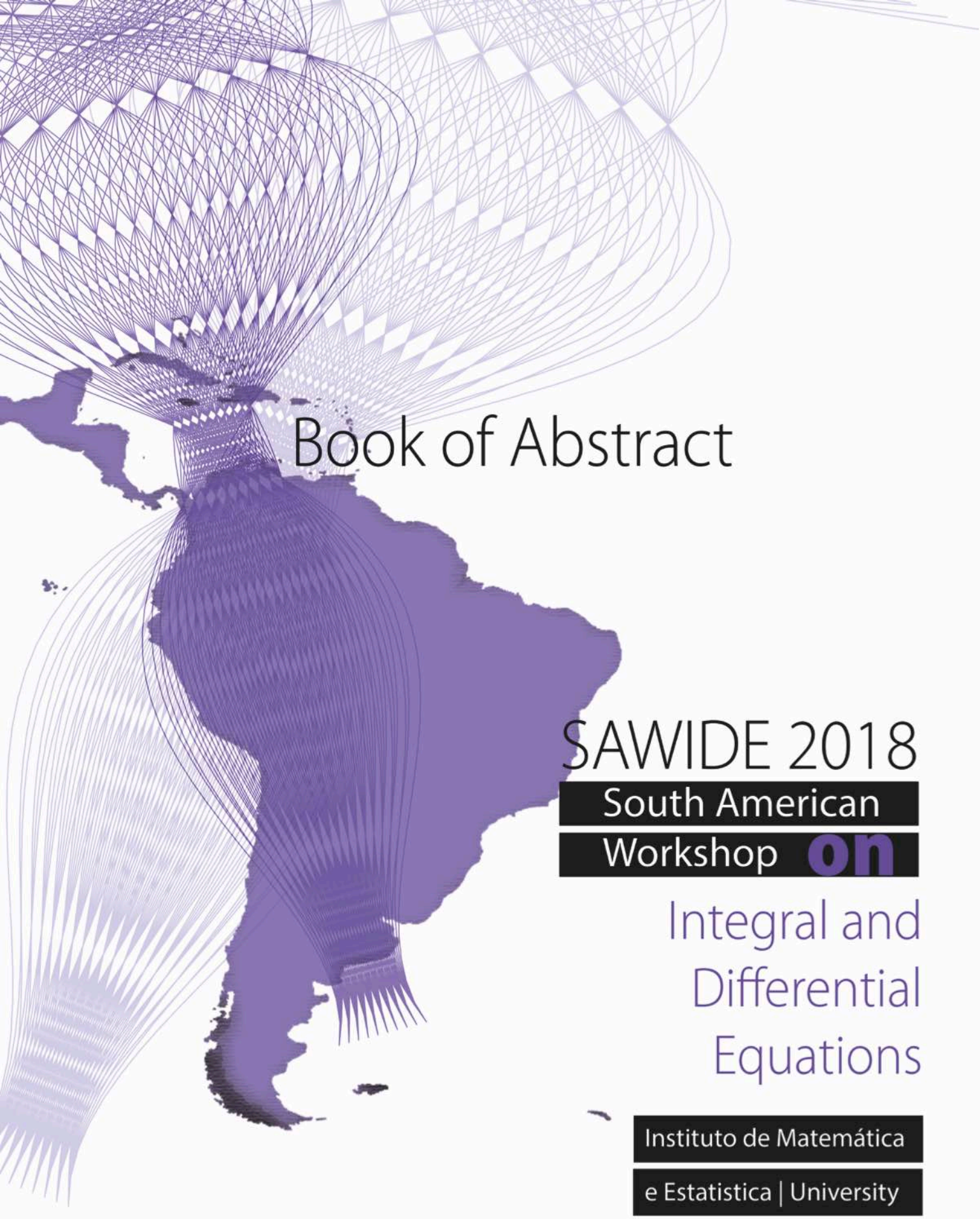

Book of Abstract

SAWIDE 2018

South American Workshop on Integral and Differential Equations

Instituto de Matemática e Estatistica | University of São Paulo, Brazil

February 26-28, 2018

SAWIDE 2018 - South American Workshop on Integral and Differential Equations

Instituto de Matemática e Estatística - Universidade de São Paulo

February 26-28, 2018

Contents

Welcome to Sawide!

