technical University of Madrid (UPM)-Tecnologías Avanzadas Inspiralia)

Wednesday 9 17:00 • Grey Room 1

Keywords: *Fluid Dynamics, Nasal airflow, Modeling and Simulation, CFD, Programming*

Abstract: The simulation of the airflow in the human upper airways provides valuable quantitative information about patient's breathing. It involves the expertise in scientific areas such as image processing, 3D reconstruction and Computational Fluid Dynamics (CFD). NASAL-FLOW service integrates under an automatised unique work-flow all these stages. Results can be analysed two-fold: a standard PDF report with the main data or by the use of an interactive web postprocessor. A customised tool for virtual modification of nasal cavity is also included within the service. As a result, a standardised procedure is set to study systematically the flow patterns of each patient, allowing comparison among different cases. Outcomes of several surgery methodologies can be evaluated computationally without invasive procedures for the patient. NASAL-FLOW web service provides fast, robust and systematic CFD analysis of the human upper airways, thus making easier its integration in daily clinical practise.

The Riemann Mapping Theorem and extensions

Óscar Roldán Blay (Universitat de València)

Wednesday 9 11:50 • Assembly Hall

Keywords: *Complex analysis, Holomorphy, Riemann mapping, Conformal maps, Prime ends, Jordan curve*

Abstract: The Riemann Mapping Theorem claims that every simply connected open set $U \subsetneq \mathbb{C}$ is biholomorphic to the open unit disc $\mathbb{D}$, that is, there exists a holomorphic bijection $f : U \to \mathbb{D}$ whose inverse is also holomorphic (these are called "Riemann mappings"). First, we will show a version of the theorem, and we will give several equivalent statements. Then, we will study in-depth under what conditions a Riemann mapping can be extended to the boundary of its domain so that the extension is continuous (or even a homeomorphism). We will give complete characterizations for both when the mapping goes from U to the disc and when it goes the other way around. We will also show a few unpublished results by Manuel Valdivia on the topic which have strong geometrical intuitions behind. Finally, we will show a counterexample by Poincaré that shows why there can't be a Riemann Mapping Theorem for several complex variables.

Finite groups acting on 4-manifolds

Carles Sáez Calvo (BGSMath - UB)

Wednesday 9 16:35 • Assembly Hall

Keywords: *4-manifolds, finite groups, transformation groups*

Abstract: If X is a smooth manifold, its diffeomorphism group $Diff(X)$ has the Jordan property if there exists a constant $C > 0$ such that any finite subgroup $G \leq Diff(X)$ has an abelian subgroup $A \leq G$ satisfying $[G : A] < C$. This property has been of interest since E. Ghys formulated the conjecture that every closed smooth manifold has a Jordan diffeomorphism group. However, the conjecture turned out to be false in dimension 4, a counterexample being $T^2 \times S^2$. In this talk, I will present a generalization of the Jordan property that holds for every 4-manifold, and use it to give a partial classification of 4-manifolds having diffeomorphisms groups satisfying the Jordan property.

A computational approach to Hopf-Galois theory

Marta Salguero García (Universitat de Barcelona)

Wednesday 9 12:15 • Red Room

Keywords: *Galois theory, Hopf algebra, computational algebra system Magma*

Abstract: Hopf-Galois theory is a generalization of Galois theory. The point is to replace Galois groups by Hopf algebras and the Galois action by a 'Hopf action' by endomorphisms. This pair gives the so-called Hopf-Galois structures. In this talk we will focus on the case of separable extensions, in which there is a characterization in terms of groups. This allowed us to use Magma to explicitly obtain all Hopf-Galois structures of a given separable extension and to determine some important properties. We will explain the two algorithms we designed and present the computational and theoretical results we can derive from the collected data. This is the result of joint works with Teresa Crespo (UB).

