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Abstracts

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Contributed Papers

Organizers:

Local Organizing Committee

Index of Abstracts

(In this index, in case of multiple authors, only the speaker is shown)

A Note on Exact and Approximate Solutions of Integral Equations of the Second Kind Using Maple Software

Javad Abdalkhani (The Ohio State University)

This talk illustrates the effectiveness and efficiency of Maple by: 1) Employing the successive iterative substitution method for both the Fredholm and the Volterra integral equations of the second kind, easily finding an exact or an accurate approximate solution to a given integral equation under proper conditions; 2) Offering a numerical method to obtain a good approximate solution to the (unknown) exact solution of the Volterra integral equations of the second kind.

Complete linear Weingarten surfaces of maximal type.

Juan Angel Aledo Sánchez* (Universidad de Castilla la Mancha)

José A. Gálvez (Universidad de Granada)

In this work we extend the Weierstrass representation for maximal spacelike surfaces in the 3-dimensional Lorentz-Minkowski space to spacelike surfaces whose mean curvature is proportional to its Gaussian curvature (linear Weingarten surfaces of maximal type). We use this representation in order to study the Gaussian curvature and the Gauss map of such surfaces when the immersion is complete, proving that the surface is a plane or the supremum of its Gaussian curvature is a negative constant and its Gauss map is a diffeomorphism onto the hyperbolic plane. Finally, we classify the rotation linear Weingarten surfaces of maximal type.

Attracting Periodic Orbits of some Classical Third Order Iterative Methods

Sergio Amat Plata (U.P.Cartagena)

In this paper, we shall use a family of iterative methods to find roots to non–linear equations and present a procedure to construct polynomials in such a way that superattracting periodic orbits of any prescribed period will occur when these iterative methods are applied. The family include Chebyshev's method, Halley's method, Super-Halley's method and Newton's method as a limit case.

Inheritance of Regularity by Peirce Gradings

José A. Anquela (Universidad de Oviedo)

A decomposition $V = V_0 \oplus V_1 \oplus V_2$ of a Jordan pair V iscalled a Peirce grading if it formally satisfies the multiplication rules of Peirce decompositions with respect to idempotents. Through the connection between Peirce gradings and subquotients, we will show how the Peirce components of a Peirce grading inherit regularity conditions (simplicity, strong primeness, primitivity, ...). Similar notions and properties are studied for Jordan triple systems.

Weak Sufficient Convergence Conditions and Applications for Newton Methods

Ioannis Argyros (Cameron University)

The famous Newton-Kantorovich hypothesis has been used for a long time as a sufficient condition for the convergence of Newton's method to a solution of an equation in connection with the Lipschitz continuity of the Fréchet-derivative of the operator involved. Using Lipschitz and center-Lipschitz conditions we show that the Newton Kantorovich hypothesis is weakened. The error bounds obtained under our semilocal convergence result are finer and the information on the location of the solution more precise than the corresponding ones given by the dominating Newton-Kantorovich theorem, and under the same hypotheses/computational cost, since the evaluation of the Lipschitz also requires the evaluation of the center-Lipschitz constant. In the case of local convergence we obtain a larger convergence radius than before. This observation is important in computational mathematics and can be used in connection to projection methods and in the construction of optimum mesh independence refinement strategies

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Relatively weakly open sets in closed balls of C^*-algebras

Julio Becerra Guerrero* (Universidad de Granada)

G. López Pérez (Universidad de Granada)

A. Rodríguez Palacios (Universidad de Granada)

Let A be an infinite-dimensional C^*-algebra. We prove that every nonempty relatively weakly open subset of the closed unit ball B_A of A has diameter equal to 2. This implies that B_A is not dentable, and that there is no any point of continuity for the identity mapping $(B_A, \text{weak}) \to (B_A, \text{norm})$.

Szegő-Padé approximants for Stieltjes functions

Manuel Bello Hernández (Universidad de La Rioja)

We prove that if the strong moment problem for a measure is determinate then the multipoint Padé approximant for the Stieltjes function converges. This result is used to obtain convergence of Szegő-Padé approximants for Stieltjes functions. Quantitative results are also given.

A Bohr type theorem in Hardy spaces

Catherine Bénéteau (Seton Hall University)

Bohr's theorem says that for any analytic function $f(z) = \sum_{n=0}^{\infty} a_n z^n$ that is bounded by 1 in the unit disk in the complex plane, $\sum |a_n| r^n \leq 1$ for any $r \leq \frac{1}{3}$, and this value $\frac{1}{3}$ is sharp. We are interested in studying the growth of series of the type $\sum |a_n|^p r^n$ when $0 < p < 1$ for analytic functions f that vanish at the origin and are in the unit ball of some Hardy space H^s. We obtain a "Bohr radius" for such functions and discuss the consequences for functions of several variables.

A computational method to construct the Lie correspondence on a matrix nilpotent Lie group

Juan Carlos Benjumea Acevedo* (Universidad de Sevilla)

F. J. Echarte (Universidad de Sevilla)

J. Néñez (Universidad de Sevilla)

A. F. Tenorio (Universidad de Sevilla)

The main goal of this paper is to construct suitable tools to compute the Lie algebra associated with a matrix Lie group given. Next, by checking the subalgebras of that algebra, the simply connected Lie group associated with them can be obtained, by integration.

Particularly, when implementing this procedure in a symbolic computational package, we obtain satisfactory results related to nilpotent Lie algebras. They can be represented by unipotent triangular matrices.

According to it, we give an algorithmic procedure which allows to obtain the brackets appearing in the law, with respect to certain basis, of the Lie algebra $\mathfrak{g}$ associated to that group G. Besides, every Lie subalgebra of $\mathfrak{g}$ determines on it an involutive distribution and thus, the associated connected integral subvariety can be constructed as a Lie subgroup of G.

As a consequence, we can give a representation by unipotent triangular matrices $n \times n$ of the simply connected Lie group associated with every nilpotent Lie algebra of dimension n, with $n \leq 6$.

Homotopy Classification of Poincaré Duality Pairs of Dimension

Beatrice Bleile (University of New England)

Poincaré duality complexes of dimension n (PD^n–complexes) are homotpy generalizations of n–dimensional manifolds and Poincaré duality pairs of dimension n (PD^n–pairs) are homotopy generalizations of n–dimensional manifolds with boundary.

In 1977 Hendriks gave a complete system of homotopy invariants of $PD3$–complexes. In 1981 Turaev provided an alternatice proof of Hendriks' classification theorem. We generalize Turaev's proof too the case of $PD3$–pairs.

Complete spacelike hypersurfaces with constant mean curvature in the de Sitter space: A gap theorem

Aldir Brasil* (Universidade Federal do Ceará)

Antonio Gervasio Colares (UFC)

Oscar Palmas (UNAM)

Let M^n be a complete spacelike hypersurface with constant mean curvature H in the de Sitter space S_1^{n+1}. We use the operator $\phi = A - HI$, where A is the second fundamental form of M, and the roots $B_H^- \leq B_H^+$ of a certain second order polynomial, to prove that either $|\phi|^2 \equiv 0$ and M is totally umbilical, or $B_H^- \leq \sqrt{\sup |\phi|^2} \leq B_H^+$. For $H \geq 2\sqrt{n-1}/n$, we prove the following results: for every number B in the interval $[\max\{0, B_H^-\}, B_H^+]$ there is an example of a complete spacelike hypersurface such that $\sqrt{\sup |\phi|^2} = B$; if $\sqrt{\sup |\phi|^2} = B_H^-$ is attained at some point, then the corresponding M is an hyperbolic cylinder. We characterize the hyperbolic cylinders as the only complete spacelike hypersurfaces in S_1^{n+1} with constant mean curvature, non-negative Ricci curvature and having at least two ends. We also characterize all complete spacelike hypersurface! s of constant mean curvature with two distinct principal curvatures as rotation hypersurfaces or generalized hyperbolic cylinders.

Radial Slit Regions and the Univalent Bloch Constant

Philip Brown (Texas A&M University)

A formula is derived for constructing a univalent mapping of the unit disc onto a starlike region with threefold rotational symmetry, determined by making radial slits in a disc centered at the origin. An explicit formula is derived for the constant $\mathbf{B}_n$ corresponding to the n-th stage of Ruth Goodman's construction (1945). Since the sequence $\{\mathbf{B}_n\}$ converges to $\mathbf{B}_\infty$, Goodman's upper bound for the univalent Bloch constant, the value of $\mathbf{B}_\infty$ can be computed to a high degree of accuracy.

