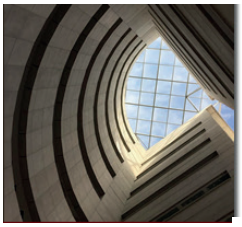

Workshop for Women in Differential Equations

UFABC - Santo André, Brazil, July 25-27
ICM 2018 Satellite Event

A SATELLITE OF

ICM 2018 RIO DE JANEIRO
INTERNATIONAL CONGRESS OF MATHEMATICIANS

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Valéria Neves D. Cavalcanti (Brazil)
Giovanna Cerami (Italy)
Mónica Clapp (Mexico)
Mimi Dai (USA)
Zuzana Dosla (Czech Republic)
Irena Lasiecka (USA)
(to be confirmed)
Helena J. Nussenzveig Lopes (Brazil)
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Susanna Terracini (Italy)
Rebecca Tyson (Canada)

- ▶ PLENARY LECTURES
- ▶ INVITED LECTURES
- ▶ POSTER SESSION

SCIENTIFIC CONTENT INCLUDES

Partial differential equations, Fluid dynamics, Transport theory, Free boundary problems, Blow-up phenomena, Controllability and variational methods, Differential equations with impulses, Boundary value problems, Fractional differential equations, Functional differential equations, Dynamical equations on time scales.

Our website: **eventos.ufabc.edu.br/wwde2018/**

For any general questions, please contact us at **wwde2018@gmail.com**

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BOOK OF ABSTRACTS

Welcome

It is a pleasure to welcome you to the Workshop for Women in Differential Equations. The main goal of this Workshop is to gather some female researchers from Brazil and abroad, with seminal contributions to the field of Differential Equations. On the contrary of what happens in other countries, only recently there has been in Brazil an attempt of promoting activities mainly concerned with gender imbalance in Mathematics. As part of an initiative that has been successfully implemented abroad, this Workshop targets at women researchers in a specific field of Mathematics.

The Workshop aims at bringing together researchers to discuss recent progress in the dynamic and rapidly growing area of Differential Equations. A wide range of topics will be addressed. These include, for instance, the following: partial differential equations, fluid dynamics, transport theory, free boundary problems, blow-up phenomena, controllability and variational methods, differential equations with impulses, boundary value problems, fractional differential equations, functional differential equations, dynamical equations on time scales, and other related topics.

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Contents

General Information

Location

The lectures will take place at Auditorium A-111-0, Building A. The registration and the coffee-break will take place at the entrance of Auditorium A-111-0, Building A.

Internet access

The University provides access to wireless internet connection via eduroam. Another option is to access the UFABC wireless network using the password 85265.

Financial support

The financial support will be available at the office 312-2 Building A, Tower 2.

Meals and refreshments

There are some restaurants nearby the campus:

Parada Obrigatória (3 minutes walking): R. Santa Adlia, 255 - Vila Sao Pedro, Santo André

Palácio do Pão (7 minutes by car): Av. Itamarati, 1001 - Vila Curuca, Santo André

Natural Jardim Restaurante (vegetarian - 7 minutes by car): R. das Monções, 480 - Jardim, Santo André

