A Walking Tour Guided by Pi

Francisco Javier Aragón Artacho, University of Luxembourg

Abstract

Are the digits of pi "random"? They probably are... but this is still a significant open question. In fact, we don't even know if the digit 3 (or any other digit) appears an infinite number of times in the decimal expansion of pi. In this talk I will show how to represent any real number in any given base as a "walk". With this representation we can visualize a number and measure the "randomness of its digits". Among the numerous images we have created, there is one that might be the largest mathematical image ever produced: a walk created with one hundred thousand million digits of pi in base 4. This image, which has a resolution of 108 gigapixels, has received an important media coverage.

Local and Global Analysis for Rough Solutions of Nonlinear Schrödinger Equations on R_n

Víctor Arnaiz Solórzano, Universidad Autónoma de Madrid

victor.arnaiz@estudiante.uam.es

Abstract

In this talk I will discuss some local-existence results for rough solutions of Nonlinear Schr□odinger equations in R_n with initial data in the Sobolev spaces Hs, for an appropiate range of s. While the local-existence theory of these type of equations is well known, the global theory is not completely satisfactory yet. I will introduce some cases of blow-up solutions and others of global existence for all time. Finally, I will explain the global-in-time existence and scattering result, proved in 2004 by Colliander, Keel, Sta_lani, Takaoka and Tao, for the cubic defocusing equation on R3 with initial data in Hs, s > 45, which is not expected to be sharp.

Topological aspects of dynamical systems

Héctor Barge Yáñez, Universidad Complutense de Madrid

Abstract

The focus of this talk is to expose some results on the topology of attractors in continuos and discrete dynamical systems de_ned on manifolds. Particularly, we are interested in pointing out the di_erences between the continuous and the discrete case. For this purpose we will show an example of a topological space, known as the dyadic solenoid, which can be an attractor for a discrete dynamical systems but it cannot be an attractor for a continuous one.

Basic Objects, Resolution and Invariants of Singularities

Ana Bravo Zarza, Universidad Autónoma de Madrid

Abstract

A resolution of singularities of an algebraic variety X is a smooth variety Y together with a proper and bi-rational morphism from Y to X. The existence of such a resolution was proved by Hironaka in the sixties when X is defined over a field of characteristic zero. Given X, in algorithmic resolution of singularities we are interested on describing explicitly the sequence of blow-ups that we need in order to find Y. The strategy is to define an upper-semi continuous function F on X whose maximum determines the center to blow-up at each step of the resolution process. To define F, we consider a local embedding of X in a neighborhood of each point of the singular locus. Once the embedding is fixed, F is constructed locally using what we call "resolution invariants". In this talk we will see how using Rees Algebras and elimination techniques, it can be shown that: (1) the resolution invariants are independent of the embedding; (2) the construction of local invariants leads to a globally defined F on X. These results appear in:

- A. Bravo, M. García-Escamilla, O. Villamayor U., "On Rees Algebras and Invariantas for Singularities over Perfect Fields", Indiana Univ. Math. J., 61 (3), (2012) 53-60.
- A. Bravo, O. Villamayor U., "On the behaviour of the Multiplicity on Schemes: Stratification and Blow-ups". To appear in "The Resolution of Singular Algebraic Varieties", Clay Mathematics Institute Proceedings (CMIP), Editors: Ellwood, Hauser, Mori, Schicho, 2014.

Uniform estimates and a principle of differentiation through dimensions

Alberto Criado, Universidad Autónoma de Madrid

Abstract

We will present a principle of differentiation through dimensions that allows to characterize some measures for which the associated maximal function is uniformly bounded in dimension. This extends the work by Naor and Tao and also applies for the study of the dimension dependence of some weighted inequalities.

Lexicographic product graphs and hyperbolicity in the Gromov sense.