On the Dynamics of the Classical Third–Order Iterative Methods

Sonia Busquier Sáez (Universidad Politécnica de Cartagena)

The dynamics of a family of third order iterative methods which are used to find roots of non–linear equations applied to complex polynomials of degrees three and four is studied. The conjugacy classes of these methods are found explicitly. The family includes Chebyshev's method, Halley's method, Super-Halley's method and Newton's method as the limit case.

Extended Centroid of Essential Ideals

Miguel Cabrera García (Universidad de Granada)

A well-known result of the theory of rings of quotients asserts that the essential ideals of a semiprime associative algebra are themselves semiprime algebras and memorize the symmetric Martindale algebra of quotients and, also, as a result, its center, this center being nothing but the extended centroid. However, an essential ideal of a semiprime nonassociative algebra may not be a semiprime algebra, and even if it were it could not memorize the extended centroid. In a paper by A. Rodríguez and the author it is shown that essential ideals which satisfy a suitable topological condition of density (in particular, the norm-dense ideals) in a normed semiprime algebra memorize the extended centroid. The purpose of this talk is to provide an algebraic extension of that result, once a suitable concept of density in algebraic setting is introduced. Some applications to multiplicatively semiprime algebras are given.

Homogenization of Dirichlet problems for general monotone elliptic and parabolic operators in general perforated domains

Carmen Calvo Jurado (Universidad de Extremadura)

Our interest in the present paper is to study the asymptotic behavior of the solutions of nonlinear elliptic problems when the operators and the open sets where they are posed vary simultaneously. We obtain a representation of the limit problem and we prove that it is stable by homogenization. A corrector result is also given and we use it to obtain the homogenization and the corrector result for nonlinear parabolic problems, when the operators are not depend on time.

Two-weight inequalities arise from a Campbell-type formula

Oscar Ciaurri Ramírez* (Universidad de La Rioja)

Krzysztof Stempak (Politechnika Wrocławska)

Juan L. Varona (Universidad de La Rioja)

Given $\nu > -1$ and a suitable function f on $(0,\infty)$, the Hankel transform of f, $\mathcal{H}_\nu f$, is defined by

$$\mathcal{H}_\nu f(x) = \int_0^\infty (xy)^{1/2} J_\nu(xy) f(y)\, dy, \qquad x > 0,$$

where $J_\nu(x)$ denotes the Bessel function of the first kind and order ν. Consider the Bochner-Riesz multiplier of order $\delta \geq 0$ for the Hankel transform $\mathcal{H}_\nu$ given by

$$S_\nu^\delta f(x) = \mathcal{H}_\nu(m^\delta \cdot \mathcal{H}_\nu f)(x) = \int_0^\infty K_\nu^\delta(x,y) f(y)\, dy,$$

where $m^\delta(y) = (1-y2)_+^\delta$ and

$$K_\nu^\delta(x,y) = \int_0 1 m^\delta(s)(xs)^{1/2} J_\nu(xs)(ys)^{1/2} J_\nu(ys)\, ds.$$

We obtain, for positive integer δ's, a Campbell-type formula for $K_\nu^\delta(x,y)$. This expression allows us to prove the bound

$$|K_\nu^\delta(x,y)| \leq C G(x,y,\nu).$$

¿From this bound we can deduce some weighted inequalities. The uniform estimate

$$\|x^a(1+x)^b S_\nu^\delta f(x)\|_{L^p(0,\infty)} \leq C \|x^A(1+x)^B f(x)\|_{L^p(0,\infty)},$$

is obtained. Moreover a weighted inequality for the Bochner-Riesz multiplier for the usual Fourier transform in $L2(\mathbb{R}^n)$ is proved.

Asturian MDS-codes

Elena Couselo Fernández (Universidad de Oviedo)

Let $q = p^t$ where p is a prime. Then for any natural number m except for $m = 3$ and $q \geq 8$ even, there exists a linear recursive m-dimensional MDS-code of length $q+1$ if $m+1$ is odd and $q+2$ if $m+1$ is even over the space Z_{p^t}

This code is believed to have the maximum of lengths of linear m-dimensional MDS-codes over the field $GF(q)$ (according to the conjecture of Bush, Blokhuis, Bruen and Thas)

Extensions of Rational Modules

Juan Cuadra Díaz (Universidad de Almería)

It is well-known that for a coalgebra C its dual algebra C^* is a topological algebra with the weak-* topology. The category of right C-comodules $\mathcal{M}^C$ is isomorphic to the category of rational left C^*-modules $Rat(C^*\text{–}Mod)$. This category may be considered as the hereditary pretorsion class associated to the linear topology $\mathcal{F}_C$ of all closed and cofinite left ideals of C^*. Thus the category of right comodules may be studied from a ring theoretic point of view using torsion theories as a tool. It is natural to investigate when this class has some interesting (torsion theoretic) properties like being a torsion theory, being perfect, stable, split, etc.

In this talk we study when $Rat(C^*\text{–}Mod)$ is a torsion class in $C^*\text{–}Mod$, i.e, it is closed under extensions. It is known that if C is left $\mathcal{F}$-noetherian (i.e. $\mathcal{F}_C$ has a basis of finitely generated ideals), then $Rat(C^*\text{–}Mod)$ is a torsion class. We will give a sufficient condition under which the converse holds. It will be derived that for almost connected coalgebras and cocommutative coalgebras both notions are equivalent. New examples of left $\mathcal{F}$-noetherian coalgebras will be constructed. We will also provide some examples of coalgebras for which $Rat(C^*\text{–}Mod)$ is a perfect torsion theory.

Uniqueness of best L_1-approximation from the set of splines with infinitely many simple knots

Antonio Damás Serrano* (Universidad de Jaén)

Miguel Marano (Universidad de Jaén)

It is well known that if $1 < p < \infty$, then there exists at most one best L_p-approximation when approximating from a convex set. This follows because the L_p-norm is strictly convex whenever $1 < p < \infty$. On the other hand, the uniqueness of best L_1-approximation does not follow a general rule and hence this is a question of main interest in theory of best approximation. So a best L_1-approximation from a convex set may not be unique. However, provided f is continuous, uniqueness may be valid when approximating from some special classes of functions. For instance, it is known that the problem of best L_1-approximation to a continuous function from the space of splines with finitely many fixed knots has a unique solution. We have extended this result as follows: Let J be an open interval and denote by $\mathcal{S}_{\Pi}$ the set of all the splines of degree at most $n-1$ with simple knots in Π, a countably infinite set of points in J, $n \geq 2$. We prove that there exists a unique best L_1-approximation to a continuous function in $L_1(J)$ from $\mathcal{S}_{\Pi}$.

Los orígenes de la combinatoria

Mary Sol de Mora Charles (UPV/EHU y UPC)

La combinatoria aparece ligada a ideas filosóficas, pero pronto sus aplicaciones a problemas matemáticos adquieren relieve. Autores como Llull, Pascal y Leibniz, entre otros, le darán forma y plantearán su utilidad para temas entonces de actualidad como la teoría de la Probabilidad, la teoría de la Decisión, la teoría de Juegos, etc. En esta comunicación se haría una presentación de los aspectos más interesantes de esta historia temprana de la combinatoria.

Banach Function Spaces from Vector Measures

Olvido Delgado Garrido (Universidad de Sevilla)

Given a countably additive measure ν with values in a Banach space X, we prove that any order continuous Banach function space Y continuously contained in the space $L1(\nu)$ of real functions which are integrable with respect to ν, can be generated by a certain positive function ρ defined over $X^* \times M$, the product of the dual space of X and the space of the measurable functions, in the sense of Y consisting in the closure of the simple functions in the Banach space of functions f such that $\rho(x^*, f) < +\infty$ for all x^* in X^*. Among the spaces generated in this way by a function ρ, we have the space $L^p(\nu)$ of functions whose p-powers are integrable with respect to ν and in general, the spaces $L_N(\nu)$ of functions such that $N(|f|)$ are integrable with respect to ν, being N an Orlicz function.

Convergence of ray sequences of Padé approximants for ${}_2F_1(a, 1; c; z)$, $(c > a > 0)$.