Distribution functions of non-linear stochastic differential systems with uncertain parameter

Ihsane SALLEH (ENSET, Rabat-Morocco)

Wednesday 9 17:00 • Multimedia Room

Keywords: *Meshfree method, Radial basis function, Fokker-Planck eqaution*

Abstract: In this work, the exponential closure method is extended to the stochastic differential equation with uncertain parameters. The Fokker-Planck-Kolmogorov equation associated to the considered random system is used to get the associated distribution function. For physical application, the dynamic behavior of beams with uncertain parameters excited by a uniformly distributed Gaussian white noise

is considered. The mathematical development and numerical procedures based on meshfree method with radial basis functions (RBF) are elaborated for numerical solutions. The obtained results are well compared to the available ones. The accuracy, effectiveness and advantages of the developed procedures in analyzing the stationary probabilistic solutions of nonlinear stochastic dynamical systems with uncertain parameters excited by a Gaussian white noise are demonstrated.

From the minimal to the maximal surface equation in certain ambient manifolds

José Antonio Sánchez Pelegrín (Universidad de Granada)

Monday 7 17:50 • Orange Room

Keywords: *Minimal surface equation, maximal surface equation, warped product space*

Abstract: The study of the duality between minimal and maximal graphs goes back to 1970, when Calabi discovered a nice correspondence between solutions of the minimal surface equation in the Euclidean space and solutions of the maximal surface equation in the Lorentz-Minkowski spacetime. Later on, several authors have studied this correspondence using different approaches. In particular, we have found a duality result between solutions of the minimal surface equation in a Riemannian warped product with base a 2-dimensional Riemannian surface (B, g_B), fiber the real line and warping function $\frac{1}{\sqrt{\gamma}}$ and solutions of the maximal surface equation in a standard static spacetime with the same base (B, g_B), fiber the real line endowed with the negative of its standard metric and warping function $\sqrt{\gamma}$.

Curvature, measures and isometries.

Jaime Santos Rodríguez (Universidad Autónoma de Madrid)

Wednesday 9 12:15 • Multimedia Room

Keywords: *Ricci curvature, isometric actions*

Abstract: Lott-Sturm-Villani defined a synthetic notion of lower Ricci curvature bounds for metric measure spaces in terms of the convexity of an entropy functional. This condition is known to generalize a lower Ricci curvature bound on a Riemannian manifold. In this talk we will look at the the properties of the isometries of a metric measure space satisfying these curvature bounds, namely we will prove that the group of isometries is in fact a Lie group.

Integro-differential Allen-Cahn equations: the saddle-shaped solution

Tomás Sanz-Perela (Universitat Politècnica de Catalunya)

Monday 7 11:25 • Red Room

Keywords: *integro-differential equations, saddle solution, Simons cone, stability*

Abstract: The talk will be devoted to present some recent results concerning the saddle-shaped solution to the semilinear equation $Lu = f(u)$ in $\mathbb{R}^{2m}$, where f is of bistable type and L is a uniformly elliptic integro-differential operator with a radially symmetric and translation invariant kernel. The most typical example for L is the fractional Laplacian. Saddle-shaped solutions are doubly radial, odd with respect to the Simons cone and vanishing only in this set. They are the simplest candidates as a counterexample of the De Giorgi conjecture in high dimensions. We establish the existence and uniqueness of the saddle-shaped solution, as well as its asymptotic behavior. The key tool used is a maximum principle for the operator L acting on doubly radial odd functions. Moreover, we show that when L is the fractional Laplacian, the saddle solution is unstable in dimensions $2m \geq 14$. Therefore, in the same dimensions the Simons cone is an unstable nonlocal minimal surface.