Amauris de la Cruz Rodríguez, Universidad Carlos III de Madrid

Abstract

If X is a geodesic metric space and $x_1, x_2, x_3 \in X$, a geodesic triangle $T = \{x_1, x_2, x_3\}$ is the union of the three geodesics $[x_{1x2}]$, $[x_{2x3}]$ and $[x_{3x1}]$ in X. The space X is δ-hyperbolic (in the Gromov sense) if any side of T is contained in a δ-neighborhood of the union of the two other sides, for every geodesic triangle T in X. If X is hyperbolic, we denote by δ(X) the sharp hyperbolicity constant of X, i.e. $\delta(X) = \inf\{\delta \geq 0 : X \text{ is } \delta\text{-hyperbolic}\}$. In this paper we characterize the lexicographic product of two graphs $G_1 \circ G_2$ which are hyperbolic, in terms of G_1 and G_2: the lexicographic product graph $G_1 \circ G_2$ is hyperbolic if and only if G_1 is hyperbolic, unless if G_1 is a trivial graph (the graph with a single vertex); if G_1 is trivial, then $G_1 \circ G_2$ is hyperbolic if and only if G_2 is hyperbolic. In particular, we obtain the sharp inequalities $\delta(G_1) \leq \delta(G_1 \circ G_2) \leq \delta(G_1) + 3/2$ if G_1 is not a trivial graph, and we characterize the graphs for which the second inequality is attained.

COMPACTNESS RESULTS OF OPERATORS BETWEEN APPROXIMATION SPACES

OSCAR DOMÍNGUEZ
UNIVERSIDAD COMPLUTENSE DE MADRID, SPAIN

ABSTRACT. Approximation spaces are a simple and elegant construction which allows to establish at the same time interesting results for function spaces, sequence spaces and spaces of operators. Given a quasi-Banach space X and scalar parameters $0 < \alpha < \infty, 0 < p, q \leq \infty, \gamma \in \mathbb{R}$, the classical theory deals with spaces X_p^α, and the limiting theory with $X_q^{(0,\gamma)}$. Outstanding examples of spaces X_p^α are Besov spaces $B_{p,q}^s$, Lorentz sequence spaces $\ell_{p,q}$, and the spaces of operators $\mathfrak{L}_{p,q}^{(a)}(E,F)$ consisting of all bounded linear operators between the Banach spaces E, F whose approximation numbers belong to $\ell_{p,q}$. Examples of $X_q^{(0,\gamma)}$ spaces are Besov spaces $B_{p,q}^{0,\gamma}$ with smoothness near zero, and the Lorentz-Zygmund operator spaces $\mathfrak{L}_{\infty,q,\gamma}^{(a)}(E,F)$. In this talk, we study the compactness properties of operators between approximation spaces, paying special attention to the limit case. We give applications to embeddings between Besov spaces.
This is joint work with F. Cobos and A. Martínez.

Zalcman's Conjecture for Univalent Functions

Iason Efraimidis, Universidad Autónoma de Madrid

Abstract

One of the most widely-known problems in the theory of functions of one complex variable was undoubtedly Bieberbach's conjecture (1916), stating that $|a_n| \leq n$ for the Taylor coefficients of all analytic univalent functions defined in the unit disk. While this was settled by de Branges in 1984, a stronger conjecture, proposed in the 60's by Lawrence Zalcman, remains open. This one states that, again for univalent functions, it should hold that $|a^2_n - a_{2n-1}| \leq (n-1)^2$. We will review the state of this problem and see some recent result, most of which form joint work with D. Vukotic.

Ideas of Resolution of Singularities and Rees Algebras

Mari Luz García-Escamilla, ICMAT – Universidad Autónoma de Madrid

Resolution of Singularities assigns to each singular variety X, a bi-rational morphism with suitable properties, say X←X', where X' is a regular variety.

H. Hironaka proved the existence of Resolution of Singularities for varieties over fields of characteristic zero. The proof he gave is existential and the first constructive proofs of Hironaka's Theorem appeared some years later.

In this talk we will focus on the concept of Constructive Resolution of Singularities: we will present the main ideas and the key difficulties to overcome.