Kathy Driver* (University of the Witwatersrand)

Kerstin Jordaan (University of Pretoria)

The Padé table of ${}_2F_1(a, 1; c; z)$ is normal for $c > a > 0$. For $m \geq (n-1)$, and c not equal to a negative integer, the denominator polynomial $Q_{m,n}(z)$ in the $[m/n]$ Pade approximant $P_{m,n}(z)/Q_{m,n}(z)$ for ${}_2F_1(a, 1; c; z)$ and the remainder term $Q_{m,n}(z) \cdot {}_2F_1(a, 1; c; z) - P_{m,n}(z)$ were explicitly evaluated by Padé. We show that for $c > a > 0$ and $m \geq (n-1)$, the poles of $P_{m,n}(z)/Q_{m,n}(z)$ lie on the cut $(1, \infty)$. We deduce that the sequence of approximants $P_{m,n}(z)/Q_{m,n}(z)$ converges to ${}_2F_1(a, 1; c; z)$ as m tends to infinity, $\frac{n}{m}$ tends to ρ with $0 < \rho \leq 1$, uniformly on compact subsets of the unit disc $|z| < 1$ for $c > a > 0$.

Grey noise and some differece fractional differential equations

Khairia El-Nadi (University of Alexandria)

A probability scheme governed by a difference fractional differential equation of the form,

$$\frac{\partial^\alpha u(x,t)}{\partial t^\alpha} = \sum_{i=1}^{m} a_i u(x + y_i, t),$$

is studied, where $0 < \alpha \leq 1$, $x = (x_1, ..., x_n)$, $y_i = (y_{i1}, ..., y_{in})$are points in the n-dimensional Euclidean space R_n and $a_i \in R_1$. An asymptotic solution of the Cauchy problem for the considered equation is given.
A general grey Brownian motion and grey noises are studied by using the considered probability scheme.

Aproximación de soluciones de ecuaciones no lineales mediante procesos iterativos que no utilizan derivadas

José Antonio Ezquerro Fernández* (Universidad de La Rioja)

Miguel A. Hernández (Universidad de La Rioja)

El método de Newton

$$x_{n+1} = x_n - [F'(x_n)]^{-1}F(x_n), \quad n = 0, 1, 2, \ldots$$

es uno de los métodos más conocidos para resolver ecuaciones no lineales de la forma $F(x) = 0$ en un espacio de Banach. Su aplicación requiere de la existencia del operador $[F'(x)]^{-1}$ en cada paso de iteración, y no siempre es fácil que esto se dé. En este trabajo, consideramos procesos iterativos de la forma

$$x_{n+1} = x_n - \delta_n F(x_n), \quad n = 0, 1, 2, \ldots,$$

donde $\{\delta_n\}$ es una sucesión real, para aproximar soluciones de la ecuación $F(x) = 0$. Estudiaremos la convergencia de este método y presentaremos un resultado de convergencia semilocal, en el que se exigirá una condición del tipo

$$\|F'(x) - \alpha I_X\| \leq \omega(\alpha, \|x\|), \quad \text{para todo } \alpha \in \mathbf{R},$$

donde $\omega : \mathbf{R} \times \mathbf{R}_+ \to \mathbf{R}_+$ es una función monótona creciente en los dos argumentos. Terminaremos ilustrando todo lo anterior con aplicaciones a diferentes ecuaciones integrales no lineales.

Hasse-Schmidt derivations and coefficient fields in positive characteristics

Magdalena Fernández-Lebrón* (Universidad de Sevilla)

Luis Narváez-Macarro (Universidad de Sevilla)

We show how to express any Hasse-Schmidt derivation in terms of a finite number of them whenever their components of degree 1 form a basis of usual derivations. Our main result is to find a natural way of producing "non-linear combinations" of Hasse-Schmidt derivations which, to some extent, could play the role of the A-module structure of derivations.

As an application, we express coefficient fields of the completion of a regular local ring of positive characteristic in terms of Hasse-Schmidt derivations, generalizing a result of Nomura-Matsumura to the case of Hasse-Schmidt derivations.

A topological method for geodesic connectedness of spacetimes.

José Luis Flores Dorado (Saint Louis University)

The problem of geodesic connectedness of semi-Riemannian manifolds (i.e. the problem as to whether each pair of their points can be joined by a geodesic) is essentially solved in the definite case due to the Hopf-Rinow Theorem. However, in the Lorentzian case, the inexistence of such a general result has done necessary the development of non-trivial techniques.

Here, we introduce a new technique to solve this problem in Lorentzian manifolds. This method is based on the Brouwer's topological degree. We show how this technique applies succesfully to different classes of spacetimes such as: GRW spacetimes, Multiwarped spacetimes and Kerr spacetime.

On Infinite Dimensional Lie Algebras Having a Cartan Decomposition

Manuel Forero Piulestan* (Universidad de Cádiz)

Antonio J. Calderón Martín (Universidad de Cádiz)

We introduce the concept of Cartan decomposition relative to a Cartan subalgebra H, in the sense of [1], for Lie algebras of arbitrary dimension. The class of simple Lie algebras having such decomposition is a wide class of Lie algebras closely related to the topologically simple L*-algebras, the simple c-involutive Lie algebras and the topologically simple compact Banach-Lie algebras. We give a description theorem for the complex ones, turning out to be the natural extension of the finite dimensional setup.

[1] Y. Billig and A.Pianzola, On Cartan subalgebra, J. Algebra 171 (1995), 397-412.

Un nuevo método numérico para la obtención de soluciones de la ecuación integro-diferencial de Volterra

Miguel Angel Fortes Escalona* (Universidad de Granada)

María Isabel Berenguer (Universidad de Granada)

Manuel Ruiz (Universidad de Granada)

Ana Isabel Garralda (Universidad de Granada)

El uso de ciertas bases de Schauder en determinados espacios de Banach permite desarrollar un nuevo método numérico para aproximar las soluciones de las ecuaciones de Volterra. Concretamente, nos centramos en el caso de la ecuación integro-diferencial y presentamos un método de resolución numérica que tiene como idea de base la utilización de bases de Schauder en el espacio $C[a, b]$ cuyos elementos son funciones lineales a trozos con soportes pequeños y la expresión de la solución de la ecuación integro-diferencial en función de dichas bases. Las virtudes fundamentales, consecuencias de las propiedades de las bases utilizadas, que este nuevo método tiene sobre otros ya conocidos (como el de colocación) son que no necesita de la resolución de sistemas ecuaciones (ni lineales ni no lineales) y todas las integrales a calcular son de funciones lineales y por tanto se pueden determinar de forma exacta sin necesidad de recurrir a métodos de integración numérica. Asimismo, las propiedades de las bases de Schauder van a permitir controlar el error cometido en la aproximación de la solución.

Initial-value problems and Schauder bases

Domingo Gámez* (University of Granada)

Ana Isabel Garralda Guillem (University of Granada)

Miguel Ruiz Galán (University of Granada)

In this work we make use of an analytic tool, Schauder bases, in order to obtain a new numerical method for solving initial-value problems.

On a construction for substitutional quasiperiodic tilings

Juan García Escudero (Universidad de Oviedo)

A construction was proposed in [1] for the obtention of inflation rules for planar patterns with odd symmetries non divisible by three. Deterministic and stochastic models have been proposed in recent years for the description of simple and composite several substitutional quasiperiodic structures [2,3]. A very well known class of octagonal patterns was introduced in 1982 by Ammann and Beenker[4]. Several types of octagonal patterns have been derived in [2]. One of the species is analized in [5] from the point of view of the vertex configurations and the Fourier transform. In this work a construction for the generation of eight-fold symmetry planar patterns is introduced. The basic building blocks are four triangle prototiles with six edge lengths. Simple and composite patterns can be obtained. Subpatterns with three prototile shapes and two edge lengths can also be generated .

References:

[1] K.P.Nischke and L.Danzer. Discrete and Comput.Geom.Vol.15,(1996),p.221 [2] J.G.Escudero. Mat.Sci.Eng.A. Vol.294,(2000),p.388. [3] J.G.Escudero. Int.J.Mod.Phys.B. Vol.15,(2001),p.1165. [4] B.Gruenbaum and G.C.Shephard. Tilings and Patterns. W.Freeman. New York.(1987) [5] J.G.Escudero and J.García. J.Phys.Soc.Jpn.Vol.70 (2001), p.3511.

Martindale-like Jordan Systems of Quotients

Esther García González* (Universidad Complutense de Madrid)

Miguel Gómez Lozano (Universidad de Málaga)

Inspired in the absorption properties of Martindale systems of quotients in associative systems, in this work we introduce the notion of Martindale-like system of quotients in the Jordan setting, and give explicit constructions of maximal Jordan systems of quotients under the hypothesis of nondegeneracy. Our constructions are based on the close connection between Jordan pairs and Lie algebras through the TKK functor, on Martínez and Siles Molina's results on systems of quotients, and on some nice properties of derivations.