Welcome to São Paulo! Bienvenidos!

It is a great pleasure to welcome you all to the first SAWIDE - South American Workshop on Integral and Differential Equations. We hope you enjoy it and have a pleasant stay.

About the SAWIDE Workshop

The main goal of this Workshop is to promote and develop scientific exchange among Phd-students and researchers from different South American institutions. The highlighted topics are integral and differential equations, although they are not limited to them. In this first edition, we are glad to gather up mathematicians from FCEyN-UBA and IME-USP here in São Paulo, Brazil.

Venue

The Lectures will take place at Antonio Gilioli Auditorium - Building A 247/262 - Instituto de Matemática e Estatística da Universidade de São Paulo - Rua do Matão 1010, São Paulo, SP.

Committees

Scientific Committee

Antônio L. Pereira
Clodoaldo Ragazzo
Julio D. Rossi
Pablo Amster

Organizing Committee

Marcone Pereira
Pedro Lopes
Pierluigi Benevieri
Sergio Oliva

Contacts

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Address:
Instituto de Matemática e Estatística USP
Rua do Matão 1010, Cidade Universitária, Butantã.
CEP 05508-090. São Paulo - SP - Brazil.

Transportation

The suggested hotel for the conference is WZ Jardins Hotel, located at Av. Rebouças 955, very close to metro stations and to Av. Paulista, one of the main spots of the city of São Paulo.

In order to go to the Workshop, it is possible to take the following bus lines:

702U-10 Cid. Universitária (It returns as Term. Pq. D. Pedro II).

7411/10 Cid. Universitária (It returns as Praça da Sé)

The buses go inside the University and there is a bus stop very close to the Institute. The bus stop is called FAU II in Google Maps.

There is also a bus stop very close to the hotel. You only need to turn left in the avenue. When you are leaving the hotel, the university is also in the left direction.

We recommend leaving the hotel with one hour in advance to arrive at the University.

Financial Support

We gratefully acknowledge financial support from FAPESP, CNPq, CAPES, AUCANI (USP) and from IME-USP.

Wireless Internet Connection

The University provides access to wireless internet connection via **eduroam**. If you do not possess an eduroam account you can access the following wireless connection:

Login: SAWIDE
Password: SAWIDE2018

Schedule Overview

Schedule	Monday 26	Tuesday 27	Wednesday 28
08h30 – 09h00	Opening		
09h00 – 09h45	Paolo Piccione	Constanza Sanchez	Paulo Cordaro
09h45 – 10h30	Joana Terra	Pablo Amster	Nicolas Saintier
10h30 – 10h50	**Coffee**	**Coffee**	**Coffee**
10h50 – 11h35	Julio Rossi	Orlando Lopes	Clodoaldo Ragazzo
11h35 – 14h00	**Lunch**	**Lunch**	**Lunch**
14h00 – 14h45	Julián Haddad	Pierluigi Benevieri	Pablo De Nápoli
14h45 – 15h30	Juliana Fernandes	**Poster**	Nataliia Goloshchapova
15h30 – 16h00	**Coffee**	**Coffee**	**Coffee**
16h00 – 16h45	Leandro Del Pezzo	João da Silva	Gaetano Siciliano
16h45 – 17h30	Antoine Laurain	Severino Melo	Jaime Angulo

Abstracts - Talks

Non-autonomous periodic perturbations of a nonlinear delayed system near an equilibrium

Tue 9:45

Pablo Amster

Departamento de Matemática/FCEyN - Universidad de Buenos Aires

Let $\Omega \subset \mathbb{R}^N$ be a smooth bounded domain and consider the autonomous system of delay differential equations

$$u'(0) = g(u(t), u(t-\tau)), (1)$$

where $g : \Omega \times \Omega \to \mathbb{R}^N$ is continuous. Let $e \in \Omega$ be an equilibrium point and assume that the linearisation at e has no nontrivial T-periodic solutions, then a standard argument shows that the small non-autonomous perturbations of (1) admit at least one T-periodic solution. Furthermore, if the field $G(x) := g(x, x)$ is inwardly pointing over $\partial\Omega$ and τ is small, then for the number of T-periodic solutions is generically at least $\|\chi \pm 1\| + 1$, where χ denotes the Euler characteristic of Ω. In this talk we shall give a topological proof of this fact and related results.