Conference Dinner

Thursday, July 7th, 8 pm, at Vivano Steak: Av. Goiás, 1135, São Caetano do Sul

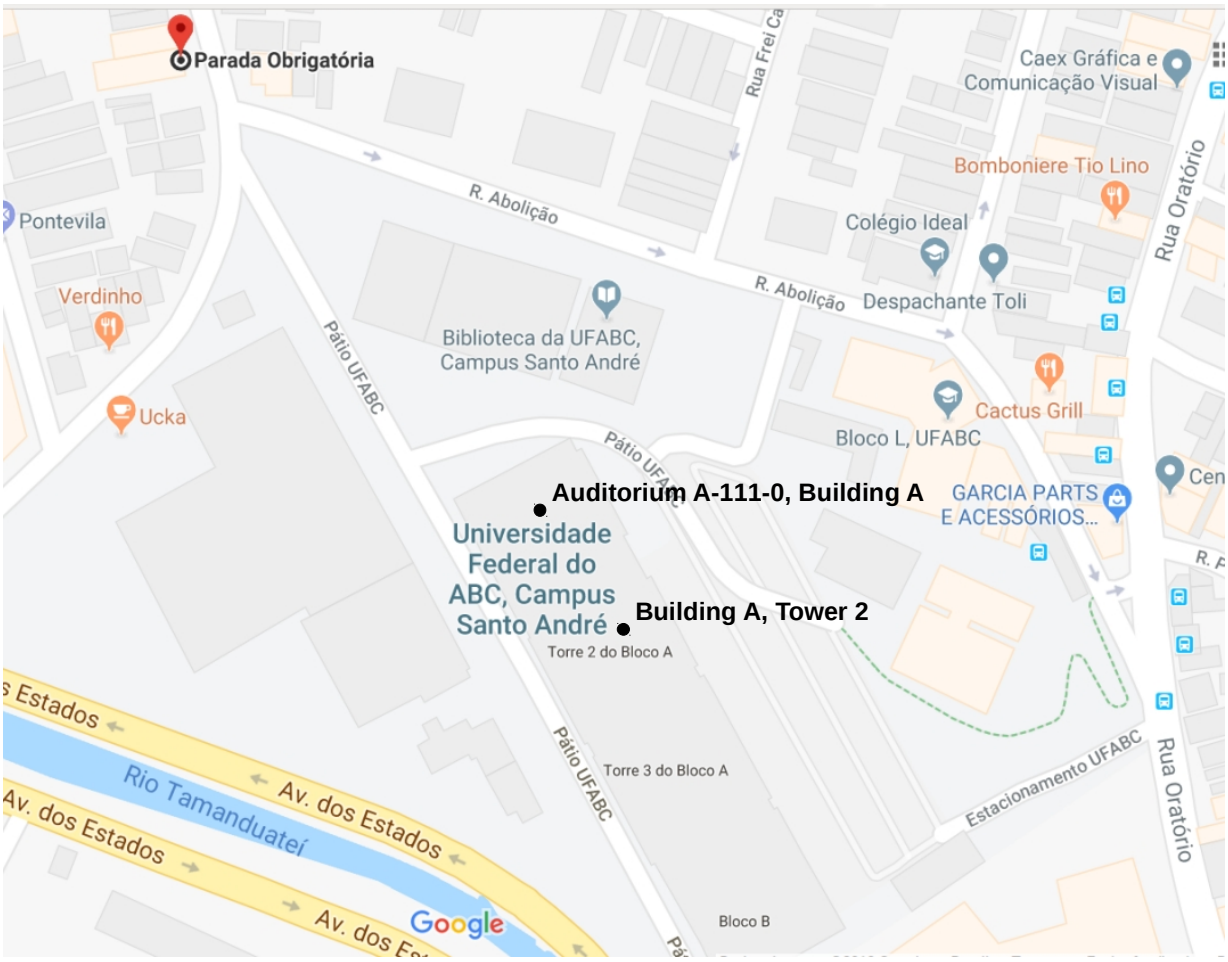
Certificates

The Certificates will be send by e-mail after the end of the Workshop.

Useful phone numbers

In case of any health emergencies call 192 (SAMU).

Police number: 190.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Program

	Wednesday (25/07)	Thursday (26/07)	Friday (27/07)
8h - 8h30	Registration		
8h30 - 9h10	Opening	Agnieszka B. Malinowska	Monica Musso
9h10 - 9h50	Anna Mazzucato	Zuzana Dosla	Luz de Teresa
9h50 - 10h20	Coffee break	Coffee break and Poster Session	Coffee break and Poster Session
10h20 - 11h	Helena Nussenzveig Lopes	Susanna Terracini	Mónica Clapp
11h - 11h40	Rebecca Tyson	Angela Pistoia	Liliane A. Maia
11h40 - 13h40	Lunch	Lunch	Lunch
13h40 - 14h20	Mayte Pérez-Llanos	Mimi Dai	Marcia Scialom
14h20 - 14h45	Cecilia F. Mondaini	Valeria Domingos Cavalcanti	Gabrielle Saller Nornberg
14h45 - 15h10	Analía Silva		Nataliia Goloshchapova
15h10 - 15h35	Priscila Leal da Silva	Robin Neumayer	Patrícia L. Cunha
15h35 - 16h05	Coffee break	Coffee break	Coffee break
16h05 - 16h30	Andréa Prokopczyk	Dora Salazar	Juliana Honda Lopes
16h30 - 16h55	Zhanna Kusnetsova	Dania González Morales	Giovana Siracusa
16h55 - 17h20	Ginnara Souto	Marta Cilene Gadotti	Rayssa Caju
17h20 - 17h45	Giane Rampasso	Amanda Angélica Feltrin Nunes	Pricila Barbosa
17h45 - 18h10	Taynara Andrade	Maria Carolina Mesquita	Thamires Santos Cruz
20h		Dinner	

Plenary Lectures

Exponential stability for the wave equation with localized memory

Valéria N. Domingos Cavalcanti
Universidade Estadual de Maringá

We discuss the asymptotic stability as well as the well-posedness of a damped wave equation subject to a locally distributed viscoelastic effect. The results have been obtained in collaboration with M. Cavalcanti, M. A. Jorge Silva and A. Y. de Souza Franco.

Existence and phase separation of solutions to a weakly coupled purely critical elliptic system

Mónica Clapp
Universidad Nacional Autónoma de México

We establish the existence of multiple fully nontrivial solutions (u, v) to the weakly coupled elliptic system

$$\begin{cases} -\Delta u = \mu_1 |u|^{2^*-2}u + \lambda\alpha |u|^{\alpha-2}|v|^{\beta}u, \\ -\Delta v = \mu_2 |v|^{2^*-2}v + \lambda\beta |u|^{\alpha}|v|^{\beta-2}v, \\ u, v \in D_0^{1,2}(\Omega), \end{cases}$$

where Ω is either a bounded smooth domain in $\mathbb{R}^N$ or the whole space $\mathbb{R}^N$, $N \geq 4$, $2^* := \frac{2N}{N-2}$ is the critical Sobolev exponent, $\alpha, \beta \in (1, 2]$, $\alpha + \beta = 2^*$, $\mu_1, \mu_2 > 0$, and $\lambda \in \mathbb{R}$.

If $\lambda = 0$ and Ω is bounded the system reduces to the well known Bahri-Coron problem and, if $\lambda = 0$ and $\Omega = \mathbb{R}^N$, it reduces to the Yamabe problem on the round sphere.

One of the solutions that we obtain is positive, and we show that it exhibits phase separation as $\lambda \to -\infty$. Moreover, when the domain is $\mathbb{R}^N$, we give a precise description of the limit domains.

This results were obtained in collaboration with Angela Pistoia (Sapienza Università di Roma) and Jorge Faya (Universidad Nacional Autónoma de México).

The existence of a global attractor for the forced critical surface quasi-geostrophic Equation in L^2

Mimi Dai
University of Illinois at Chicago

We prove that the critical surface quasi-geostrophic equation driven by a force f possesses a compact global attractor in $L^2(\mathbb{T}^2)$ provided $f \in L^p(\mathbb{T}^2)$ for some $p > 2$.

Asymptotic problems for second order differential equations

Zuzana Došlá

Brno, Czech Republic

2000 MSC: 34C10

We present some recent results in asymptotic and oscillatory theory for second order differential equations.

First, we resolve the open problem concerning the coexistence on three possible types of nononscillatory solutions (subdominant, intermediate, and dominant solutions) in the superlinear case. We study the coexistence of nonoscillatory and oscillatory solutions.

Secondly, we consider some boundary value problems on half-line. In particular, the existence of decaying globally positive solutions is examined using a fixed point approach. Some interesting similarities and discrepancies with the difference equations will be pointed out, too.

This is a joint research with Serena Matucci and Mauro Marini, University of Florence.

References

[1] Došlá Z., Marini, M.: *On super-linear Emden-Fowler type differential equations*, J. Math. Anal. Appl. **416** (2014), 497–510.

[2] Došlá Z., Marini M., Matucci S.: *A Dirichlet problem on the half-line for nonlinear equations with indefinite weight*. Ann. Mat. Pura Appl. **196** (2017), 51–64.