Soluciones renormalizadas para algunos problemas parabólicos con difusión singular y datos en $L1$

Concepción García Vázquez* (Universidad de Cádiz)

Francisco Ortegón Gallego (Universidad de Cádiz)

Se trata de encontrar una función u que sea solución en cierto sentido del problema

$$\begin{array}{rcll} \frac{\partial u}{\partial t} + w\nabla u - \operatorname{div}\left[A(u)\nabla u\right] + g(u) & = & f, & \text{en } Q, \\ u & = & 0, & \text{sobre } \partial\Omega \times (0,T), \\ u & = & u_0, & \text{en } \Omega, \end{array} \tag{1}$$

donde $Q = \Omega \times (0,T)$, con $T > 0$ y $\Omega \subset \mathbb{R}^N$ abierto y acotado, con frontera $\partial\Omega$ lipstchiziana. Sea $s_0 < 0$, se supondrá que el coeficiente de difusión $A : Q \times (s_0, +\infty) \mapsto \mathbb{R}^{N\times N}$ es una función de Caratheodory, tal que existe $\beta : (s_0, +\infty) \mapsto \mathbb{R}$ continua y estrictamente positiva, con $\beta^{1/2} \notin L1(s_0, 0)$, tal que

$$\forall s \in (s_0, +\infty), \xi \in \mathbb{R}^N,\ \beta(s)|\xi|^2 \leq A(x,t,s)\xi\xi,\ \text{cpd } (x,t) \in Q.$$

Además, $\beta(s)$ se va a infinito cuando s se acerca a s_0. Además, sólo exigiremos $f \in L1(Q)$ y $u_0 \in L1(\Omega)$ con $u_0 \geq s_0$.

Se demuestra la existencia de una solución renormalizada del problema (1). Asimismo, bajo hipótesis un poco más restrictivas, se puede garantizar la unicidad de dicha solución.

Constructive approximation on Riemann surfaces

Paul M. Gauthier (Université de Montréal)

It is possible to approximate on certain Riemann surfaces by using the Cauchy formula in the case of holomorphic approximation and the Green formula in the case of harmonic approxmation.

Unsolvability of algebraic equations leads to iterative methods

José Orlando Gomes Freitas (University of Madeira)

Many mathematicians try to find a formula to solve the fifth degree equation. In 1824 Niels Abel (1802-1829) published a valid proof that we cannot solve the general polynomial of the fifth degree (using radicals and Évariste Galois (1811-1832) generalized this result. On a mundane level, numerical methods can be used to find the zeros. The resolution of equation was attack by iteration methods. Felix Klein, in 1884, showed there is a method to find the roots using rotations of the icosahedron, the regular polyhedron with 20 triangular faces. Newton's Method is the search algorithm sine qua non of numerical analysis and scientific computation. By other hand we can see this method as a discrete dynamical system, first noted by E. Schroeder in 1870/71, and Sir Arthur Cayley in 1879. Using this method to solve interactively the equation $z^3 - 1 = 0$ Cayley discovered some chaotic behaviour. He said: The solution is easy and elegant in the case of quadric equation, but the next succeeding case of the cubic equation appears to presents considerable difficulty.

We can understand what Cayley conjectured with the Julia's work and Fatou's work in the beginning of the XX century. Their work was continued by Douady, Hubbard, Milnor, Lyubich and many others, making today part of the theory of the iteration of the complex applications.

Renormalized solutions of a nonlinear parabolic-elliptic system

María Teresa González Montesinos (Universidad de Cádiz)

This work is concerned with the proof of the existence of renormalized solution to a parabolic–elliptic system, where the diffusion coefficients, $a(x,t,s)$ and $\sigma(x,t,s)$, are not bounded. Moreover, a, σ and F (which divergence is the right hand side of the elliptic equation) are Caratheodory functions and no asymptotic behavior is assumed for large values of s.

This system may be considered as a generalization of the well-known thermistor problem; in that case, the unknown u is the temperature inside the conductor and φ the electrical potential.

On a family of Naturally Graded Lie Algebras no p-filiform

Alfonso González Regaña* (Universidad de Sevilla)

L. M. Camacho (Universidad de Sevilla)

J. R. Gómez (Universidad de Sevilla)

Aknowledge of the naturally graded algebras among those of a given class of Lie algebras offers essential information about the structure of the class.

So far, the classification of naturally graded Lie algebras is only known for some families of p-filiform Lie algebras. We present the classification of naturally Lie graded algebras up to dimension 8 of a family no p-filiform of Lie algebras, by using the software Mathematica.

On ideal and subalgebra coefficients in certain k-algebras

María Isabel González Vasco (Universidad de Oviedo)

It is known that for any field k and any ideal U in the polynomial ring $k[X_1,\ldots,X_n]$, there exists a *minimal field of definition* of U: i.e, of all the subfields $k'' \leq k$ such that U is generated by polynomials with coefficients in k'', there is a smallest field k' contained in all the others. Similarly, the existence of a *minimal field of definition* has been proven for any one-sided ideal or k-subalgebra of a given semigroup algebra. However, it was shown that this result can not be extended to the case of arbitrary k-algebras. We show that the above concept can be generalized to a large class of (not necessarily associative) algebras. Let k be a field with prime field k_0. Let A be a k-algebra for which there is a k-vector space basis Ω of A such that, for all $\omega_1,\omega_2 \in \Omega$, the product $\omega_1\omega_2$ is contained in the k_0-vector space spanned by Ω. We prove that, for any one-sided ideal or k-subalgebra U of A, there exists a smallest $k' \leq k$ such that U is generated–as one-sided ideal resp. as k-algebra– by elements in the k'-vector space spanned by Ω.

Polynomials for Kloosterman Sums

Stan Gurak (University of Dan Diego)

Let a, m, and d be integers with $m > 1$ and $GCD(a, m) = GCD(d, m) = 1$ where $1 < a < m$. The Kloosterman sums may be given by

$$R(a, d, m) = \exp(2\pi i a(x + dx^*)/m),$$

where the summation is taken over a reduced system of residues modulo m and x^* denotes the multiplicative inverse of x modulo m. While explicit formulas for the Kloosterman and related sums have been determined, little is known about the polynomials such sums satisfy. Here I explicitly compute the beginning coefficients of these polynomials.

On the semilocal convergence of Newton's methods under unifying conditions

José Manuel Gutiérrez Jiménez (Universidad de La Rioja)

Semilocal convergence theorems are provided for Newton's method in a Banach space setting. Our conditions are very general and in special cases can be deduced in earlier results. The advantadge of our conditions is in the fact that they can cover a wider range of problems than before. We complete this study with some numerical examples.

Tangles and Matroids

Stephen Huggett (University of Plymouth)

Operations on an alternating link diagram can be represented, via the planar graph whose medial is the link diagram, by well-known operations on matroids. In fact, given a planar graph there are two well-established methods of generating an alternating link diagram. Switching from one of these methods to the other corresponds, in knot theory to tangle insertion in the link diagrams, and in combinatorics to the tensor product of the matroids. Other examples arise from 2-sums of matroids.

Isotonies on ordered cones through the concept of a decreasing scale

Esteban Induráin Eraso* (Universidad Pública de Navarra)

Gianni Bosi (Università di Trieste)

María Jesús Campión (Universidad Pública de Navarra)

Juan Carlos Candeal (Universidad de Zaragoza)

Magalì E. Zuanon (Università Cattolica del Sacro Cuore di Milano)

The main purpose of this paper is that of providing a characterization of the existence of a continuous and order-preserving real-valued function defined on a topological preordered cone that also preserves the cone operation (i.e., it is homogeneous of degree one on the strictly positive real numbers). The approach followed to obtain this characterization is based on the existence of particular scales that behave well with respect to the cone operation and that we call homogeneous scales. The notion of a scale can be understood as a generalization of the Urysohn approach to get continuous functions on a topological space. This fruitful idea was already used by Nachbin to provide results about the existence of continuous order-preserving functions on preordered topological spaces. We go further by extending the previous approach to the algebraical context. Although we mainly focus on topological preordered real cones, some links with the representability problem of totally preordered topological vector spaces and semigroups are also considered. This issue is of particular importance in mathematical economics.

Global Properties for Semistar Operations

Pascual Jara* (Universidad de Granada)

M. Fontana (UniversitÓ degli Studi "Roma Tre")

P. Jara (Universidad de Granada)

E. Santos (Universidad de Granada)

S. Huggett (University of Plymouth)

We study the "local" behavior of several relevant properties concerning semistar operations, like finite type, stable, spectral, e.a.b. and a.b. We deal with the "global" problem of building a new semistar operation on a given integral domain, by "gluing" a given homogeneous family of semistar operations defined on a set of localizations. We apply these results for studying the local–global behavior of the semistar Nagata ring and the semistar Kronecker function ring. We prove that an integral domain D is a Prüfer $\star$–multiplication domain if and only if all its localizations D_P are Prüfer $\star_P$–multiplication domains.