We will discuss the relevance of Rees Algebras in this process. For instance, once we find a local invariants that lead to a resolution (resolution of local rings), their globalization requires some efforts. This aspect can be simplified using Rees Algebras.

- Bravo A.; García-Escamilla M.L.; Villamayor O. E.
  On Rees algebras and invariants for singularities over perfect fields.
  Indiana Univ. Math. J. **61** (2012) n. 3, 1201--1251.
- Hironaka, H.
  Three key theorems on infinitely near singularities.
  Singularities Franco-Japanaises *Sémin. Congr*., **10** (2005), 87--126.

On the slice-ribbon conjecture and pretzel knots

Ana García Lecuona (Aix-Marseille Universitè)

Thinking of the three dimensional sphere as the boundary of the four dimensional ball, we will say that a knot in S^3 is slice if it bounds an embedded disc in B^4. In general it is very difficult to establish whether a given knot is slice or not: there are several known obstructions to sliceness, but when these vanish the standard procedure to show that a knot is slice is to actually construct the slicing disc. In this talk we will describe some properties of slice knots, we will discuss the slice-ribbon conjecture and we will show an infinite family, which we conjecture complete, of slice knots inside the family of pretzel knots.

J.I. Díaz and **D. Gómez-Castro** (Universidad Complutense de Madrid, Spain)
diaz.racefyn@insde.es, dgomez91@gmail.com

Efficiency over cylinders: Steiner symmetrization and shape differentiation

Abstract: We consider a parabolic reaction-diffusion mathematical model

$$\begin{cases} w_t - \Delta w + \lambda\beta(w) = f, & \mathbb{R}_+ \times G \\ w = w_0, & \{0\} \times G \\ w = 1, & \mathbb{R}_+ \times \partial G \end{cases}$$

which appears in applications, for example, on Chemical Engineer. We analyze the different efficiency of the domain, which is defined

$$\eta(t, G) = \frac{1}{|G|} \int_G \beta(w(t, x))\, dx$$

We extended the Steiner symmetrization techniques for domains $G = G' \times G''$ previously used by Alvino, Trombetti, Diaz and Lions (1996) for the elliptic linear problem coupled with techniques from Schwarz symmetrization in the nonlinear problem (see J.I. Diaz (1985)). We show that, for this kind of domain, $G' = B_R$ provides the lowest effectivity for fixed G'' and $|G'|$. However, we point out that, as a result of a theorem by C. Bandle in 1985 effective cylindrical reactors may have a circular basis as long as they are low (that is, it is contained between two close parallel hyperplanes), and generalize the result to maximal monotone operators on the limit case. For this class of domains we provide a sufficient condition for optimal effectiveness.

Gromov Hyperbolicity in Mycielski Graphs

"Hiperbolicidad en el sentido de Gromov en grafos Mycielskianos"

Ana Granados Sanandrés, Universidad Carlos III de Madrid

Dado un grafo simple G con vértices, el grafo Mycielskiayno G^M de G es otro grafo que contiene a G como subgrafo isométrico, junto con vértices y aristas adicionales generadas de cierta manera.

Es fácil ver que todo grafo Mycielskiano G^M es δ Gromov hiperbólico con $5/4 \le \delta \le 5/2$. Nosotros caracterizamos los grafos G cuyos Mycielskians tienen constante $\delta=5/4$ y $\delta =5/2$.