[3] Došlá Z., Marini M., Matucci S.: *Global Kneser solutions to nonlinear equations with indefinite weight*, to appear on DCDS-B.

Fluids, walls and vanishing viscosity

Helena J. Nussenzveig Lopes

UFRJ

The vanishing viscosity problem consists of understanding the limit, or limits, of solutions of the NavierStokes equations, with viscosity ν, as ν tends to zero. The Navier-Stokes equations are a model for real-world fluids and the parameter ν represents the ratio of friction, or resistance to shear, and inertia. Ultimately, the relevant question is whether a real-world fluid with very small viscosity can be approximated by an ideal fluid, which has no viscosity. In this talk we will be primarily concerned with the classical open problem of the vanishing viscosity limit of fluid flows in domains with boundary. We will explore the difficulty of this problem and present some known results. We conclude with a discussion of criteria for the vanishing viscosity limit to be a solution of the ideal fluid equations.

Semilinear Parabolic Equations with asymptotically linear growth

Liliane A. Maia
Universidade de Brasília

We present some recent work on the existence and behaviour of solutions of the following class of semilinear parabolic equation

$$\begin{cases} \partial_t u = \Delta u + f(u), \\ u|_{\partial\Omega} = 0, \\ u|_{t=0} = u_0(x), \end{cases} \tag{1}$$

where Ω is an open bounded smooth domain in $\mathbb{R}^N$, $N \geq 2$, and we assume that f is asymptotically linear at infinity. We analyze the behavior of the solutions when the initial data varies in the phase space $H_0^1(\Omega)$. We obtain global solutions which may be bounded or blow-up in infinite time (grow-up). Our main tools are the comparison principle and variational methods. Particular attention is paid to initial data at high energy level. We use the Nehari manifold to separate $H_0^1(\Omega)$ into regions of initial data where uniform boundedness or grow-up behavior of the semiflow may occur. This is work in collaboration with Juliana Pimentel (UFABC, Brazil).

Optimal control of the discrete-time fractional-order Cucker-Smale model

Agnieszka B. Malinowska
Bialystok University of Technology

We obtain necessary optimality conditions for the discrete-time fractionalorder Cucker-Smale optimal control problem. By using fractional order differences on the left side of nonlinear system we introduce memory effects to the considered problem.

A Hölder Infinity Laplacian obtained as limit of Orlicz Fractional Laplacians

Mayte Pérez-Llanos
Departamento de Matemática, FCEyN - Universidad de Buenos Aires and IMAS - CONICET

Given a bounded and smooth domain $\Omega \subset \mathbb{R}^N, s \in (0,1)$ and a suitable function f we consider the family of problems

$$\begin{cases} (-\Delta_{g_n})^s u_n = f & \text{in } \Omega \\ u_n = 0 & \text{on } \mathbb{R}^N \setminus \Omega, \end{cases} \tag{2}$$

where the operator $(-\Delta_g)^s$, is defined as

$$(-\Delta_g)^s u := \text{p.v.} \int_{\mathbb{R}^N} g\left(\frac{u(x)-u(y)}{|x-y|^s}\right) \frac{dy}{|x-y|^{N+s}}, \tag{3}$$

where p.v. stands for the integral *in principal value*.

The functions g_n are odd and verify that $g_n(t) = G_n'(t)$, being $\{G_n(t)\}_{n\in\mathbb{N}}$ a sequence of Orlicz functions, satisfying the growth condition $q_n^- G_n(t) \leq t g_n(t) \leq q_n^+ G_n(t)$ for any $t > 0$. For each $n \in \mathbb{N}$, the constants $q_n^\pm$ are bounded away from zero and infinity.

We call the operator specified in (3) fractional $g-$Laplacian, since with the choice

$$g\left(\frac{u(x)-u(y)}{|x-y|^s}\right)=\frac{|u(x)-u(y)|^{p-2}(u(x)-u(y))}{|x-y|^{s(p-1)}},$$

we recover the well known fractional $p-$Laplacian operator.

Our purpose is to pass to the limit as $n\to\infty$ in (2) whenever

$$q_n^-\leq\beta q_n^+,\quad q_n^\pm\to\infty \text{ as } n\to\infty.$$

As expected, we obtain the same limit problem than the one arising for the fractional p_n-Laplacian, as the sequence $p_n\to\infty$. However, the suitable framework for the operator (3) are the so call fractional order Orlicz-Sobolev spaces, which are the non homogeneous extensions of the fractional order (power type) Sobolev spaces $W^{s,p}$ with $s\in(0,1)$ and $p\geq 1$.

This is a collaborative work with Julián Fernández-Bónder and Ariel Salort, also from U. de Buenos Aires and CONICET

Optimal mixing and irregular transport by incompressible flows

Anna Mazzucato
Penn State University

I will discuss transport of passive scalars by incompressible flows (such as a die in a fluid) and measures of optimal mixing and stirring under physical constraint on the flow. In particular, I will present recent results concerning examples of flows that achieve the optimal theoretical rate in the case of flows with a prescribed bound on certain Sobolev norms of the associated velocity, such as under an energy or an enstrophy budget. These examples are related to examples of (instantaneous) loss of Sobolev regularity for solutions to linear transport equations with non-Lipschitz velocity.

Infinite-time Bubbling in the Critical Nonlinear Heat Equation

Monica Musso
PUC-Chile

In this talk I will present two results concerning construction of infinite time bubbling solutions for critical nonlinear heat equations of Fujita type.

Blowing-up solutions for Yamabe-type problems

Angela Pistoia
Sapienza - Università di Roma

In this talk, I will discuss the existence and multiplicity of blowing-up solutions for linear perturbation of Yamabe problem. I will also present some recent results concerning multiplicity of large conformal metrics with prescribed scalar curvature.