Parabolicity of the Riemannian product of rotationally symmetric spaces

Erik Sarrión Pedralva (Universitat Jaume I)

Monday 7 12:15 • Orange Room

Keywords: *Riemannian geometry, parabolicity, rotationally symmetric spaces*

Abstract: A complete and non-compact Riemannian manifold is parabolic if and only if every subharmonic and bounded continuous function defined on it is constant. We study the relation between the geometry of a manifold and this functional analytic property. Specifically, the main goal of our work focuses into the study of geometrical descriptions (expressed as conditions on the curvature) for the parabolicity of the Riemannian product of rotationally symmetric spaces

Affective decision making models with applications to social robotics

Liu Si (ICMAT)

Monday 7 11:25 • Assembly Hall

Keywords: *affective computing, adversarial risk analysis, decision theory*

Abstract: Our paper provides a model for an autonomous agent that makes decisions partly influenced by affective factors when interacting with humans and other agents. The factors included are emotions, mood, personality traits (HEXACO) and activation sets for impulsive behavior. Our development is based on our previous multi-objective expected utility and adversarial risk analysis (ARA) model. Our

final aim is to provide a believable approach implementable within non-expensive social robotic platforms. Affective mechanisms seem essential to improve the interaction among human and robotic agents. Affective robots should not only provide better performance in assisting humans, but also might enhance robots' abilities to make decisions. These approaches could enable an intelligent agent to adapt dynamically to users and its environment and potentially be used to enhance a wide range of applications. We describe several simulations showing its relevance and capacity to improve agent adaptivity.

Model-Based Evaluation of Signal Processing Algorithms for the Detection of Rub in Aeroderivative Gas Turbines with Accelerometers on Casing

Alejandro Silva Bernárdez (Escuela Técnica Superior de Ingenieros Industriales)

Monday 7 17:25 • Assembly Hall

Keywords: *rotordynamics, rub; aeroderivative turbines; accelerometers; early fault detection; fourier 15 analysis; real cepstrum; wavelet transform*

Abstract: A common fault in turbomachinery is rotor-casing rub. Vibration as indicator of rub is usually measured with displacement sensors mounted between rotor and stator. But in machines such as aeroderivative turbines, with increasing industrial relevance in power generation, constructive reasons prevent the use of those sensors, being only acceleration signals at selected casing locations available. Their inferior information content about the machine dynamics hinders the characterization of machinery condition. In this work we introduce a rotor model for the simulation of rub between the rotor and the flexible casing of an aeroderivative turbine. With it we evaluate the performance of several signal processing methods for the detection of rotor-casing rub. Several degrees of rub severity are tested. The evaluation criteria are potential for rub-feature identification and denoising capabilities. The aim is to enable early fault diagnosis of rub before it causes machine shutdown or damage.

Quantitative a Priori Estimates for Fast Diffusion Equations with Caffarelli-Kohn-Nirenberg weights. Harnack inequalities and Hölder continuity

Nikita Simonov (Universidad Autunoma de Madrid)

Wednesday 9 16:35 • Red Room

Keywords: *Harnack inequalities; Hölder Continuity; Caffarelli-Kohn-Nirenberg inequalities*

Abstract: We study a priori estimates for a class of non-negative local weak solution to the weighted fast diffusion equation $u_t = |x|^{\gamma}\nabla \cdot (|x|^{-\beta}\nabla u^m)$, with $0 < m < 1$ posed on cylinders of $(0,T) \times \mathbb{R}^N$. The weights $|x|^{\gamma}$ and $|x|^{-\beta}$, can be both degenerate and singular and need not to belong to the Mouckenhoupt class $\mathcal{A}_2$, a typical assumption for these kind of problems. The weights that we consider are not translation invariant and this causes a number of extra difficulties: for instance, the scaling properties of the equation change when considering the problem around the origin or far from it. We will present quantitative upper and lower estimates for local weak solutions, focussing our attention where a change of geometry appears. Such estimates fairly combine into forms of Harnack inequalities. As a consequence, we obtain Hölder continuity of the solutions

Thin Triangle Party!