Bounds on Gromov Hyperbolicity Constant

Abstract

If X is a geodesic metric space and $x_1, x_2, x_3 \in X$, a geodesic triangle $T = \{x_1, x_2, x_3\}$ is the union of the three geodesics $[x_1x_2]$, $[x_2x_3]$ and $[x_3x_1]$ in X. The space X is δ-hyperbolic in the Gromov sense if any side of T is contained in a δ-neighborhood of the union of the two other sides, for every geodesic triangle T in X. If X is hyperbolic, we denote by $\delta(X)$ the sharp hyperbolicity constant of X, i.e. $\delta(X) = \inf\{\delta \geq 0 : \quad X \text{ is } \delta\text{-hyperbolic}\}$. To compute the hyperbolicity constant is a very hard problem. Then it is natural to try to bound the hyperbolycity constant in terms of some parameters of the graph. Denote by $\mathcal{G}(n, m)$ the set of graphs G with n vertices and m edges, and such that every edge has length 1. In this work we estimate $A(n, m) := \min\{\delta(G) \mid G \in \mathcal{G}(n, m)\}$ and $B(n, m) := \max\{\delta(G) \mid G \in \mathcal{G}(n, m)\}$. In particular, we obtain good bounds for $A(n, m)$ and $B(n, m)$, and we compute the precise value of $A(n, m)$ for many values of n and m. Besides, we apply these results to random graphs. In addition, we obtain an upper bound of the size of any graph in terms of its diameter and its order.

Keywords: Gromov hyperbolicity, hyperbolicity constant, finite graphs, geodesic.

Global inversion of non-smooth mappings

Óscar Madiedo, Universidad Complutense de Madrid

Abstract

The main aim of this talk is to make known new results of global inversion of non-smooth mappings, using the concepts of Clarke generalized Jacobian and the pseudo-jacobian matrices of Jeyakumar and Luc.

El Teorema de Calabi-Yau / The Calabi-Yau Theorem

Juan José Madrigal, Universidad Complutense de Madrid

Resumen

El Teorema de Calabi-Yau es considerado uno de los más importantes de la matemática del siglo XX. En este documento se estudia dicho teorema exhaustivamente, desarrollando con completitud y cuidadoso detalle las ramas principales que abarca. Los dos primeros capítulos contienen el soporte geométrico: variedades complejas y clases de Chern. Los capítulos cuarto y quinto, por el contrario, tratan el soporte analítico: una compleja base funcional junto con los resultados clave sobre los que se apoya la demostración del teorema, entre los que se encuentran las altamente no triviales estimaciones a priori. El tercer capítulo sirve como articulación de los dos grandes bloques anteriores, resaltando la enorme relevancia del Teorema de Calabi-Yau en física, como ingrediente constitutivo de la Teoría de Cuerdas moderna, y en matemáticas, como elemento precursor del Análisis Geométrico, nueva y potente rama de la geometría actual.

Abstract

The Calabi-Yau Theorem is considered to be among the most important in the 20th century mathematics. In this document this theorem is exhaustively studied, developing completely and with great detail the main covered branches. The two first chapters involve the geometric support: complex manifolds and Chern classes. Fourth and fifth chapters, on the other hand, deal with the analytical support: a complex functional machinery together with the key results where the proof of the theorem is supported, which include the highly non-trivial a priori estimates. The third chapter joins these two big theories, highlighting the huge importance of Calabi-Yau Theorem in Physics, as constituent part of modern String Theory, and in Mathematics, as forerunner element of Geometrical Analysis, new and powerful branch of present Geometry.

Classical and semiclassical Koornwinder orthogonal polynomials in two variables

Francisco Marcellán[1], **Misael E. Marriaga**[1], **Teresa E. Pérez**[2], **Miguel A. Piñar**[2]

We consider Koornwinder's method ([4]) to construct orthogonal polynomials in two variables from orthogonal polynomials in one variable. We study the two three term relations for Koornwinder polynomials and we deduce the explicit expression for the matrix coefficients using the three term recurrence relation for the involved univariate orthogonal polynomials. These matrices are diagonal or tridiagonal with entries computable from the relations in one variable.

Furthermore, semiclassical orthogonal polynomials in two variables, which are the natural generalization of the classical orthogonal polynomials, are defined ([1], [3]) as the orthogonal polynomials associated to a two-variable quasi-definite moment functional satisfying a non-unique matrix Pearson-type equation. The semiclassical or classical character of orthogonal polynomials is determined by the corresponding matrix Pearson-type equation with polynomial matrix coefficients of lowest degree. Given the moment functional associated to a system of Koornwinder polynomials obtained from classical orthogonal polynomials in one variable, the matrix Pearson-type equation cannot be directly determined from the Pearson equations of the underlying moment functionals in one variable. We consider two methods to deduce matrix Pearson-type equations for moment functionals associated to Koornwinder polynomials.