ON THE MODEL OF FIFTH ORDER KDV-BBM EQUATION "FINALLY"

J.L. Bona, X. Carvajal, M. Panthee and M. Scialom*[1]
[1]IMECC-UNICAMP

Long-crested water waves propagating shoreward are commonplace in the shallow water zone of large bodies of water. Waves of this general form are easily generated in laboratory settings as well. If a standard xyz-coordinate system is adopted in which z increases in the direction opposite to which gravity acts, such waves are often taken to propagate along the x-axis, say in the direction of increasing values, and to be independent of the y-coordinate. In this case, if dissipation and surface tension effects are ignored, the fluid assumed to be incompressible and the motion irrotational, the standard representation of the velocity field and the free surface is provided by the Euler equations for the motion of a perfect fluid with the boundary behavior at the free surface determined by the Bernoulli condition. On typical geophysical length scales, these equations provide reasonably good approximations of what is actually observed in nature. In detail, this system has the form

Key words and phrases. Nonlinear dispersive wave equations, Water wave models, KdV equation, BBM equation, Cauchy problems, local & global well-posedness

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On hierarchic control for coupled parabolic equations

Luz de Teresa
UNAM Mexico

In this conference we will discuss the problem of hierarchic control for two coupled parabolic equations. We start recalling the problem for a single heat equation and will see what happens as soon as two coupled equations are considered. We present recent results and propose open problems. This work is in collaboration with Victor Hernandez-Santamaria.

Spiralling and other solutions in limiting profiles of competition-diffusion systems

Susanna Terracini
Università di Torino

Reaction-diffusion systems with strong interaction terms appear in many multi-species physical problems as well as in population dynamics. The qualitative properties of the solutions and their limiting profiles in different regimes have been at the center of the community's attention in recent years. A prototypical example is the system of equations

$$\begin{cases} -\Delta u + a_1 u = b_1|u|^{p+q-2}u + cp|u|^{p-2}|v|^q u, \\ -\Delta v + a_2 v = b_2|v|^{p+q-2}v + cq|u|^p|v|^{q-2}v \end{cases}$$

in a domain $\Omega \subset \mathbb{R}^N$ which appears, for example, when looking for solitary wave solutions for Bose-Einstein condensates of two different hyperfine states which overlap in space. The sign of b_i reflects the interaction of the particles within each single state. If b_i is positive, the self interaction is attractive (focusing problems). The sign of c, on the other hand, reflects the interaction of particles in different states. This interaction is attractive if $c > 0$ and repulsive if $c < 0$. If the condensates repel, they eventually separate spatially giving rise to a

free boundary. Similar phenomena occurs for many species systems. As a model problem, we consider the system of stationary equations:

$$\begin{cases} -\Delta u_i = f_i(u_i) - \beta u_i \sum_{j \neq i} g_{ij}(u_j) \\ u_i > 0 \ . \end{cases}$$

The cases $g_{ij}(s) = \beta_{ij} s$ (Lotka-Volterra competitive interactions) and $g_{ij}(s) = \beta_{ij} s^2$ (gradient system for Gross-Pitaevskii energies) are of particular interest in the applications to population dynamics and theoretical physics respectively.

Phase separation and has been described in the recent literature, both physical and mathematical. Relevant connections have been established with optimal partition problems involving spectral functionals. The classification of entire solutions and the geometric aspects of phase separation are of fundamental importance as well. We intend to focus on the most recent developments of the theory in connection with problems featuring anomalous diffusions, non-local and non symmetric interactions.

Modelling the Dynamics of the Canada Lynx and Snowshoe Hare Population Cycle

Rebecca Tyson

University of British Columbia, Canada

The population cycle of the showshoe hare has been a focus of scientific interest for the past century. These populations are characterized by striking high amplitude multi-year cycles with a period of 8-11 years. For many years, the showshoe hare cycle was thought to be a classical predator-prey interaction between the hare and the lynx. Existing models have shown the importance of the predator-prey interaction, and have approximately captured many traits of the cycle. None however, have been able to simultaneously capture all of the five main cycle characteristics, namely the maximum population, minimum population, cycle amplitude and cycle period for both the lynx and hare. In particular, models generally predict minimum hare densities that are much higher than those observed in the field. Our first objective is to develop a model of the lynx-hare population dynamics that generates cycles with realistic boreal values for all five cycle probes mentioned above. We then use this model to investigate possible sources of the difference in dynamics between northern and southern hare populations: the northern populations exhibit large multiannual cycles, while the southern populations exhibit little to no cycling. In particular, we study the effect of generalist predation and of habitat fragmentation.

Invited Lectures

Controllability for a class of neutral differential equations with delay

Andréa Cristina Prokopczyk Arita*[1], Fernando Gomes de Andrade[2]
[1]Universidade Estadual Paulista, São José do Rio Preto, SP
[2] Universidade Federal do Piauí, Bom Jesus, PI

In this work we study controllability for a class of neutral control system described by the following abstract differential equations with delay

$$\frac{d}{dt}\left(x(t)+F(t)(x_t)\right)=Ax(t)+L(t)(x_t)+Bu(t),\ t\geq 0, \tag{4}$$
$$x_0=\varphi\in\mathcal{C}, \tag{5}$$

where $x(t)\in X$, $u(t)\in U$, $\forall\ t\geq 0$, X is the state space, U is the control space, both are Hilbert spaces, $r>0$, $\mathcal{C}=C([-r,0],X)$ is the space of all continuous functions from $[-r,0]$ to X, for each t, $x_t:[-r,0]\to X$ is the history of x at t, i.e. $x_t(\theta)=x(t+\theta)$ for all $\theta\in[-r,0]$, $A:D(A)\subset X\to X$ is the infinitesimal generator of an analytic semigroup of bounded linear operators on X, $X^\beta=(D((-A)^\beta),\|\cdot\|_\beta)$ for some $\beta\in(\frac{1}{2},1)$, $L:[0,\infty)\to\mathcal{L}(\mathcal{C},X)$ is a strongly continuous function, i.e. $t\mapsto L(t)\psi$ is continuous for all $\psi\in\mathcal{C}$, $B:U\to X^\beta$ is a bounded linear operator, and $F:[0,+\infty)\to\mathcal{L}(\mathcal{C},X^\beta)$, is strongly continuous and satisfies the Lipschitz condition below

$$\|(-A)^\beta F(t)(\psi_1)-(-A)^\beta F(s)(\psi_2)\|\leq C_0(|t-s|+\|\psi_1+\psi_2\|_{\mathcal{C}}),$$

for all $t,s\in[0,\tau]$, $\psi_1,\psi_2\in\mathcal{C}$ and some positive constant C_0.