Hang Lu Su (ICMAT)

Tuesday 8 11:25 • Orange Room

Keywords: *hyperbolic geometry, introduction, intuitive, Morse's lemma, Svarc-Milnor lemma, geodesics*

Abstract: Hyperbolic geometry is fun and intuitive! In this short talk, we will i) look at examples of hyperbolic spaces, ii) quickly state three key theorems in it (divergence of geodesics, local geodesics are quasi-geodesics and stability of quasi-geodesics which is also known as Morse's lemma) as well the intuition behind them, iii) present the Švarc-Milnor lemma to hopefully justify why you'll keep hearing 'let G act properly and co-compactly on a space H" if you hang around the field!

Mathematical modeling and homogenization for nonlinear behavior of reinforced piezoelectric composites

Nada TASSI (University Mohammed 5. Rabat-Morroco)

Monday 7 17:50 • Red Room

Keywords: *Mathematical modeling, integral equations, nonlinear behavior, effective properties, elliptic integrals, Green's functions*

Abstract: In the present work, a mathematical modeling for the nonlinear behavior of piezoelectric materials based on integral equations is elaborated. Partial differential equations governing equilibrium are coupled and nonlinear. The problem of heterogeneous inclusion taking account of the nonlinear behavior is analyzed by the Green's functions and interaction tensors. Based on elliptic integrals and

localization tensors, a mathematical modeling is derived. The self-consistent iterative scheme is developed here for numerical solutions. Numerical results of effective elastic properties are given for several piezoelectric inclusions with various shapes and types.

Is it complex to be a hub?

Alejandro Tlaie Boria (Center for Biomedical Technology)

Tuesday 8 11:00 • Blue Room

Keywords: *Dynamical Complexity, Complex Networks, Neuronal Networks*

Abstract: In this talk, we will deal with the relationship between the topological position a node occupies in a complex network and its dynamical state. Furthermore, it would be interesting to determine whether it is possible to infer a node's topological place from its dynamics. We work with the noisy Morris-Lecar (M-L) model, which is a tool for modeling the electrical potential of a neuron's membrane, and the Rössler Oscillator, which is a chaotic model. We will give a brief overview of the usefulness of Complex Networks, present the complexity measure that we used to characterize the time series and, finally, show our results (both simulated and experimental).

Computing the homology of closed semialgebraic sets

Josue Tonelli Cueto (Technische Universität Berlin)

Tuesday 11 11:00 • Grey Room 1

Keywords: *semialgebraic geometry, homology computation, numerical methods*

Abstract: Semialgebraic set are sets that can be described by polynomials and inequalities. One of the open computational problems concerning them, it is to compute their homology (Betti numbers and torsion coefficients) in single exponential time. As of today, the known algorithms have doubly exponential complexity (and this is so for almost all input data). In this talk, we describe a new numerical algorithm for computing the homology of closed semialgebraic sets given by Boolean formulas without negations over lax polynomial inequalities. The algorithm works in weak exponential time. This means that outside a subset of data having exponentially small measure, the cost of the algorithm is single exponential in the size of the data. This improves over previously known algorithms. This is joint work with Peter Bürgisser and Felipe Cucker.

Surrogate-based analysis of turbulence and fire-spotting in wild-land fire modeling

Andrea Trucchia (BCAM (Basque Center for Applied Mathematics) and UPV-EHU, Campus de Leioa)

Tuesday 8 11:25 • Red Room

Keywords: *Wild-land fire, Sensitivity Analysis, Uncertainty Quantification, Polynomial Chaos*

Abstract: Wild-land fires are multi-scale and multi-physics phenomena, whose corresponding models require a large number of parameters. Uncertainty Quantification (UQ) on the output is needed, as well as Sensitivity Analysis (SA) on the inputs to determine the most influential parameters. After UQ and SA steps are performed, Data Assimilation procedures can be pursued. Here we consider a model that accounts for the effect of turbulence and fire spotting by imposing statistical fluctuations on the fire perimeter. The aim is the variance-based sensitivity analysis and the determination of the statistical properties of the burnt area at each time, given the uncertainties on the inputs. A Montecarlo approach is not viable due to the high computational cost, and thus surrogate modeling is required. Two classes of surrogate models are investigated, namely Gaussian Process Surrogates and Polynomial Chaos (PC). Sparse techniques for PC surrogates are employed to overcome the limited database size.