Keywords: Orthogonal polynomials in two variables, three term relations, classical orthogonal polynomials

Referencias

[1] M. Álvarez de Morales, L. Fernández, T. E. Pérez, M. A. Piñar, Semiclassical orthogonal polynomials in two variables, *J. Comput. Appl. Math.* 207, 323–330 (2007).

[2] C. F. Dunkl; Y. Xu, *Orthogonal polynomials of several variables*. Encyclopedia of Mathematics and its applications 81. Cambridge University Press, Cambridge, 2001.

[3] L. Fernández; T. E. Pérez; M. A. Piñar, Classical orthogonal polynomials in two variables: a matrix approach, *Numer. Algorigthms* 39, 131–142 (2005).

[4] T. H. Koornwinder, Two variable analogues of the classical orthogonal polynomials, in *Theory and Application of Special Functions*. R. Askey Editor, Academic Press (1975), 435–495.

[1]Departamento de Matemáticas
Universidad Carlos III de Madrid
Avenida de la Universidad, 30
28911, Leganés, Madrid (Spain)
pacomarc@ing.uc3m.es, mmarriag@math.uc3m.es

[2]Departamento de Matemática Aplicada
Facultad de Ciencias
Universidad de Granada
18071. Granada (Spain)
tperez@ugr.es, mpinar@ugr.es

Uniform convergence of Hermite-Padé approximants for certain systems of analytics and meromorphic functions

Sergio Medina, Universidad Carlos III de Madrid

Abstract

Padé approximation has two natural extensions to vector rational approximation through the so called type I and type II Hermite-Padé approximants. We study the convergence of sequences of type I and type II Hermite-Padé approximants with respect to a Nikishin system of functions and to a rational modification of Nikishin systems of functions. In this talk, we provide Markov and Stieltjes type theorems on the convergence Hermite-Padé approximants.

Mathematical modelling and analysis in Solid Mechanics: elasticity, fracture, cavitation.

Carlos Mora, Universidad Autónoma de Madrid

I will explain the mathematical modelling of elastic deformations of solids, and how the Calculus of variations can be used in their analysis, in particular, to prove minimum-energy configurations. Deformations that are not purely elastic like those presenting singularities such as fracture or cavitation can also be analysed through a variant of the elastic model. In that case, apart from the elastic energy, a new surface energy is added to account for those singularities. We will then see that tools from Geometric measure theory are needed to analyse those problems.

Limits as p goes to infinity in elliptic problems related to operators of p-Laplacian type. Overviewed and recent applications

Mayte Pérez-Llanos, Universidad Autónoma de Madrid

In this talk we are giving an overview of this kind of elliptic problems involving di_erent types of p-Laplacian operators, taking limits as the exponents go to in_nity. From its origin up to more recent applications. This analysis emerged for _rst time in the sixties, when _nding the best Lipschitz extension of a Lipschitz function f : @ ! R to the whole domain , see references [1, 19, 25]. However, the problem of uniqueness was not solved until the nineties, see [9]. It requires a di_erent sense of solutions than in the previous references, namely, solutions in viscosity sense, we refer to [5, 11]. Then we will introduce several subsequent works motivated by these pioneer papers, with di_erent types of p-laplacian operators, or interesting variations, see for instance [2, 8, 12, 13, 15, 16], among a vast list. We will conclude talking about more recent works dealing with nonlocal operators. For this matter we refer to [3, 4, 10, 14].
Our contributions in this field are [6, 7, 17, 18, 20, 21, 22, 23, 24]. Regarding this issue I would like to mention to my collaborators in this topic: Agnese di Castro, Raúl Ferreira, Pedro Martínez-Aparicio, Julio D. Rossi and José Miguel Urbano.