Growth Estimates for Generalized Factors of H^p Spaces

Angeliki Kazas (Suny College at Oneonta)

With φ an inner function and M_φ the multiplication operator on a given Hardy space it is known that for any given function f in the Hardy space we may use the Wold decomposition to obtain a factorization of the given f (not the Riesz factorization). This new factorization has been shown to be useful in the study of commutants of Toeplitz operators.

We study the smoothness of each factor of this factorization.We show in some cases that the factors lie in the same Hardy space (or smoothness class) as the given function f. We also construct an example to show that there are bounded, holomorphic functions which have factors that are not in given Hardy p-space. Many of our results are produced by studying a natural class of positive measures associated to the given inner function.

Stability of Stochastic Differential Equations under Discretization

Andrzej Korzeniowski (University of Texas at Arlington)

In the context of stability of stochastic differential equations there are two aspects to be concerned with. First has to do with stability of the original continuous time system whereas the second , prior to computing approximate solutions, deals with stability region which depends on the time step discretization. Given a stochastic differential equation $(SDE)\ dX(t) = BX(t)dt + \sum_{i=1}^{k} C^i X(t)dW^i(t)$ in R^d, where B, C^i are dxd matrices and $W^i(t)$ are standard independent Wiener processes, an *exponential mean square stability* (*EMS-stability*) of (SDE) subject to discretization $t_n = nh$, $h > 0$ is studied. It is shown that analogous discrete system is *EMS-stable* if and only if there exists a linear operator T on the set of dxd matrices which is a positive contraction. This general result can be applied to a numerical approximation of choice and is illustrated in the case of the first order Mil'shtein scheme.

On Leibniz 3-algebras

José Manuel Casas Mirás (Universidad de Vigo)

Manuel Ladra González* (Universidad de Vigo)

Leibniz 3-algebra are K-vector spaces $\mathcal{L}$ equipped with a trilinear bracket $[-,-,-] : \mathcal{L} \times \mathcal{L} \times \mathcal{L} \to \mathcal{L}$ satisfying the following fundamental identity

$$[[x,y,z],a,b] = [[x,a,b],y,z] + [x,[y,a,b],z] + [x,y,[z,a,b]]$$

Examples of Leibniz 3-algebras are the Lie triple systems and $\mathbb{R}^4$ with bracket given by the generalization of cross-product in $\mathbb{R}^3$.

The goal of this presentation is to analyze two important aspects of Leibniz 3-algebras:

Firstly, it is well-known that an associative algebra can be functorially endowed with a structure of Lie algebra by means of the bracket $[x,y] = x.y - y.x$. This functor has as left adjoint the universal enveloping algebra functor. Here we obtain a similar construction between Leibniz 3-algebras and trialgebras (K-vector spaces endowed with three associative operations).

Secondly, the universal central extension associated to a perefect Leibniz 3-algebra is constructed by means of a non-abelian tensor product of Leibniz 3-algebras. From here, we obtain an interpretation of ${}_3HL_1(\mathcal{L})$ (the homology groups with trivial coefficients of a Leibniz 3-algebra $\mathcal{L}$) by means of a formula Hopf type.

MLUR renormable Banach spaces

Sebastian Lajara López* (Universidad de Castilla La Mancha)

A. Pallarés (Universidad de Murcia)

Recall that a Banach space X (or its norm $\|\ \|$) is said to be Midpoint Locally Uniformly Rotund (MLUR) if $\lim_n \|x_n\| = 0$ whenever $x_n, x \in X$ and $\lim_n \|x_n \pm x\| = \|x\| = 1$. Banach spaces with equivalent MLUR norms have been characterized by A. Moltó, J. Orihuela, S. Troyanski and M. Valdivia **[2]** in terms of countable decompositions of such spaces. We get some results on MLUR renormings of Banach spaces using that characterization and properties of the class of σ-slicely continuous maps, recently introduced by A. Moltó, J. Orihuela, S. Troyanski and M. Valdivia **[3]**. We provide a condition of MLUR renormability in Banach spaces with certain decompositions. From this result we deduce an MLUR version of a theorem of V. Zizler **[4]** on Banach spaces with projectional resolutions of the identity, and a generalization of a result of R. Haydon **[1]** about MLUR renormings of $\mathcal{C}(K)$ spaces.

[1] R. Haydon, Proc. London Math. Soc. 78, (1999), 541-585.
[2] A. Moltó, J. Orihuela, S. Troyanski and M. Valdivia, Quartely Journal of Mathematics 52, (2001), 181-193.
[3] A. Moltó, J. Orihuela, S. Troyanski and M. Valdivia, Non linear tansfer technique, preprint.
[4] V. Zizler, Bull. Austr. Math. Soc. 29 (1984), 259-265.

Tame and wild coordinates of $R[x, y]$

Chi Ming Lam (University of Hong Kong)

Let p be a polynomial in $R[x, y]$. p is a coordinate of $R[x, y]$ if there is an automorphism φ of $R[x, y]$ such that $\varphi(x) = p$. A tame automorphism of $R[x, y]$ is an automorphism which is a composition of affine and elementary automorphisms of $R[x, y]$. p is a tame coordinate of $R[x, y]$ if there is a tame automorphism φ of $R[x, y]$ such that $\varphi(x) = p$. A coordinate which is not tame is called wild. In this talk, the speaker will introduce algorithms to determine coordinates, tame and wild coordinates in $R[x, y]$.

On Tensornorms and Operator Ideals Defined by an Orlicz Sequence

Gabriel I. Loaiza* (Universidad EAFIT, Colombia)

J. A. López Molina (Universidad Politécnica de Valencia)

M. J. Rivera (Universidad Politécnica de Valencia)

The classical theory of tensornorms and operator ideals studies mainly those defined by means of sequence spaces ℓ_p. Regarding the Orlicz sequence spaces as natural generalizations of ℓ_p spaces, we use a Orlicz sequence space to define a tensornorm and, using local techniques, we characterize the minimal and maximal operator ideals associated to that norm, in the sense of Defant and Floret. Starting out from the characterizations we analyze the coincidence between components of the two operator ideals. This in turn enables us to prove some metric properties of the tensornorm.

Filtrations on finitely presented algebras

Francisco Javier Lobillo Borrero (Universidad de Granada)

Let k be a field, and $R = k\langle X\rangle/I$ where $X = \{x_1, \ldots, x_n\}$ and I is finitely generated. Assume that the irreducible elements with respect to I consist in standard polynomials, i.e., for each $i < j$ there is an element $x_j x_i - \phi(X) \in I$ where $\phi(X)$ is standard. The existence of filtrations with a good behaviour with respect to this generators is characterized. As application of previous result, the exactness of Gelfand–Kirillov dimension, the Auslander condition and the Cohen-Macaulay property are studied.

Teoremas de inserción y propiedades de tipo normalidad en espacios L-topologicamente generados

Iraide Mardones Pérez (Universidad del Pais Vasco)

En este trabajo continuamos el desarrollo de la teoría de los espacios $\mathbb{I}(L)$-topológicos. Probamos que, cuando $(L, ')$ es un retículo meet-continuo, un espacio L-topológico es L-normal (completamente L-normal, perfectamente L-normal) si y sólo si $\Omega_L(X)$ es $\mathbb{I}(L)$-normal (completamente $\mathbb{I}(L)$-normal, perfectamente $\mathbb{I}(L)$-normal). La herramienta esencial para probar lo anterior es un teorema de inserción que nos proporcionará una condición necesaria y suficiente para poder insertar un par de funciones semicontinuas $\mathbb{R}(L)$-valuadas entre dos funciones comparables. También como consecuencia de este teorema obtendremos una caracterización de la L-normalidad completa en términos de inserción de funciones.

A characterization of Painlevé transcendents under changes of the independent variable

Angel María Martín del Rey* (Universidad de Salamanca)

J. Muñoz Masqué (Instituto de Física Aplicada, CSIC)

G. Rodríguez Sánchez (Universidad de Salamanca)

The search for nonlinear ODEs with solutions without moving critical points —equations with Painlevé property—has been an important mathematical problem. For the equations $y'' = F(xx, y, y')$, which are rational in y', algebraic in y and analytic in x, Painlevé and Gambier found fifty types of differential equations satisfying Painlevé property, six of them have solutions in terms of the Painlevé transcendents. The goal of this communication is to characterize the first three Painlevé transcendents (due originally to Painlevé) with respect to the subgroup of horizontal transformations of the plane (*i.e.* with respect to the group of changes of the independent variable) by using differential invariants. The method supplies a criterion to know whether a second-order ODE is reducible to one of Painlevé transcendents by means of a change of variables in the horizontal subgroup.