Retarded functional differential equations on manifolds: existence and bifurcations results

Tue 14:00

Pierluigi Benevieri

Instituto de Matemática e Estatística - Universidade de São Paulo

We investigate T-periodic parametrized first and second order retarded functional equations on differentiable manifolds. We prove existence and global continuation results for T-periodic solutions. The approach is topological and is based on the degree theory for tangent vector fields as well as on the fixed point index theory.

Wed 9:00

Semi-global solvability with loss of one derivative of partial differential operators on surfaces

Paulo Cordaro

Instituto de Matemática e Estatística - Universidade de São Paulo

we prove that for linear partial differential operators in two variables that satisfy the Nirenberg-Treves condition (P) the well known Hörmander's semi-global solvability theorem can be improved by showing that solutions can in fact be taken with a sharp loss of one derivative.

Wed 14:45

On the standing waves of the NLS equation with point interactions on the star graph

Nataliia Goloshchapova

Instituto de Matemática e Estatística - Universidade de São Paulo

During the talk we will discuss well-posedness and stability properties of the standing wave solutions $e^{i\omega t}\mathbf{\Phi}(x)$ to the NLS equation with so-called δ- and δ'-interactions on the star graph $\mathcal{G}$ (the star graph is given by N half-lines joined at the vertex $\nu = 0$). Moreover, we will mention briefly some variational problems associated with the NLS equation on $\mathcal{G}$. The main result is the orbital instability of the excited states to the NLS-δ equation for negative intensity of δ-interaction. In our study we use the classical theory by M. Grillakis, J. Shatah, W. Strauss, the theory of extensions of symmetric operators, and the perturbation theory. This is a joint work with J. Angulo Pava (IME-USP)

Mon 14:00

Global bifurcation-like Theorems in presence of non-vanishing Spectral Flow

Julián Haddad

Instituto de Ciências Exatas (ICEx) - Universidade Federal de Minas Gerais

Given a one-parameter family of functions $f_t : H \to \mathbb{R}$ where $f_t(0) = 0, \nabla f_t(0) = 0$ and H is a real Hilbert space, the Spectral Flow of the Hessian of f was related recently to local bifurcation results by Fitzpatrick, Pejsachowicz and Waterstraat. While this invariant is finer than the topological index, the existent results are of local nature, in contrast to the global bifurcation theorem of Krasnoselski and Rabinowitz. We prove a global bifurcation theorem for "target values" of f under Spectral Flow hypothesis.

Shape optimization for an eigenvalue problem with indefinite weight

Mon 16:45

Antoine Laurain

Instituto de Matemática e Estatística - Universidade de São Paulo

We show several theoretical and numerical results, and discuss open questions, for a free boundary problem motivated by a model of population dynamics. The question is to determine optimal spatial arrangements of favorable and unfavorable regions for a species to survive. The mathematical formulation of the model leads to an indefinite weight linear eigenvalue problem in a fixed box and we consider the general case of Robin boundary conditions. It is known that the optimal weight is piecewise constant and take two values with opposite signs. We parameterize it using the characteristic function of the set on which resources are located. Thus, the optimal spatial arrangement is obtained by minimizing the positive principal eigenvalue with respect to the shape of this set, under a volume constraint.

Uniqueness and radial symmetry of minimizers for a nonlocal variational problem

Tue 10:50

Orlando Lopes

Instituto de Matemática e Estatística - Universidade de São Paulo

For $-n < p < 0 < q$ and

$$K(x) = \frac{\|x\|^q}{q} - \frac{\|x\|^p}{p},$$

the existence of minimizers of

$$E(u) = \int_{R^n \times R^n} K(x-y)u(x)u(y)\,dx\,dy$$

under

$$\int_{R^n} u(x)\,dx = m > 0; \quad 0 \le u(x) \le M,$$

with given m and M, has been proved. Moreover, except for translation, uniqueness and radial symmetry of the minimizer has been proved for $-n < p < 0$ and $q = 2$. In our lecture, we show that, except for translation, uniqueness and radial symmetry of the minimizer hold for $-n < p < 0$ and $2 \le q \le 4$. Applications are given.