References

[1] G. Aronsson Extension of functions satisfying Lipschitz conditions. Ark. Mat. 6 , (1967), 551{561.
[2] T. Bhattacharya, E. Dibenedetto and J. Manfredi, Limits as p ! 1 of _pup = f and related extremal problems, Rend. Sem. Mat. Univ. Politec. Torino 1989, Special Issue, 1568 (1991).
[3] C. Bjorland, L. Ca_arelli, and A. Figalli, Nonlocal tug-of-war and the in_nity fractional Laplacian, Comm. Pure Appl. Math. 65 (2012), 337{380.
[4] A. Chambolle, E. Lindgren and R. Monneau. A H□older In_nity Laplacian. ESAIM Control Optim. Calc. Var. DOI: 10.1051/cocv/2011182.
[5] M.G. Crandall, H. Ishii and P.L. Lions. User's guide to viscosity solutions of second order partial di_erential equations. Bull. Amer. Math. Soc. 27 (1992), 1{67.
[6] Di Castro, A., P_erez-Llanos, M. and Urbano, J. M. Limits of anisotropic and degenerate elliptic problems. Commun. Pure Appl. Anal. 11 (2012), no. 3, 1217{1229.
[7] Ferreira, R. and P_erez-Llanos, M.Limit problems for a Fractional p□Laplacian as p ! 1, submitted.
[8] I. Fragal_a, F. Gazzola and B. Kawohl. Existence and nonexistence results for anisotropic quasilinear elliptic equations. Ann. I. H. Poincar_e ANL, 21 (2004), 715{734.
[9] R. Jensen. Uniqueness of Lipschitz extensions: Minimizing the sup norm of the gradient. Arch. Rational Mech. Anal. 123 (1993), 51{74.
[10] H. Jylh□a, An optimal transportation problem related to the limits of solutions of local and nonlocal p-Laplace-type problems, To appear in Rev. Mat. Complut. DOI 10.1007/s13163-014-0147-5

[11] P. Juutinen. Minimization problems for Lipschitz functions via viscosity solutions. Univ. Jyvaskyla, (1996), 1{39.
[12] P. Juutinen, P. Lindqvist and J.J. Manfredi. The 1-eigenvalue problem. Arch. Rational Mech. Anal., 148, (1999), 89{105.
[13] P. Juutinen, P. Lindqvist and J.J. Manfredi. On the equivalence of viscosity solutions and weak solutions for a quasilinear equation. SIAM J. Math. Anal. 33(3), (2001), 699{717.
[14] E. Lindgren and P. Lindqvist Fractional eigenvalues, Calc. Var. Partial Di_erential Equations 49 (2014), no. 1-2, 795826.
[15] J. J. Manfredi, J.D. Rossi, and J.M. Urbano. Limits as p(x) ! 1 of p(x)-harmonic functions. Nonlinear Anal. 72 (2010), no. 1, 309{315.
[16] J. J. Manfredi, J.D. Rossi, and J.M. Urbano. p(x)-harmonic functions with unbounded exponent in a subdomain. Ann. Inst. H. Poincar Anal. Non Lin_eaire 26 (2009), no. 6, 2581{2595.
[17] Mart__nez-Aparicio, P., P_erez-Llanos, M. and Rossi, J.D. The eigenvalue problem for the 1-homogeneous p-laplacian and its limit as p ! 1. Revista Matem_atica Complutense 27 (2014), 241{258.
[18] Mart__nez-Aparicio, P., P_erez-Llanos, M. and Rossi, J.D. The sublinear problem for the 1-homogeneous p-laplacian Proc. Amer. Math. Soc. 142 (2014), no.8, 2641{2648.
[19] E. J. McShane. Extension of range of functions. Bull. Amer. Math. Soc. 40 (12), (1934), 837{842.
[20] P_erez-Llanos, M. Anisotropic variable exponent (p(_); q(_))-Laplacian with large exponents. Advanced Nonlinear Studies 13 (2013), 1023{1054.
[21] P_erez-Llanos, M. and Rossi, J. D. An anisotropic in_nity Laplacian obtained as the limit of the anisotropic (p; q)- Laplacian. Commun. Contemp. Math. 13 (2011), no. 6, 1057{1076.
[22] P_erez-Llanos, M. and Rossi, J. D. Limits as p(x) ! 1 of p(x)-harmonic functions with non-homogeneous Neumann boundary conditions. 187{201, Contemp. Math., 540, Amer. Math. Soc., Providence, RI, 2011.
[23] P_erez-Llanos, M. and Rossi, J. D. The limit as p(x) ! 1 of solutions to the inhomogeneous Dirichlet problem of the p(x)-Laplacian. Nonlinear Anal. 73 (2010), no. 7, 2027{2035.
[24] P_erez-Llanos, M. and Rossi, J. D. The behaviour of the p(x)-Laplacian eigenvalue problem as p(x) ! 1. J. Math. Anal. Appl. 363 (2010), no. 2, 502{511.
[25] H. Whitney. Analytic extensions of di_erentiable functions de_ned in closed sets. Trans. Amer. Math. Soc. 36 (1), (1934), 63{89.