Periodic solutions of state-dependent impulsive differential equations

José Manuel Uzal (Universidade de Santiago de Compostela)

Monday 7 16:35 • Red Room

Keywords: *impulsive differential equations, periodic solutions, fixed point theorem*

Abstract: Many evolution processes are characterized by the fact that they experience a sudden change in their state at certain moments of time. It is natural to assume that these changes act instantaneously and in the form of impulses. Mathematical models in aircraft control, population dynamics, economics or drug administration show impulses effects. The moments of impulse effects could be fixed beforehand or they could depend on the solution. We study a second-order differential equation with state-dependent impulses. The existence of periodic solutions is obtained by means of a new twist fixed-point theorem, similar to Poincaré's last geometric theorem.

Algebras and Superalgebras

Guillermo Vera de Salas (Universidad Rey Juan Carlos)

Wednesday 9 17:50 • Blue Room

Keywords: *Superalgebra, Jordan algebra, Lie algebra, Grassmann envelope*

Abstract: An introduction to Associative, Jordan and Lie superalgebras and their relation with Associative, Jordan and Lie algebras via Grassmann envelope.

Classification of three-dimensional real coboundary Lie bialgebras

Daniel Wysocki (University of Warsaw)

Monday 7 11:00 • Grey Room 1

Keywords: *coboundary Lie bialgebra, Grassmann algebra, algebraic Schouten-Nijenhuis bracket,* $\mathfrak{g}$*-invariant metric*

Abstract: A *Lie bialgebra* is a pair $(\mathfrak{g}, \delta)$, where $\mathfrak{g}$ is a Lie algebra along with a map $\delta : \mathfrak{g} \to \mathfrak{g} \wedge \mathfrak{g}$, called a *cocommutator*, that induces a Lie algebra structure in $\mathfrak{g}^*$ while satisfying a compatibility condition: the *1-cocycle condition*. If $\delta(\cdot) = [\cdot, r]_{SN}$ for an $r \in \Lambda^2\mathfrak{g}$, where $[\cdot,\cdot]_{SN}$ is the algebraic Schouten-Nijenhuis bracket in the Grassmann algebra $\Lambda\mathfrak{g}$, the Lie bialgebra $(\mathfrak{g}, \delta)$ is called *coboundary*. This notion has many applications in the theory of integrable systems and quantum gravity, to name a few. In this talk I will present a new geometric approach to classifying three-dimensional real coboundary Lie bialgebras through Grassmann algebras, which simplifies previous results on the topic. To illustrate the method, several examples will be discussed.