Caracterización de elipsoides por secciones

Pedro Martín Jiménez* (Universidad de Extremadura)

Javier Alonso Romero (Universidad de Extremadura)

Demostramos que los elipsoides son los únicos cuerpos convexos de $\mathbb{R}^n$ cuyas secciones paralelas a dos hiperplanos son siempre elipsoides (elipses si $n = 2$) homotéticos. Además, son los únicos cuerpos convexos con centro cuyas secciones paralelas a tres hiperplanos son elipsoides (elipses si $n = 2$). Presentamos contraejemplos si se modifican cualquiera de las hipótesis.

Formulas for Pi(x) and the n-th prime

Sebastian Martín Ruíz (I.E.S. Salmedina)

In this article we gave a formula for the nth prime number pn that involves only the elementary operations +,-,X,/ and the floor function. We use the inequalities of Rosser and Schoenfeld to give a complete proof of the formulas.

Transitivity and Reflexivity of Spaces of Hankel Operators

Ruben Martinez Avendaño* (Michigan State University)

E. Azoff (University Of Georgia)

J. Solazzo (University of Georgia)

In this talk, we will present some results involving the transitivity and reflexivity of ultra-weakly closed spaces of Hankel operators (in $\mathbf{H}^2$). We show that the space of all Hankel operators is transitive, but none of its proper subspaces are transitive. After proving that the space of all Hankel operators is elementary, we show that there is a natural correspondence between hyperplanes of Hankel operators and functions in $\mathbf{H}^1$. Using this correspondence, we can show when the hyperplanes are reflexive in terms of the canonical inner-outer factorization of the corresponding $\mathbf{H}^1$ function.

Chaotic polynomials on infinite dimensional spaces

Félix Martínez-Giménez* (Universidad Politécnica de Valencia)

Alfredo Peris (Universidad Politécnica de Valencia)

We show the existence of polynomials defined on Banach and Fréchet spaces of analytic functions which are chaotic in the sense of Devaney. In particular, we find chaotic homogeneous polynomials on the space $\mathcal{H}(\mathbb{D})$ of analytic functions on the disc. Non-homogeneous chaotic polynomials are also presented for Banach spaces of analytic functions. These results are related to the study of the Julia set of certain polynomials defined on the complex plane.

Hyperbolic groups, geodesic flow and so on

Igor Mineyev (University of Illinois at Urbana-Champaign)

Gromov hyperbolic groups are the ones that generalize the fundamental groups of closed hyperbolic manifolds. (And this is why they probably should have been called "quasi-hyperbolic".) For many years, results about hyperbolic groups followed the following pattern. Take a geometric concept, say, "geodesic", "isometry", "conformal" etc, then add an additive and/or multiplicative constant in the definition, and add "quasi" to the name. Then your task is to take a geometric theorem or property and to prove it for general hyperbolic groups with all the names replaced with their "quasi" versions.

I would like to present constructions of several geometric concepts that "dequasify" the "quasi"-language for hyperbolic groups. In particular, each hyperbolic group admits: a continuous cross-ratio, a visual metric on the boundary with a conformal and Möbius group action, a continuous horofunction that is independent of a ray to infinity, and a geodesic flow with strong properties.

Pappus-Guldin versus Weyl's tube formulae

Vicente Miquel Molina* (Universidad de Valencia)

M. Carmen Domingo-Juan (Universidad de Valencia)

We survey recent results on Pappus-Guldin type formulae for volumes in real and complex space forms, concluding from there the kind of motion and the form of a section of the tube which can give a Weyl's type tube formulae

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Estudio de la $\mathcal{O}$-torsión en un $\mathcal{D}$-módulo

Maria Angeles Moreno Frías (Universidad de Cádiz)

Consideremos $\mathcal{D}$ el anillo de gérmenes de operadores diferenciales lineales con coeficientes en $\mathcal{O} = \mathbf{C}\{x_1, \ldots, x_n\}$. Sea M un $\mathcal{D}$-módulo holónomo. M también puede considerarse un $\mathcal{O}$-módulo. En este trabajo pretendemos estudiar la $\mathcal{O}$-torsión del $\mathcal{D}$-módulo M. Para ello estudiamos la relación que existe entre ésta, la restricción a los diferentes hiperplanos $x_i = 0$ y las raíces de la b-función.

On the proper homotopy classification of locally compact $A2_n$-polyhedra

Fernando Muro Jiménez (Universidad de Sevilla)

The algebraic invariants used by J. H. C. Whitehead to classify (stable) homotopy types of simply connected 4-dimensional polyhedra are the cellular chain complex and the (Steenrod) Pontrjagin invariant. Proper homotopy theory is a middle step between the homotopy and homeomorphism classification of spaces. Algebraic tools in proper homotopy theory have been developed by several authors (Baues-Quintero, Beattie, Edwards-Hastings, Farrell-Wagoner), such a the proper cellular chain complex. However the fact that the "proper" algebra has projective dimension 2 motivates important differences with ordinary homotopy theory. In this talk we shall show that in general there are not Pontrjagin-Steenrod invariants in proper homotopy theory. For this we construct new proper cohomological invariants and compute one of them in a purely algebraic way from the proper cellular chain complex by using quadratic algebra. We shall also give a stable proper homotopy classification theorem for properly simply connected 4-dimensional locally compact polyhedra with less than 3 ends, and exhibit a proper Moore space of degree 2 which is not a proper co-H-space.

Discrete valuations of $k((X_1, ..., X_n))$

Miguel Angel Olalla Acosta* (Universidad de Sevilla)

Francisco Javier Herrera Govantes (Universidad de Sevilla)

José Luis Vicente Córdoba (Universidad de Sevilla)

Let v be a rank m discrete valuation of $K = k((X_1, ..., X_n))$, centered in $R = k[[X_1, ..., X_n]]$.

In the case $n = 2$ and $m = 1$ we know that $k((X_1, X_2))$ can be embedded, by a finite number of monoidal transformations and change of coordinates, into a field $k((Y_1, Y_2))$ such that the extended valuation is the ususal order function.

In this work we prove that, if the transcendence degree of the residual field of v over k is $n - m$ (i.e. the dimension of v), then K can be embedded into a field $k((Y_1, ..., Y_n))$ such that the extended valuation is a monomial valuation.

In the general case (arbitrary rank) we give a procedure to construct the residue field of the valuation, by extending it to a field where the "natural" extension of v is "as close as possible" to a monomial valuation.

Locating Pursuers on the Plane

Francisco Alonso Ortega Riejos* (Universidad de Sevilla)

Martín Cera (Universidad de Sevilla)

Juan A. Mesa (Universidad de Sevilla)

Frank Plastria (Vrije Universiteit Brussel)

Pursuit curve is a term defined by George Boole in his "Treatise on differential equations" (1859), although its origin is probably earlier. A pursuit curve is the trajectory which hunter (or pursuer) X follows to catch its prey (or target) A. Both points X and A are assumed to be mobile, where the velocity of X is higher than that of A, while the following geometrical property is satisfied: the tangent line to the pursuit curve, at the point where hunter X is located at any time $t \geq 0$, passes through the point where prey A lies. By assuming that target trajectories follow straight lines, the analytical expression of the time used by the pursuer in capturing each prey is deduced. In this setting, two location problems related to supervision of n mobile targets are formulated and solved. Namely, locating the median pursuer (where the weighted sum of capture time is minimised) and locating the central pursuer (where the maximum time of interception is minimised).

Long ascending paths in dimension 4

Julian Pfeifle* (TU Berlin)

Volker Kaibel (TU Berlin)

Günter M. Ziegler (TU Berlin)

Consider a linear program whose feasible domain P is given by a system of linear inequalities $P = \{x \in \mathbf{R}^d : Ax \leq b\}$, where $A \in \mathbf{R}^{n \times d}$ and $b \in \mathbf{R}^n$. We may assume that P is a polytope, i.e., nonempty and bounded.

The *monotone upper bound problem* asks for bounds on the worst-case behavior of the simplex algorithm on P irrespectively of the pivot rule used. Namely, given some "upward" direction in $\mathbf{R}^d$, is it true that the maximal possible number $M(d, n)$ of vertices on a strictly ascending path along edges on P equals the maximal number of vertices $M_{\text{ubt}}(d, n)$ that P can have according to the (combinatorial) Upper Bound Theorem?