Tue 16:45

Operators with analytic orbit for the torus action

Severino T. Melo

Instituto de Matemática e Estatística - Universidade de São Paulo

For each $t \in \mathbb{T}^n = \mathbb{R}^n/(2\pi\mathbb{Z})^n$, let T_t denote the unitary operator on $L^2(\mathbb{T}^n)$, $(T_t u)(x) = u(x-t)$ (we denote by x or t both an element of $\mathbb{R}^n$ and its equivalence class in $\mathbb{T}^n$). A bounded operator A on $L^2(\mathbb{T}^n)$ is said to be an *analytic operator for the torus action* if $t \mapsto T_t A T_{-t}$ is a real-analytic map taking values in the Banach algebra $\mathcal{L}(L^2(\mathbb{T}^n))$ of all bounded operators on $L^2(\mathbb{T}^n)$. We prove that A is analytic, in this sense, if and only if there is a sequence $(a_j)_{j\in\mathbb{Z}^n}$, $a_j \in C^\infty(\mathbb{T}^n)$, satisfying, for some $C > 0$ and for all multiindices $\alpha \in \mathbb{N}^n$,

$$\sup\{|\partial_x^\alpha a_j(x)|;\, x \in \mathbb{T}^n,\, j \in \mathbb{Z}^n\} \leq C^{|\alpha|+1}\alpha!,$$

such that A is given by

$$Au(x) = \sum_{j\in\mathbb{Z}^n} a_j(x) e^{ij\cdot x}\widehat{u}_j, \quad \widehat{u}_j = \frac{1}{(2\pi)^n}\int_{\mathbb{T}^n} e^{-ij\cdot y}u(y)\,dy.$$

This can be regarded as an abstract characterization of the zero-order pseudodifferential operators on the torus in Hörmander's $\rho = \delta = 0$ class which are analytic in a sense defined by Trèves. It implies that such class is a spectrally invariant *-algebra. The proof is based on Cordes' characterization of the global pseudodifferential operators on $\mathbb{R}^n$ of type $\rho = \delta = 0$ as the bounded operators on $\mathcal{L}(L^2(\mathbb{R}^n))$ whose orbit under the natural action of the Heisenberg group is smooth.

This is joint work with Rodrigo Cabral. It will appear in Studia Mathematica.

Wed 14:00

Weighted Inequalities for the Fractional Laplacian and the Existence of Extremals

Pablo De Nápoli

Departamento de Matemática/FCEyN - Universidad de Buenos Aires and CONICET, UBA

We obtain improved versions of Stein-Weiss and Caffarelli-Kohn-Nirenberg inequalities, involving Besov norms of negative smoothness. As an application of the former, we derive the existence of extremals of the Stein-Weiss inequality in certain cases, some of which are not contained in the celebrated theorem of E. Lieb.

Joint work with Irene Drelichman and Ariel Salort.

Reference: https://arxiv.org/abs/1705.00030

Stability theory for the NLS-δ' equation

Wed 16:45

Jaime Angulo Pava

Instituto de Matemática e Estatística - Universidade de São Paulo

We study the orbital stability of standing waves with discontinuous bump-like profile for the nonlinear Schrödinger model with the *repulsive* δ'-interaction on the line. In particular, it is showed that such standing waves are unstable in the energy space under some restrictions for parameters. The use of extension theory of symmetric operators by Krein-von Neumann is fundamental for estimating the Morse index of self-adjoint operators associated with the linearization of NLS-δ' equation. Moreover, the Perron-Frobenius property for the repulsive δ'-interaction is established.

This work is in collaboration with Nataliia Goloshchapova/IME-USP

Monotonicity and symmetry results for a semi-linear fractional Laplace equation in the half space

Mon 16:00

Leandro M. Del Pezzo

Departamento de Matemática y Estadística - Universidad Torcuato Di Tella

In this talk, we will show existence and qualitative properties of positive, bounded solutions of the semi-linear nonlocal equation:

$$(LP) \quad \begin{cases} (-\Delta)^s u = f(u), & \text{in } \mathbb{R}^N_+ \\ u = 0, & \text{on } \partial\mathbb{R}^N_+ \end{cases},$$

where $(-\Delta)^s$, $0 < s < 1$, stands for the fractional Laplacian, $\mathbb{R}^N_+ = \{x = (x', x_N) \in \mathbb{R}^N\colon\ x_N > 0\}$ is the half-space and f is a locally Lipchitz nonlinearity. More specifically, we will prove the monotonicity of solutions of (LP) and their one-dimensional symmetry.