Our main result presents conditions to relate the approximate controllability of (4)-(5) with the approximate controllability of the non delayed and linear system

$$x'(t)=Ax(t)+Bu(t),\ t\geq 0,$$
$$x(0)=x^0\in X.$$

References

[1] Henríquez, H.,Prokopczyk, A. *Controllability and stabilizability of linear time-varying distributed hereditary control systems.* Mathematical Methods and in the Applied Science 38, 2250-2271, 2015.

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[3] Naito, K. *Controllability of semilinear control systems dominated by the linear part.* SIAM J. Control and Optimization, vol. 25, no. 3, 715-722, 1987.

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Continuity of attractors for a family of semi linear parabolic problems in Lipschitz domains

Pricila Barbosa

UFAM

The study of existence and continuity of attractors for parabolic problems in relation to the perturbation of the domain is a subject much approached in the literature. In general, works that deals with perturbations of domain has as assumptions that the domain is smooth. In this talk we consider a family of semi-linear parabolic problems with non-linear Neumann boundary conditions, defined in Lipschitz domains. These domains are obtained considering a family of perturbations of the square that depend on a parameter ϵ, and converge to the identity in the norm C^1. Using tecniques of perturbations of the boundary and under appropriates assumptions on the problem addressed, we will prove that the associated semigroup has a global attractor and the family of attractors obtained is continuous at $\epsilon = 0$.

Asymptotic Behaviour of solutions for a coupled elliptic system in the punctured ball

Rayssa Caju

UFPB

Our main goal is to study the asymptotic behavior near an isolated singularity of local solutions for strongly coupled critical elliptic systems of the form

$$-\Delta_g u_i + \sum_{j=1}^{2} A_{ij}(x)u_j = \frac{n(n-2)}{4}|\mathcal{U}|^{\frac{4}{n-2}}u_i \tag{6}$$

which are defined in the punctured unit ball, where g a smooth Riemannian metric on $B_1^n(0)$ and A is a C^1 map from the unit ball to the vector space of symmetrical 2×2 real matrices.

Since from the viewpoint of conformal geometry our systems are pure extensions of Yamabe-type equations in the strongly coupled regime, there has been considerable interest in recent years in proving compactness results for this type of systems. Such type of problems provides a natural background for the interplay between geometry and asymptotic analysis.

We prove a sharp result on the removability of the isolated singularity for all components of the solutions when the dimension is less than or equal to five and minus the potential A of the operator is cooperative.

Joint work with João Marcos do Ó e Almir Santos.

Regularity Theory for a Nonlinear Fractional Diffusion Equation

Bruno de Andrade[1] and Thamires Santos Cruz*[2]
[1]Departamento de Matemática - UFS
[2] Departamento de Matemática - UFRPE

Fractional diffusion equations

$$u_t(t,x) = dg_\alpha * \Delta u(t,x) + r(t,x) \quad t > 0,\ x \in \mathbb{R}^n, \tag{7}$$

where $g_\alpha(t) = \frac{t^{\alpha-1}}{\Gamma(\alpha)}$, $0 < \alpha < 1$, have attracted much interest mostly due to their applications in the modeling of anomalous diffusion, since this subject involves a large variety of natural sciences such as physics, chemistry, biology, geology and their interfacial disciplines, see e.g. [1, 3, 5, 7] and the references therein. One of the main characteristics of an anomalous diffusion of this kind is the non-Markovian nature of the subdiffusive process defined by (7). Indeed, in the fractional diffusion case the mean squared displacement is given by

$$m(t) = ct^\alpha, \quad t > 0,$$

with some constant $c > 0$, which shows that the diffusion is slower than in the classical case of Brownian motion, see [5].

From the mathematical point of view, the study of these equations was initiated by Schneider and Wyss [6] and has been of interest of many researchers since then. For example, Kemppainen et al. [4] prove optimal estimates for the decay in time of solutions to a class of non-local in time linear subdiffusion equations by using estimates based on the fundamental solution and Young's inequality, see also [8]. In [2], de Andrade and Viana consider the nonlinear fractional diffusion equation

$$u_t(t,x) = \int_0^t dg_\alpha(s)\Delta u(t-s,x) + |u(t,x)|^{\rho-1}u(t,x),\ \text{in } (0,\infty)\times\mathbb{R}^n,$$
$$u(x,0) = u_0(x),\ \text{in } \mathbb{R}^n,$$

and prove a global well-posedness result for initial data $u_0 \in L^p(\mathbb{R}^n)$ in the critical case $p = \frac{\alpha n}{2}(\rho - 1)$. They also provide sufficient conditions to obtain self-similar solutions and study spatial decays to the problem.

Stimulated by these works, in this paper we study a nonlinear fractional diffusion equation. We analyze the behavior of the resolvent family associated to the problem in the scale of fractional power spaces associated to the Laplace operator. We ensure existence and uniqueness of regular mild solutions to the problem in the L^q setting. Furthermore, we consider global existence or non-continuation by blow-up of such solutions.

Keywords: Fractional diffusion equations, Regularity theory of solutions, Blow-up alternative.

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Infinitely many solutions for the Hénon-type equation in hyperbolic space

Patrícia L. Cunha (jointly with Flávio A. Lemos)

Fundação Getulio Vargas

In this article we study the existence of infinitely many solutions for the semilinear elliptic equation of Hénon-type in hyperbolic space. The problem involves logarithm weight in the Poincaré model ball with singularities on the boundary. Putting together the compactness embedding with Clark's theorem, a result of infinity solutions is established.

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Stability results for impulsive functional differential equations

Marta Cilene Gadotti

IGCE-Unesp

In nature, many evolutionary systems go through momentary abrupt changes, due to sudden phenomena in the environment. In population dynamics, these short-time phenomena include weather disasters, earthquakes, harvesting, migration of birds. As a result of these multiple applications, the theory of impulsive differential equations has emerged as an important area of investigation and in order to have more realistic models, often the past history of the systems should be taken into account-which has led to the introduction of time-delays in differential equations. In this work, we establish conditions for the existence of global solutions and for the global asymptotic and global exponential stabilities of an equilibrium point for a family of differential equations with infinitive delay and impulses.