We present a *positive* solution to this problem in dimension $d = 4$ for all n by realizing a family of polar-to-neighborly 4-polytopes in such a way that there exists a strictly ascending Hamiltonian path along edges, where progress is measured along the 4-axis. Two noteworthy features of the construction are that our polytopes have maximally many vertices but are *not* polars of cyclic polytopes, yielding perhaps the first interesting application of non-cyclic neighborly polytopes, and that they are *not* deformed products in the sense of Amenta and Ziegler.

In higher dimensions, preliminary computational studies suggest a *negative* answer.

Topological Quantum Field Theories and Gerbes

Roger Picken (Instituto Superior Tecnico)

We generalise the notions of holonomy and parallel transport for abelian bundles and gerbes using an embedded Topological Quantum Field Theory construction, and obtain state-sum-like integral formulae for the parallel transport along paths and surfaces.

Talk based on math.DG/0302065 and references therein.

Higher order Painleve equations

Andrew Pickering (Universidad de Salamanca)

A classical problem, dating from the end of the nineteenth century, is that of seeking new transcendental functions defined by ordinary differential equations (ODEs). This led to the classification of ODEs having what is today referred to as the Painlevé property, i.e. having their general solution free of movable branched singularities. In particular, it led to the discovery of the six Painlevé equations, which did indeed define new transcendental functions.

More recently, over the last five years or so, there has been a surge of interest in the discovery of higher order analogues of the Painlevé equations. Here we describe our recent results in this direction, which include new hierarchies of ODEs having as first members Painlevé equations, and also an understanding of the connections between certain features of these ODEs (e.g. Bäcklund transformations) and the underlying structures of associated completely integrable partial differential equations (e.g. Hamiltonian structures, Miura maps).

Shapley-Bondareva Theorem for games on partially ordered linear spaces

Justo Puerto Albandoz (Universidad de Sevilla)

In this paper we analyze cooperative games whose characteristic function takes values in a partially ordered linear space. Thus, the classical concepts in cooperative game theory have to be revisited and redefined. Depending on the sense given to the domination relationship different solution concepts can occur. Shapley-Bondareva theorem is extended for this class of games. The classes of the vector-valued and stochastic games are examples of this general theory.

Linear differential equations and analytic function spaces

Jouni Rättyä* (University of Joensuu)

J. Heittokangas (University of Illinois at Urbana-Champaign)

R. Korhonen (Loughborough University)

The solutions of the linear homogeneous differential equation

$$f^{(k)} + A_{k-1}(z)f^{(k-1)} + \cdots + A_1(z)f' + A_0(z)f = 0, \quad k \in \mathbb{N}, \tag{2}$$

where the coefficients $A_0(z), \ldots, A_{k-1}(z)$ are analytic in the unit disc D are known to be analytic functions in D. Moreover, it is known that the coefficients are $\mathcal{H}$-functions in the unit disc if and only if all solutions of (2) are analytic in D and of finite order of growth in the sense of Nevanlinna theory in D. In this talk we are mainly concerned with more detailed analysis on the growth of the analytic solutions and coefficients of (2) in the unit disc.

We consider two kind of problems: (a) Find sufficient conditions for the coefficients in (2) such that all solutions belong to certain function space. (b) If all solutions of (2) belong to certain function space what can be said about the growth of the coefficients in the sense of function spaces. The classes considered are, for example, the Bergman spaces, the Hardy spaces, Nevanlinna class and the α-Bloch spaces.

Modeling Analytic Maps of the Unit Ball

Alexander Richman* (Purdue University)

Y. C. Yeow (Purdue University)

In one variable, analytic self-maps of the disk with non-zero derivative at the Denjoy-Wolff point, can be modeled by either a translation or a dilation acting on either the plane or the half plane (Cowen; Pommerenke and Baker; Koenig). In several variables, the situation is more complicated both in types of modeling maps and the domains on which they act.

We focus here on a generalization of linear fractional maps proposed by Cowen and MacCluer. We show how translations, dilations, and Heisenberg translations, along with combinations, appear as modeling maps acting on spaces, half-spaces, and Siegel-type half spaces.

Estimates for some kinds of exponenential sums over singular varieties

Antonio Rojas León (Princeton University)

We extend some results of Deligne and Katz on exponential sums over (possibly singular) varieties X defined over a finite field k, and find a general estimate for the sum of the traces of certain kinds of *ell*-adic sheaves on X. In particular we can give estimations for some exponential sums and for the number of points of a general hypersurface section of X over a finite extension of k.

High Order Algorithms for N-th root Approximation

Natalia Romero Álvarez* (Universidad de La Rioja)

M. A. Hernández (Universidad de La Rioja)

Given any natural number $q \geq 2$, we describe a new Newton-type iteration with the property, that for every start point $t_0 > R^{1/n}$, converges monotonically to $R^{1/n}$ with q order of convergence. Besides, this new iteration defines an uniparametric family of iterative processes, such that for $q = 2$ and $q = 3$ the Newton and the Chebyshev methods are respectively obtained.

Coloured Tessellations by NEC Polygonal Groups

Ceferino Ruíz* (Universidad de Granada)

Domingo Gámez (Universidad de Granada)

Miguel Pasadas (Universidad de Granada)

A kaleidoscope is obtained as the quotient of a space by the own discontinuous action of a group of transformations; this can also be obtained from a fundamental domain, which characterizes it. In the present study, the specific case of the Hyperbolic Plane is analyzed with respect to the action of a hyperbolic polygonal group, which is a particular case of an NEC group. Under the action of these groups, the hyperbolic plane is tessellated using tassels with a polygonal shape. The reflections act upon them with respect to their sides as generators of the group. Clear examples of quadrilateral tessellations of the hyperbolic plane with the quadrilaterals of Saccheri and Lambert are given. We show tessellations of the Poincaré hyperbolic models created with the *Hyperbol* package for *Mathematica* software that it has been developed by the authors. They are found in the basic structure of the colored mosaics or tessellations of the hyperbolic plane.

Derivadas parciales de funciones en conjuntos cúbicos, aplicaciones en aproximación de funciones, cálculos de homología y estudio de datos

Eduardo Sáenz de Cabezón Irigaray (Universidad de La Rioja)

Partiendo de la estructura de conjunto cúbico de $\mathbb{R}^n$, se definen operadores de derivación y coderivación parcial de funciones sobre estos conjuntos. Basándonos en estos operadores desarrollamos distintas vías de aplicación:

Por un lado se elabora una teoría de aproximación de funciones sobre conjuntos cúbicos a través de desarrollos en series de polinomios.

Por otra parte, en función de las derivadas y coderivadas parciales se describen los operadores borde y coborde que permiten al cálculo de homologías y cohomologías de los conjuntos cúbicos.

Mediante la definición de funciones de densidad asociadas a nubes n-dimensionales de datos se elaboran procedimientos de minería de datos tales como búsqueda de clusters, datos espúreos, estructuración de la nube, etc.

Rogers-Ramanujan type identities and the Fibonacci Sequence

Jose Plinio O. Santos (State university of Campinas)

In this paper we give new combinatorial interpretations for the Fibonacci Nunbers by defining bijections from previous interpretation that we have provided in a recent paper "On the Combinatorics of Polinomial Generalizations of Rogers-Ramanujan type identities" (Discrete Math. 254(2002) 497-511).

By defining $F_0 = 1, F_1 = 2, F_n = F_{n-1} + F_{n-2}, n \geq 2$, we have proved, for instant, the following theorem:

The total number of partitions of the form $a_1 + a_2 + \ldots + a_r, a_i < a_j$ *fori* $< j$*, with parts taken from* $1, 2, 3, \ldots, n$*, where* a_{2k+1}*, is odd and* a_{2k} *is even is equal to* $F_n - 1$.

Irrationality Bases, Super Liouville Numbers, and Euler's Constant

Jonathan Sondow (New York, NY, USA)

Let x be an irrational number. We introduce a new measure of irrationality, the "irrationality base" beta(x). If x is a Liouville number, then beta(x) may exceed 1; otherwise beta(x) equals 1. Thus the irrationality base can be regarded as a measure of irrationality for Liouville numbers. Just as x is called a Liouville number if its irrationality exponent is infinite, we call x a "super Liouville number" if its irrationality base is infinite. We present examples where the irrationality base is finite but greater than 1, and examples where it is infinite.

We give a sequence of positive integers, and offer numerical evidence for a condition on the fractional parts of their logarithms. We prove that the condition implies an upper bound on the irrationality base of Euler's constant, gamma. In particular, gamma is irrational (but not a super Liouville number) if the condition is true. If it is false, we derive an upper bound on the irrationality exponent of gamma, provided a sub-condition holds.