Algebraic and topological techniques for the Yamabe problem in noncompact manifolds

Mon 9:00

Paolo Piccione

Instituto de Matemática e Estatística - Universidade de São Paulo

I will present a formulation of the Yamabe problem in noncompact manifolds, giving examples of existence and of non-existence of solutions. I will then discuss some ideas to use Topology and a little bit of Algebra to establish some multiplicity results. This will lead to studying the space of flat metrics on a compact manifold, and its boundary, which consists of spaces obtained by collapsing compact flat manifolds.

Mon 14:45

Semilinear parabolic equations with unbounded attractors

Juliana Fernandes S. Pimentel

Centro de Matemática, Computação e Cognição - Universidade Federal do ABC

We consider non-dissipative semilinear parabolic equations on a bounded interval. We review the recently developed theory for the autonomous version of this class of problems and present a characterization for the associated noncompact global attractor.

Wed 10:50

Hydrodynamic Vortex on a Compact Surface: the "Steady Vortex Metric" and generalizations to higher dimensions.

Clodoaldo Grotta Ragazzo

Instituto de Matemática e Estatística - Universidade de São Paulo

In this talk we will introduce a special metric on closed surfaces called "Steady Vortex Metric". This metric is characterized by the fact that the fundamental solution of the Laplacian is locally given by $log(d)$ where $d = d(x, y)$ is the Riemannian distance between the points x and y. A generalization of this definition to higher dimensions is given. For surfaces, a "Steady Vortex Metric" always exist in any given conformal class of metrics. It is an open question if the same statement holds in higher dimensions.

Mon 10:50

Games for PDEs with eigenvalues of the Hessian

Julio D. Rossi

Departamento de Matemática/FCEyN - Universidad de Buenos Aires

For a function $u : \Omega \subset \mathbb{R}^N \mapsto \mathbb{R}$, we consider the Hessian, D^2u, and its ordered eigenvalues

$$\lambda_1(D^2u) \leq ... \leq \lambda_N(D^2u).$$

Here our main concern is the Dirichlet problem for the equation

$$\lambda_j(D^2u) = 0, \tag{1}$$

and, more generally, any sum of k different eigenvalues

$$P_{i_1,...,i_k}(D^2u) := \sum_{i_1,...,i_k} \lambda_{i_j}(D^2u) = 0. \tag{2}$$

These operators appear in connection with geometry but our goal is to provide a probabilistic interpretation.

We will describe games whose values approximate viscosity solutions to these equations in the same spirit as the random walk can be used to approximate harmonic functions.

Joint work with P. Blanc (U. Buenos Aires, Argentina).

Existence results for nonlinear ellitpic equations with measure valued absorption potential

Wed 9:45

Nicolas Saintier

Departamento de Matemática/FCEyN - Universidad de Buenos Aires and IMAS-CONICET, UBA

We study the semilinear elliptic equation $-\Delta u + g(u)\sigma = \mu$ with Dirichlet boundary condition in a smooth bounded domain where σ is a nonnegative Radon measure, μ a Radon measure and g is an absorbing nonlinearity. We show that the problem is well posed if we assume that σ belongs to some Morrey class. Under this condition we give a general existence result for any bounded measure provided g satisfies a subcritical integral assumption. We study also the supercritical case when $g(r) = |r|^{q-1}r$, with $q > 1$ and μ satisfies an absolute continuity condition expressed in terms of some capacities involving σ. This is a joint work with L. Veron (Univ. Tours - France)

On a quasilinear Schrödinger-Poisson system with critical nonlinearity

Wed 16:00

Gaetano Siciliano

Instituto de Matemática e Estatística - Universidade de São Paulo

In the talk we discuss the existence of positive solutions for a quasilinear Schrödinger-Poisson system in the whole space under a critical nonlinearity. This system is obtained by coupling the Schrödinger Lagrangian with the Born-Infeld Lagrangian of the electromagnetic field and gives rise to a quasilinear equation for the electric field. It is also shown that these solutions converges to a positive solution of the "classical" Schrödinger-Poisson system whenever the Born-Infeld parameter tends to zero.