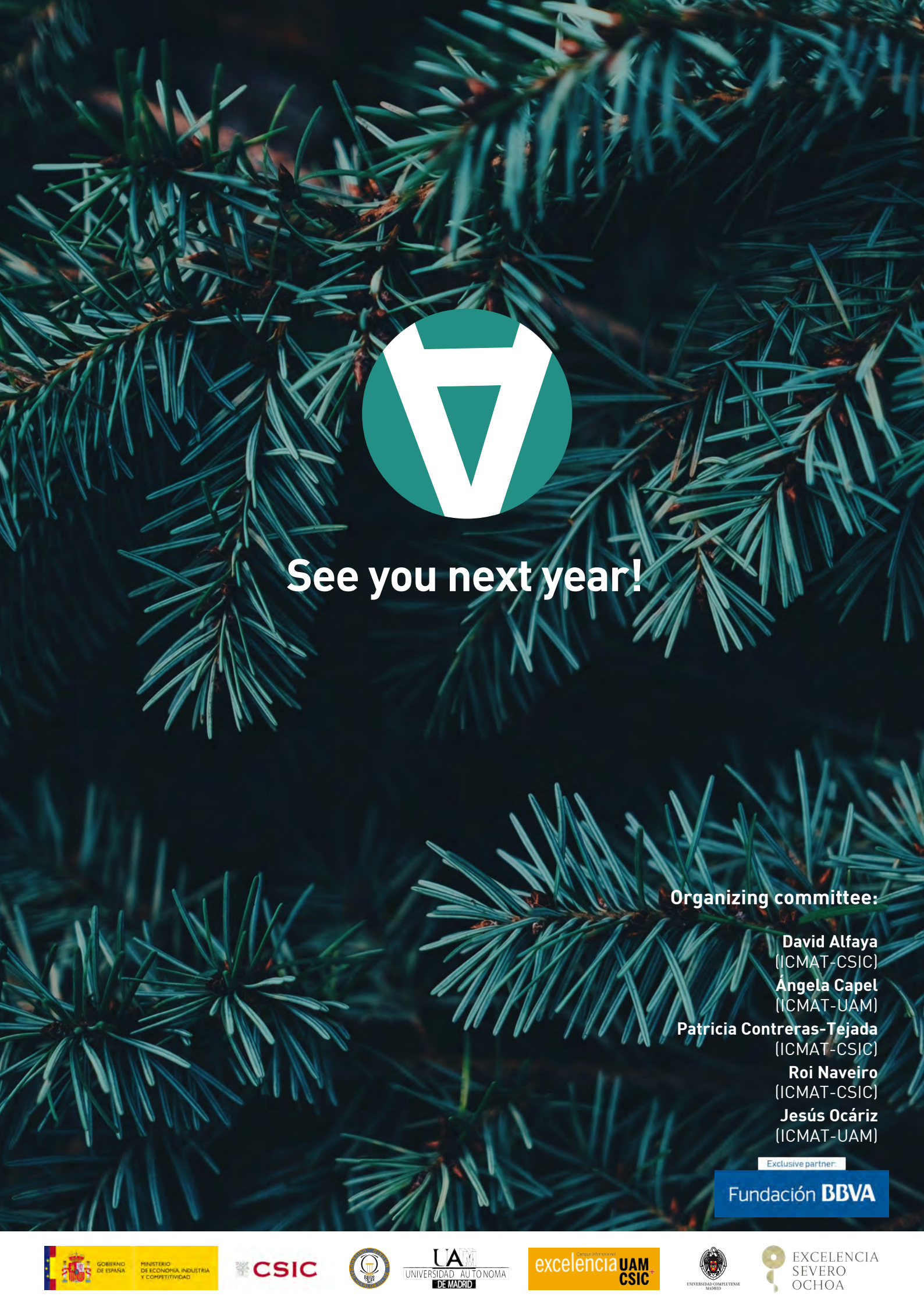
Geometric characterisations of $\ell^1(\Gamma)$

Antonio Zarauz Moreno (University of Almeria)

Tuesday 8 12:15 • Assembly Hall

Keywords: *Geometry of Banach spaces, convex sets, extreme point, face*

Abstract: Given a vector space of arbitrary dimension X, we introduce the problem of finding a compatible norm such that the closed unit ball of that normed space has a minimum number of extreme points. In this context, it is convenient to clarify what we mean by "minimality" of extreme points, as well as other concepts concerning the dimension of the space and the extremal structure of the unit ball of a normed space. In order to find a suitable solution for this problem, two characterisations of $\ell^1(\Gamma)$ are given.



See you next year!

Organizing committee:

David Alfaya
(ICMAT-CSIC)
Ángela Capel
(ICMAT-UAM)
Patricia Contreras-Tejada
(ICMAT-CSIC)
Roi Naveiro
(ICMAT-CSIC)
Jesús Ocáriz
(ICMAT-UAM)

Exclusive partner:
Fundación BBVA

GOBIERNO DE ESPAÑA · MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD · CSIC · UAM UNIVERSIDAD AUTÓNOMA DE MADRID · excelencia UAM CSIC · UNIVERSIDAD COMPLUTENSE MADRID · EXCELENCIA SEVERO OCHOA