Resonance in an interacting induced dipoles polarization model

Francisco Torrens Zaragoza (Universidad de Valencia)

As an example of the manner in which the molecular polarizability depends on the atom polarizabilities, the isotropic molecule CH_4 is considered. Additivity of atom polarizabilities would require that the surface be a plane. This is approximately true near the origin, where interactions are small. However, the experimental polarizability of CH_4 is 2.62 cubic angstrom, and this value is reached only in regions of the surface where the influence of interactions is quite marked. The most notable feature is a curve of discontinuity along which the polarizability approaches $\pm\infty$. This behaviour is seen in the polarizability surfaces of several molecules that are similarly explored. Its origin for diatomic molecules $A-B$ is explained. The atomic polarizabilities for atoms A and B are inversely related along the curve of discontinuity for this case. In a polyatomic molecule as CH_4, the curve of discontinuity is of the form expected for diatomic molecules. The significance of a polarizability of $\pm\infty$ is that the molecule is in a state of resonance and absorbs energy from the applied field. This occurs in spite of the fact that any absorption properties of the atoms have not been introduced.

Weighted function spaces: Primitives and Derivatives

Luis Manuel Tovar Sánchez (IPN, México)

Consider the Hardy Spaces H^p or any of the well known spaces B^p, Qp or Dp. Given a function "f" in any of these spaces, where are its derivatives - of any order- and its primitives?. It is possible to determinate to which of these spaces belong "f" if I have some information about of its derivatives or primitives? There are several classic results about these questions specially related with Hardy spaces. This work contribute with several new results to complete the scheme of answers to these very natural questions.

Hyperbolic temperature of two bodies in contact

Macarena Trujillo Guillén* (Universidad Politécnica de Valencia)

J. A. López Molina (Universidad Politécnica de Valencia)

The classical theory of heat conduction predicts an infinite speed of heat conduction and the existence of heat fluxes of infinite value. This prediction is unrealistic from a physical point of view, however, the classical or parabolic equation continued being used since the equation results agreed with the experience. The development of new technologies has produced new physical situations where great amounts of heat are applied to materials in very short times. In these situations, new experiments revealed differences between theoretical results and the experience. This fact has promoted the need of a new heat conduction model based on the modified Fourier's law that gives rise to a new heat conduction equation based on an hyperbolic differential equation. The objective of this paper is to show the complete analytical temperature solution for the problem of heat conduction between two bodies that are placed together in contact. We consider two cases: Firstly, that the contact between two bodies is perfect and secondly, that exists contact resistance between two bodies.

Cesáro means for Fourier-Neumann series

Oscar Ciaurri Ramírez (Universidad de La Rioja)

Krzysztof Stempak (Politechnika Wrocławska)

Juan L. Varona* (Universidad de La Rioja)

Let J_μ be the Bessel functions of order μ. For $\alpha > -1$, the functions $x^{-\alpha-1}J_{\alpha+2n+1}(x)$, $n = 0, 1, 2\ldots$, form an orthogonal system in $L2((0,\infty), x^{2\alpha+1}\,dx)$, but the span of such functions is not dense in this space. For a function f, let $S_n^\alpha f$ denote the partial sums of its Fourier series; consider also take the means $R_n^\alpha f = \frac{\lambda_0 S_0^\alpha f + \cdots + \lambda_n S_n^\alpha f}{\lambda_0 + \cdots + \lambda_n}$, with $\lambda_k = 2(\alpha+2k+2)$. Here, we are finding exact expression for the kernel of $R_n^\alpha f$. As a consequence, we analyze the range of p and α for which the uniform boundendness of $R_n^\alpha f$ in $L^p((0,\infty), x^{2\alpha+1}\,dx)$ holds. Then, we study the convergence of $R_n^\alpha f$ when $n \to \infty$; note that this convergence is equivalent to the convergence of the $(C,1)$ Cesàro means. Finally, we describe the closure of the span of the orthogonal system in terms of the functions whose modified Hankel transform of order α is supported on the interval $[0,1]$.

Classification of the 5-dimensional Power-Associative 2nd-order Bernstein Algebras

Pilar Vicente Matilla* (Universidad de León)

H. Guzzo Jr. (Universidade de Sao Paulo)

A nth-order Bernstein algebra is a commutative baric algebra (A, w) satisfying:

$$x^{[n+2]} = (\omega(x))^{2^n}\, x^{[n+1]} \quad \text{for all } x \in A$$

and n is the smallest one with such property. If n is 2, that is, $x^{[4]} = (\omega(x))^4 x^{[3]}$ then A is a 2nd-order Bernstein algebra.

A is power-associative if $\left(x^2\right)^2 = x^4$ for every $x \in A$.

Let (A,ω) be a power-associative 2nd - order Bernstein algebra, if $\omega(x) = 1$ then $\left(x^2\right)^2$ is an idempotent. If e is an idempotent then A has a Peirce decomposition, $A = Ke \bigoplus U_e \bigoplus V_e$ where, $U_e = \left\{x \in A \;/\; ex = \frac{1}{2}x\right\}$, $V_e = \{x \in A \;/\; ex = 0\}$, the set of idempotent elements of A is given by $\Im(A) = \left\{e + u + u^2 \;/\; u \in U_e\right\}$. If $e' = e + u + u^2$ is other idempotent element of A then $U_{e'} = \{u' + 2uu' \;/\; u' \in U_e\}$and $V_{e'} = \{v - 2uv \;/\; v \in V_e\}$

$dimU_e, AnnN_N, AnnU_{eU_e}, U_e + U_e^2, dim(U_e^2 + V_e^2), dimU_eV_e, dim(U_e^2)$,
$dim(U_e^3), dim(N_{U_e})$ are invariants of A.

$v^3 = 0$ for every $v \in V_e$ is an invariant too and in this case $dim(N_{V_e})$ not depend on the choice of the idempotent element.

$Type(A) = (1 + r, s)$, where $r = dimU_e$ and $s = dimV_e$

If $type(A) = (1 + r, 3)$ and $v^3 = 0$ for every $v \in V_e$ then $dim(V_e^2) = 1$ and $V_e^3 = 0$.

If $type(A) = (1 + r, 4)$ and $v^3 = 0$ for every $v \in V_e$ then $dim(V_e^2) = 2$ and $V_e^3 = 0$.

If $type(A) = (1 + r, 4)$ and there exists $v \in V_e$ with $v^3 \neq 0$ then $dim(V_e^2) = 1$ and $V_e^4 = 0$.

If $type(A) = (2, s)$ then $U_eV_e = 0$.

We finally classify the 5-dimensional Power-Associative 2nd-order Bernstein Algebras.

On the Hurwitz Problem for Groups of Exponent n

Anthony Weaver (University of New York)

Let G be a finite group of exponent n. An orientation-preserving G-action a=a(G) on a compact surface determines a non-negative integral tenso= r T(a) of rank equal to the number of distinct prime factors of n. T(a) encodes the signature of the covering Fuchsian group of a and is therefore called the "signature tensor" of a. We g ive necessary and sufficient conditions for a given tensor T of rank n to be the signature tensor of a G-action, when G belongs to certain classes such as abelian, nilpotent, etc. This method provides an approach to the so-called "Hurwtiz problem": given a group, determine the set of genera on which the group acts by orientation-preserving homeomorphisms. In particular, it provides quick proofs of several well-known minimum genus results.

Point Distributions and Circle Packings

George Williams (Texas Tech University)

The problem of optimally distributing n points on the surface of a sphere has a long history, complicated by the difficulty in deciding what should be meant by an "optimal" distribution. Except for few special values of n, most of the work to date has focused on numerical approximation of the optimal configurations. We describe a method for quickly generating nearly-optimal distributions using circle packings.

Finite Blaschke products of contractions

Pei Yuan Wu (National Chiao Tung University)

Let A be a contraction on Hilbert space H and f be a finite Blaschke product. In this talk, we consider the problem when $f(A)$ has norm equal to 1. This is first reduced via some elementary arguments to the case when $f(z)$ is a power of z. We prove that if H is finite dimensional and A has no eigenvalue of modulus 1, then the largest integer k for which the norm of the kth power of A equals 1 is at least $m/(n-m)$, where n is the dimension of H and m equals the dimension of the kernel of $I - A * A$. The case of $k = n - 1$ is the most interesting: it characterizes the n-dimensional compression of the shift. This latter characterization is in turn related to some conditions in terms of the associated Toeplitz and Hankel operators, which has been studied before. However, our approach via matrix analysis is more elementary. This is a joint work with Hwa-Long Gau.