Instability of standing waves of the NLS equation with δ'-interaction on the line

Nataliia Goloshchapova

Institute of Mathematics and Statistics, University of São Paulo

During the talk we will discuss the nonlinear Schrödinger equation with the repulsive δ'-interaction on the line (NLS-δ'). The main result is the orbital instability of the standing wave solutions to NLS-δ' with discontinuous bump-like profile in the energy space under some restrictions on the parameters of the equation. In our approach we essentially use the extension theory by Krein-von Neumann, and the analytic perturbation theory. In particular, the Perron-Frobenius property for the Schrödinger operator with the repulsive δ'-interaction on the line is established.

*This is a joint work with J. Angulo Pava (IME-USP)

Levi-Leblond equations and their symmetries

Zhanna Kuznetsova

Federal University of ABC

We investigate systems with color Lie (super) algebra symmetries. In the first part of the talk I give a brief introduction in color Lie algebras and superalgebras focusing on the Z2*Z2 particular case. In the second part I present an analysis of the symmetry operators of the Levy-Leblond equation which is a nonrelativistic wave equation of a spin 1/2 particle (nonrelativistic analog of the Dirac equation). It is shown that the equation has two kinds of symmetries. One is given by the super Schroedinger algebra and the other one by a Z2Z2 graded Lie superalgebra. The realization of the Z2*Z2 superalgebra is presented in terms of matrix differential operators.

Homogenization of Liouville equation from Stochastic Deformations

Taynara de Andrade da Costa Lima

UFRJ

In this talk, we will consider the homogenization's problem of the Liouville equations in the stochastic deformation's settings, namely the potential and initial data, defined from stochastic deformations. Under the hypothesis that, the stochastic deformation gradient is stationary (continuous and discrete cases), we will show homogenized equations, which involves both macroscopic and microscopic scales.

Well-posedness for a non-isothermal flow of two viscous incompressible fluids

Juliana Honda Lopes
Universidade Federal de So Carlos, Brazil

The dynamic interface of a mixture of two different fluids plays an important role in the hydrodynamic theory, due to the growing application in engineering. This work is concerned with a non-isothermal diffuse-interface model which describes the motion of a mixture of two viscous incompressible fluids. The model consists of modified Navier-Stokes equations coupled with a phase-field equation given by a convective Allen-Cahn equation, and energy transport equation for the temperature. More precisely, we consider the following system

$$\begin{aligned} u_t + u \cdot \nabla u - \nabla \cdot (\nu(\theta) Du) + \nabla p &= (-\epsilon \Delta \phi + F'(\phi)) \nabla \phi - \alpha \Delta \theta \nabla \theta \\ \nabla \cdot u &= 0 \\ \phi_t + u \cdot \nabla \phi &= \gamma(\epsilon \Delta \phi - F'(\phi)) \\ \theta_t + u \cdot \nabla \theta &= k \Delta \theta \end{aligned}$$

in $\Omega \times (0, \infty)$, where Ω is a bounded domain in $\mathbb{R}^n$, $n = 2, 3$, with smooth boundary $\partial\Omega$.

This model admits a dissipative energy inequality. It is investigated the well-posedness of the problem in the two and three dimensional cases without any restriction on the size of the initial data. Moreover, regular and singular potentials for the phase-field equation are considered.

Bifurcation of Solutions for Generalized ODE's via Degree Theory

Maria Carolina S. Mesquita Macena
Universidade Federal de So Carlos

We establish conditions on the existence of bifurcation points of solutions of generalized ordinary differential equations via coincidence degree theory. We also present applications to impulsive differential equations.

Analysis of a feedback-control data assimilation algorithm

Cecilia F. Mondaini
Tulane University

Forecasts of the future state of a complex physical system (e.g., the atmosphere) that are purely generated from a theoretical model are commonly affected by the limitations of the model in adequately representing reality. Data assimilation is the technique that combines the theoretical model with information from physical observations in order to obtain a better prediction of the future state of the system. In this talk, I will show some analytical results concerning a data assimilation algorithm based on feedback control. This is based on joint works with A. Biswas, C. Foias and E. Titi.

Uniform a priori L^∞ estimates for degenerate quasilinear elliptic equations

Dania González Morales

Pontifícia Universidade Católica, Rio de Janeiro Rio de Janeiro, Brasil

We obtain a priori L^∞- estimates for quasilinear elliptic problems like

$$-Qu = H(x,u) \tag{8}$$

where

$$-Q(u) := \begin{cases} (i) - \Delta_p u \ \text{ if } \ u \in W^{1,p}_{\text{loc}}(\Omega) \cap L^\infty(\bar{\Omega}) \\ (ii) - \Delta_p u + b(x)|\, Du\,|^{p-1} \ \text{ if } \ u \in W^{1,\infty}_{\text{loc}}(\Omega) \cap L^\infty(\bar{\Omega}),\ 1 < p \leq 2, \end{cases} \tag{9}$$

under some hypothesis on H.
We consider, more precisely, weak sub and super solutions of (8) in the Sobolev spaces $W^{1,p}_{\text{loc}}(\Omega)$ or $W^{1,\infty}_{\text{loc}}(\Omega)$, for $i)$ and $ii)$ respectively.
We do not need to assume that H behaves as a determinate power growth at infinity. We obtain results for sub and supersolutions independently, which can be combined into L^∞ uniform bounds. Thus we may consider not only equations but also systems of inequalities with opposite signs satisfied by different functions and containing different nonlinearities.
Our bounds have local and global nature since no condition on the whole boundary is assumed.

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TBA

Robin Neumayer

Northwestern University

On the multiplicity phenomena for fully nonlinear equations with natural growth

Gabrielle Saller Nornberg
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The study of nonlinear elliptic equations with natural dependence in the gradient had its beginning in the '80s, essentially with the works of Boccardo, Murat and Puel, and has been an active research object ever since. Until 2010 almost all results concerned existence of solutions in situations where uniqueness can also be obtained. Then multiplicity of bounded solutions related to nonlinear equations with quadratic growth in the gradient was observed by Sirakov, in a very particular case related to the Laplacian, for equations with constant coefficients.