Log-Lipschitz type estimates for fully nonlinear parabolic equations

Tue 16:00

João Vitor da Silva

Departamento de Matemática/FCEyN - Universidad de Buenos Aires

In this Lecture, we discuss sharp regularity estimates for viscosity solutions of parabolic equations as follows

$$\frac{\partial u}{\partial t} - F(x,t,Du,D^2u) = f(x,t) \text{ in } \mathcal{Q}_1 = \mathcal{B}_1 \times (-1,0],$$

where F is a second order fully nonlinear (uniformly elliptic) operator with merely mensurable (under small enough oscillation) and $f \in L^{p,q}(\mathcal{Q}_1)$, i.e., an anisotropic

Lebesgue space with exponents $p, q \in [1, \infty)$ fulfilling $\frac{n}{p} + \frac{2}{q} = 1$. Under such statements, we establish local Log-Lipschitz type regularity estimates for such models, in the sense that

$$\sup_{Q_r} |u(x,t) - u(0,0)| \leq -\mathfrak{C} r \log r, \quad \forall\ 0 < r \ll 1$$

for a constant $\mathfrak{C} > 0$ depending only on dimension and structural parameters of operator. We will survey other sharp qualitative estimates if time permits.

The mathematical insights in order to prove such sharp regularity estimates are based on a refined compactness method, as well as a systematic iterative approximation procedure arising from [CKS] and [Tei]. These estimates can be found in [Theorem 4.2 and 6.1,daST] and are an extension/improvement to ones obtained in [Theorem 2 and 3,Tei] and [Theorem 7.3,CKS].

This is joint work with Eduardo V. Teixeira (University of Central Florida - USA).

References:

[CKS] M.G. Crandall; M. Kokan and A. Swiech, *L^p-theory for fully nonlinear uniformly parabolic equations*, Comm. Partial Differential Equations 25, no. 11 (2000), 1997–2053.

[daST] J.V. da Silva and E.V. Teixeira, *Sharp regularity estimates for second order fully nonlinear parabolic equations*. Math. Ann. 369 (2017), no. 3–4, 1623–1648. https://doi.org/10.1007/s00208-016-1506-y.

[Tei] E. V. Teixeira, *Universal moduli of continuity for solutions to fully nonlinear elliptic equations*. Arch. Rational Mech. Anal. 211, no 3, 911–927 (2014).

Mon 9:45

The ∞-eigenvalue problem with a sign-changing weight

Joana Terra

FaMAF - Universidad Nacional de Córdoba

We study the limit as p tends to infinity of the p-Laplacian eigenvalue problem with a sign-changing weight. We establish results concerning the limit of the first positive and negative eigenvalues as well as the limit of the associated eigenfunctions. The equation satisfied by the limiting eigenfunction is to be taken in the viscosity sense. This is a joint work with Uriel Kaufmann and Julio Rossi.

Optical solitons in nematic liquid crystals

Tue 9:00

Constanza Sanchez de la Vega
Departamento de Matemática/FCEyN - Universidad de Buenos Aires

This talk is concerned with the following $2-D$ system that couples a Schrodinger evolution equation to a nonlinear elliptic equation and models Âš the propagation of a laser beam in a nematic liquid crystal:

$$i\partial_z u + \frac{1}{2}\Delta u + u\sin(2\theta) = 0, \nu\Delta\theta - q\sin(2\theta) = -2\|u\|^2\cos(2\theta)$$

where u, and θ depend on the "optical axis" coordinate $z \in \mathbb{R}$, and the "transverse coordinates" $(x, y) \in \mathbb{R}^2$. The nonlinear elliptic equation describes the response of the director angle to the laser beam electric field. We obtain results on well-posedness and solitary wave solutions of this system, generalizing results for a well-studied simpler system with a linear elliptic equation for the director field, see [1].

Joint work with Juan Pablo Borgna, Panayotis Panayotaros, Diego Rial

References:

[1] P. Panayotaros and T. R. Marchant. Solitary waves in nematic liquid crystals. Physica D: Nonlinear Phenomena, 268:106-117, 2014.