Mayte Pérez-Llanos: Departamento de Matemáticas, Universidad Aut_onoma de Madrid, Facultad de Ciencias, mod 17, Campus de Cantoblanco, 28049 Madrid, SPAIN. mayte.perez@uam.es

Secants and Tangents

Christian Peskine, Institut de Mathèmatique de Jussieu

According to the celebrated "Trisecant Lemma", a "general projection" of a smooth algebraic curve on a plane has only ordinary double points. Inother words, the trisecant, the tangents and the stationary bisecants (they shall be explained) do not _ll up the space. I intend to explain at length this classical result, hoping in particular to attract the interest of those who have never heard of it. I will then discuss secants and tangents to a smooth algebraic variety and explain how the "Trisecant Lemma" is a special case of a very natural and general satement. The role and importance of "general tangents", which are not clear in the case of the "Trisecant Lemma" will appear clearly in this new context. If time and strength are left, I will present and discuss the (higher) polar varieties (of a smooth variety) and explain how a classical result of Mather _ts also in this theory.

Donaldson techniques in s-symplectic foliations

Álvaro del Pino, Universidad Autónoma de Madrid

Abstract

In this talk we will define what a symplectic manifold is and how this notion relates to complex projective varieties. Donaldson techniques will be introduced and it will be shown that a symplectic analogue of the Lefschetz hyperplane theorem holds. If time allows, a recent result of Martínez-Torres, del Pino and Presas will be discussed, that proves that a foliated version of the Lefschetz hyperplane theorem also holds for s-symplectic foliations.

LOWER BOUNDS FOR FRACTIONAL RIESZ TRANSFORMS ON GENERAL CANTOR SETS

MARIA CARMEN REGUERA

ABSTRACT. In this talk we study estimates from below for the L^2 norm of the s-dimensional Riesz transform, with kernel $x/|x|^{s+1}$ for $s \in (d-1, d)$, of measures supported on very general Cantor sets in $\mathbb{R}^d$. The bounds obtained are written in terms of the densities of the cubes appearing in the construction of the Cantor sets. These estimates allow to establish an equivalence between the capacity γ_s associated with the s-dimensional Riesz kernel and the capacity $\dot{C}_{\frac{2}{3}(d-s),\frac{3}{2}}$ from non-linear potential theory associated to the Wolff potential for the so called uniformly disconnected compact sets.

The comparability of the two capacities was first understood by Mateu, Prat and Verdera, who proved $\gamma_s(E) \equiv \dot{C}_{\frac{2}{3}(d-s),\frac{3}{2}}(E)$ for any compact set E in the case $0 < s < 1$. The general case is still a big open problem in Geometric analysis. Our result is the latest contribution and it is based on previous work on the subject by Eiderman-Nazarov-Volberg, Mateu-Tolsa and Tolsa.

This is joint work with Xavier Tolsa.