Further improvements were done in the last years, specially by Arcoya, de Coster, Jeanjean, Sirakov, Souplet and Tanaka, in order to give a more clear picture of the set of solutions, still for the case of the Laplacian and by using tools applicable exclusively to divergence form second order operators.

In this talk, we will discuss some recent results obtained for nondivergence form equations, and even for fully nonlinear uniformly elliptic scenario, in the context of L^p-viscosity solutions. We also give a generalization of the Hölder type results of Caffarelli-Świech-Winter to our equations.

Joint work with Boyan Sirakov (PUC-Rio).

Concave-convex structure for a nonlocal and nonhomogeneous problems

Amanda Angélica Feltrin Nunes
Universidade Federal de São Carlos

In this work we establish multiplicity of solutions to some nonhomogeneous and nonlocal elliptic problems. The nonlocal term on the operator is of Kirchhoff type and it may be degenerated or not, continuous or discontinuous at the origin. The operator includes several examples appearing in the applications like p-Laplace , p&q-Laplace, generalized p-mean curvature among others. The main class of nonlinearity involved is a combination of concave and convex terms. The results to be proved assure the existence of infinitely many negative energy solutions, infinitely many positive energy solutions whose energy diverges to infinity and existence of, at least, two positive solution.

Regularity theory for a degenerate/singular fully nonlinear elliptic equation with variable exponent

Giane C. Rampasso
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The purpose of this work is to study the regularity theory of a degenerate/singular fully nonlinear elliptic equation in the non-divergence form

$$|Du|^{\theta(x)}F(D^2u) = f(x) \quad \text{in} \quad B_1, \tag{10}$$

for a (λ, Λ)-elliptic operator F and a variable exponent given by a function $\theta : B_1 \to \mathbb{R}$. Arguing through approximation techniques and a geometrical tangential analysis, we produce estimates $C^{1,\alpha}$ for the viscosity solutions to (10) with the variable exponent θ satisfying certain conditions. In fact, to produce these estimates, we relate the problem (10) with an auxiliar one for which a regularity theory is already available. This is a joint-work with A. Bronzi (Unicamp), E. Pimentel (PUC-Rio) and E. Teixeira (UCF-USA).

MULTISPIKE SOLUTIONS OF A BREZIS-NIRENBERG TYPE PROBLEM IN DIMENSION THREE

Dora Salazar

Universidad Nacional de Colombia, Sede Medellín

We consider the problem

$$\Delta u + \lambda u + u^5 = 0, \quad u > 0 \quad \text{in } \Omega,$$

in a smooth bounded domain $\Omega \subset \mathbb{R}^3$, under zero Dirichlet and Neumann boundary conditions.

For the Dirichlet problem, we find solutions exhibiting bubbling behavior at several different points of the domain as λ tends to a special value λ_0, which we characterize in terms of the Green function of $-\Delta - \lambda$. Let us recall that a solution with minimal energy for this problem exists if and only if $\lambda \in (\lambda^*, \lambda_1)$ where $\lambda^* \in (0, \lambda_1)$ is the so called Brezis-Nirenberg number and λ_1 is the first eigenvalue of $-\Delta$ in Ω with zero Dirichlet boundary condition. A precise characterization of λ^* was proved by Druet. A variant of this condition on λ can be used to describe single bubble concentration at other values of λ, as shown by Dolbeault, del Pino and Musso. The condition on λ_0 that we find for multi-bubble solutions is a non-obvious but natural generalization of the condition given by Dolbeault, del Pino and Musso for single bubble solutions.

For the Neumann problem we find also a phenomenon of simultaneous concentration at several points and find the finite dimensional function describing the location and rate of concentration.

This is a joint work with Monica Musso (University of Bath and Pontificia Universidad Católica de Chile).

OPINION FORMATION MODEL WITH HETEROGENEOUS PERSUASION AND ZEALOTRY

Analía Silva

UNSL-IMASL

Understanding the way a human population reaches an agreement on a given subject or on the opposite way, why multiple opinions survive and oppose themselves is a long standing subject in sociology. In recent years, opinion formation, have attracted a considerable attention from the physic and the mathematic community. In this talk we explain a model of opinion formation with heterogeneous agents. We assume that they have different power of persuasion, and each agent has its own level of zealotry, that is, an individual willingness to being convinced by other agent. Also, we include zealots or stubborn agents that never change opinions. We derive a Bolzmann-like equation for the distribution of agents on the space of opinions, we approximate it with a transport equation with a nonlocal drift term and we study the long-time asymptotic behavior of solutions. This is a joint work with M. Perez LLanos (UBA-IMAS), J.P. Pinasco(UBA-IMAS) and N. Saintier (UBA-IMAS).

Integrability and existence of classical solutions for a homogeneous third order evolution equation

Priscila Leal da Silva*[1] and Igor Leite Freire[2]

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Since the 1960's, there has been an increasing interest in Korteweg-de Vries (KdV) type equations

$$u_t + F(u, u_x, u_{xx}, u_{xxx}) = 0, \tag{11}$$

where F denotes a rational function on its arguments, and what today is called *integrable equations*. A KdV type equation (11) is said to be integrable if it admits an infinite hierarchy of nontrivial conservation laws, and the KdV equation

$$u_t + 6uu_x - u_{xxx} = 0 \tag{12}$$

served as a prototype for integrable equations [1, 2, 3, 4, 6].

Recently, in 2012 Sen, Ahalpara, Thyagaraja and Krishnaswami [5] introduced the singular third order equation

$$u_t + 2a\frac{u_x u_{xx}}{u} = \epsilon a u_{xxx}, \tag{13}$$

where $a, \epsilon \in \mathbb{R}$ are arbitrary parameters, and obtained

$$u(t,x) = \frac{c}{2}\text{sech}^2\left(\frac{\sqrt{c}}{2}(x - ct)\right),$$

a famous solitonic solution of the KdV equation (12), as a solution for the particular case $a = \epsilon = 1$. This solution, however, seemed to be the only common property between equations (12) and (13). More explicitly, the authors of [5] were not able to choose a and ϵ in a way to transform (13) into (12).