Abstracts - Posters

H^∞-Calculus and Pseudodifferential Operators

Poster Section

Marco Eduardo Barros

Instituto de Matemática e Estatística - Universidade de São Paulo

Operator Theory provides tools for creating functions of linear operators in a natural way. In particular, a functional calculus can always be defined for a sectorial operator. When some suitable estimates hold, we say that the sectorial operator has a bounded H^∞ functional calculus. Showing that an operator has this property is a way to estabilish maximal regularity for linear evolution equations. We discuss a condition for an operator to have a bounded H^∞ functional calculus and overview the steps for the proof that a class of differential and pseudodifferential operators satisfies this condition.

Asymptotic behavior for a class of nonlocal nonautonomous problems

Poster Section

Flank D. M. Bezerra, A. L. Pereira

Departamento de Matemática - Universidade Federal da Paraíba

In this paper we consider the nonlocal nonautonomous evolution problem

$$\begin{cases} \partial_t u = -u + g\left(t, Ku\right), \text{ in}\,\Omega, \\ \qquad u = 0, \text{ in}\,\mathbb{R}\backslash\Omega. \end{cases}$$

where Ω is a smooth bounded domain in $\mathbb{R}^N$, $g : \mathbb{R} \times \mathbb{R} \to \mathbb{R}$ and K is an integral operator with a symmetric kernel. We prove existence and some regularity properties of the pullback attractor. We also show additional forward asymptotic results in the asymptotically autonomous case, using the properties of the Lyapunov functional for the limiting problem.

Key words and phrases: Pullback attractors; nonlocal diffusion equations; nonautonomous equations; evolution process.

Bibliography:

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Poster Section

Poster

Abraão Caetano Mendes

Instituto de Ciências Exatas - Universidade Federal do Amazonas

Por muito tempo procurou-se responder à questão da validade (ou não- validade) do Teorema de Peano em espaços de Banach de dimensão infinita. Mas, em 1974, Godunov mostrou que o Teorema de Peano é válido em um espaço de Banach X se, e somente se, X tem dimensão finita. Voltou-se, então, a atenção para a Forma Fraca do Teorema de Peano no caso de dimensão infinita. Em 2003, Shkarin mostrou que se X é um espaço de Banach contendo um subespaço complementado com base de Schauder incondicional, então a Forma Fraca do Teorema de Peano não é válida. Veremos este resultado ao longo desta apresentação.

Poster Section

Asymptotic behaviour of a parabolic problem with concentrated terms

Lucas Galhego Mendonça, Gleiciane da Silva Aragão

Instituto de Matemática e Estatística - Universidade de São Paulo

In this study we analyze the asymptotic behaviour of a nonlinear parabolic problem with homogeneous Neumann boundary conditions and with terms concentrating in a neighborhood of the boundary and this neighborhood shrinks to boundary when a parameter goes to zero. Under certain conditions of critical growth of the nonlinearities, sign and dissipative, we show: 1. Existence and uniqueness of solutions. 2. The solutions of concentrated problem converge in a Sobolev space to the solution of parabolic problem with nonlinear Neumann boundary conditions. 3. Existence of global attractors. 4. The family of attractors is upper semicontinuous.

Homogenization of the p-laplacian in thin domains: The unfolding approach

Poster Section

Jean Carlos Nakasato and Marcone Corrêa Pereira
Instituto de Matemática e Estatística - Universidade de São Paulo

In this work we apply the unfolding operator method to thin domains of type $R_\epsilon = \left\{(x,y) \in \mathbb{R}^2 : 0 < x < 1,\, 0 < y < \epsilon g\left(\frac{x}{\epsilon\alpha}\right)\right\}$, where $\alpha > 0$ and $g : \mathbb{R} \to \mathbb{R}$ is a L-periodic function not necessarily smooth satisfying $0 \leq g_0 \leq g(.) \leq g_1$ for some fixed non-negative constants g_0 and g_1. This approach was presented by Arrieta and Pesqueira to study the linear Neumann problem $-\Delta u + u = f$ posed in two-dimensional thin domains with an oscillatory boundary. We generalize this problem to the nonlinear p-laplacian problem $-\Delta pu + |u|^{p-2}\, u = f$ with homogeneous Neumann boundary condition, $p > 1$. As Arrieta and Pesqueira, we assume very mild hypothesis on the regularity of the oscillatory boundary to obtain the homogenized limit problem for the three different cases depending on the order of the period of the oscillations.

Pullback attractors for a class of non-autonomous thermoelastic plate systems

Poster Section

Marcelo Nascimento
Departamento de Matemática - Universidade Federal de São Carlos

In this article we study the asymptotic behavior of solutions, in the sense of pullback attractors, of the evolution system

$$\begin{cases} u_{tt} + \Delta^2 u + a(t)\Delta\theta = f(t,u), & t > \tau,\, x \in \Omega \\ \theta_t - \kappa\Delta\theta - a(t)\Delta u_t = 0, & t > \tau,\, x \in \Omega \end{cases},$$

subject to boundary conditions

$$u = \Delta u = \theta = 0,\, t > \tau,\, x \in \partial\Omega,$$

where Ω is a bounded domain in $\mathbb{R}^N$ with $N \geq 2$, which boundary $\partial\Omega$ is assumed to be a $\mathcal{C}^4$-hypersurface, $\kappa > 0$ is constant, a is an H\"older continuous function and f is a dissipative nonlinearity locally Lipschitz in the second variable. Using the theory of uniform sectorial operators, in the sense of P. Sobolevski\u{\i} (\cite{sobol}), we give a partial description of the fractional power spaces scale for the thermoelastic plate operator and we show the local and global well-posedness of this non-autonomous problem. Furthermore we prove existence and uniform boundedness of pullback attractors.

Poster Section

Eigenstructure of Laplace's operator on the equilateral triangle

Diego Sousa de Oliveira

Centro de Matemática, Computação e Cognição - Universidade Federal do ABC

This research is a study of Laplace's operator and its eigenstructure over the equilateral triangle under Dirichlet boundary condition, which one requires the annulment of the eigenfunctions on the border. The main idea is solve the corresponding partial differential equation by using a specific change of coordinates system that will allow to apply the separate variables method with the boundary condition and symmetry properties from the triangle to get the desired eigenfunctions and eigenvalues.

Poster Section

Continuous solutions for divergence-type equations associated to elliptic systems of complex vector fields

Tiago Picon

Faculdade de Filosofia, Ciência e Letras de Ribeirão Preto - Universidade de São Paulo

In this work, we characterize all the distributions $F \in \mathcal{D}'(U)$ such that there exists a continuous weak solution $v \in C(U, \mathbb{C}^n)$ (with $U \subset \Omega$) to the divergence-type equation

$$L_1^* v_1 + ... + L_n^* v_n = F,$$

where $\{L_1, \ldots, L_n\}$ is an elliptic system of linearly independent vector fields with smooth complex coefficients defined on $\Omega \subset \mathbb{R}^N$. In case where $(L_1, \ldots, L_n)$ is the usual gradient field on $\mathbb{R}^N$, we recover the classical result for the divergence equation proved by T. De Pauw and W. Pfeffer. Its proof is based on the closed range theorem and inspired by [1] and [3] in the classical case. Our method slightly differs from theirs by relying on the Banach-Grothendieck theorem and introducing tools from pseudodifferential operators, useful in our local setting of a system of complex vector fields with variable coefficients

This is a joint work with Prof. Laurent Moonens (University of Paris-Sud, Orsay).

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On an Ambrosetti-Prodi problem with coercive nonlinearity

Poster Section

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In this work we approach a semilinear elliptic problem with the Neumann condition of Ambrosetti-Prodi type

$$\begin{cases} \Delta u = g\left(x, u, \nabla u\right) + t\varphi, & \text{in } \Omega \\ \frac{\partial u}{\partial \eta} = 0, & \text{on } \partial\Omega \end{cases}.$$

The novelty is the coercivity of g.

$$\lim_{|s|\to\infty} \overline{g}\left(x, s\right) = \infty, \text{ uniformly on } \Omega,$$

where $\overline{g}$ is a function which satifies $g(x, s, p) \geq \overline{g}(x, s)$ for all $(x, s, p) \in \Omega \times \mathbb{R} \times \mathbb{R}^N$. In this context, the existence of a supersolution is not ensured anymore. We overcome this dificulty by modifying the nonlinearity and appblying the Banach's fixed-pont Theorem.

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