In this work we discuss equation (13) in terms of integrability and its consequences for solutions. We show it is possible to reduce a certain case of (13) to (12) using a Miura type transformation. With this transformation, we construct an auxiliary linear system, based on a Schrdinger operator, whose non vanishing solutions will provide solutions for (13).

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On evolutionary Volterra equations with state-dependent delay

Bruno de Andrade and Giovana Siracusa *
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In this work we study some topological properties of the solution set for a class of integro-differential equations with state-dependent delay

$$\begin{cases} u'(t) &= \int_0^t a(t-s)Au(s)ds + f\left(t, u_{\rho(t,u_t)}\right), \quad t \in [0,b], \\ u(0) &= \varphi \in \mathfrak{B}, \end{cases} \tag{14}$$

where $A : D(A) \subset X \to X$ is a closed linear operator defined on a Banach space X, the kernel $a \in L^1_{loc}((0,\infty))$ and the history $u_t : (-\infty, 0] \to X$, given by

$$u_t(\theta) = u(t+\theta),$$

belongs to some abstract phase space $\mathfrak{B}$ described axiomatically. Furthermore, $f : [0,b] \times \mathfrak{B} \to X$ and $\rho : [0,b] \times \mathfrak{B} \to (-\infty, b]$ are given functions. From the mathematical point of view, we are motivated by elegance and simplicity that evolutionary integro-differential equations of the type (14) provides to problems in mathematical physics.

As typical application of (14) we consider the problem

$$\begin{cases} u_t(t,x) = \int_0^t da(s)u_{xx}(t-s,x) + h\big(t,x,u(t-\sigma(\|u(t,x_0)\|),x)\big), \ t \geq 0, \ x \in [0,\pi], \\ u(t,0) = u(t,\pi) = 0, \quad t > 0, \\ u(t,x) = \varphi(t,x), \quad t \leq 0, \quad x \in [0,\pi], \end{cases}$$

where $x_0 \in (0,\pi)$ is fixed, $a : [0,\infty) \to (0,\infty)$ is a function of bounded variation on each compact interval $J = [0,T]$, $T > 0$, with $a(0) = 0$, and

$$\sigma : [0,\infty) \to [0,\infty)$$

is a continuous function. This type of equations has been the subject of many research papers in the last years since it has applications in such different fields as the theory of viscoelastic materials, thermodynamics, electrodynamics and population biology, cf. [1, 2, 3, 4, 5, 6, 7, 8] and references therein.

This work was partially supported by CAPES/FAPITEC under grant 88887.157386/2017-00.

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Asymptotical recursive motions and topological conjugation on impulsive system

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An impulsive system is denoted by $(X, \pi; M, I)$ and it consists of three ingredients: a continuous dynamical system on a phase space X, a nonempty closed set M in X that is called the impulsive set and a continuous function I defined in M responsible by the discontinuities of the system, called the impulse function. The continuous dynamical system governs the flow until it meets the impulsive set where the flow undergoes a change of state. The impulse function specifies how occurs the change of state and the dynamical system continues the movement after this change. The new flow constructed above governs the impulsive dynamical and we set a discontinuous dynamical systems.

In this talk, we consider recursive motions, as almost periodic motions in the context of impulsive semidynamical systems. We introduce the concept asymptotically almost periodic motions and give sufficient conditions to obtain the existence of asymptotic almost periodic motions in impulsive semidynamical systems, see [1]. We also investigate some relations between comparable points and the existence of a weak topological conjugation and application in [2].

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Poster Session

Regularity theory for fully nonlinear mean-field games systems

Pêdra D. S. Andrade
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In this poster, we examine fully nonlinear mean-field game systems. We start with a variational approach and derive our problem as the Euler-Lagrange equation associated with a minimization problem. First, we combine the regularity theory for fully nonlinear problems with the information on the double-divergence equation to produce gains of integrability/regularity for the solutions of the MFG system. We resort to former (asymptotic) results base on the geometric notion of recession operator. Second, we obtain optimal conditions on the data of the problem to establish the existence of classical solutions to the coupling (e.g., a priori estimates together with fixed-point type of arguments). This corpus of results is part of the authors PhD dissertation, produced under the direction of Professor Edgard Pimentel.

Upper semicontinuity of the pullback attractors of non-autonomous damped wave equations with terms concentrating on the boundary

Gleiciane da Silva Aragão
Universidade Federal de São Paulo

In this work we analyze the asymptotic behavior of the pullback attractors of a non-autonomous damped wave equation when some reaction terms are concentrated in a neighborhood of the boundary and this neighborhood shrinks to boundary as a parameter ε goes to zero. We prove a result of regularity of the pullback attractors and that the family of attractors is upper semicontinuous at $\varepsilon = 0$.

Spectral Theory and Applications

Juliane Carolina Baiochi Dalben
IMECC-UNICAMP

The idea of the poster is to present results that I explored during my undergraduate research. Firstly, a spectral analysis of the Laplacian operator will be made. Then the intention is to expose some applications, such as the isoperimetric problem and its relation with vibrating membranes and the best constant for the Poincar Inequality. For this, the Sobolev spaces will be briefly introduced.

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Data-driven causality investigation of environmental drivers of dengue

Caroline Franco

IFT - UNESP

In tropical countries, mosquito-born diseases such as dengue are a constant cause of concern, presenting incidence peaks acknowledgedly correlated with seasonal oscillations of environmental factors (e.g. temperature, humidity, precipitation). Though there are controlled studies relating the vector's life cycle and some environmental factors, it is still not well understood how these variables affect the dynamics of the disease cases. In this context, we aim to directly investigate which are the environmental drivers affecting dengue incidence. Seeking results more robust than the ones obtained by a traditional correlation analysis, we use the *Empirical Dynamic Modeling* framework to examine causal links between observational time-series of the dynamic variables. Preliminary results indicate a causal effect linking absolute humidity, maximum temperature and the number of cases.

Singularity formation in toy models for incompressible flow

Leonardo Epiphanio Galvão

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In this presentation, I will explore some toy models for the equations of incompressible fluid flow, in hopes of gaining insight on the possible devices for finite time singularity formation. This is achieved by examining geometric and/or analytic similarities between the models and the $3D$ Euler and Navier-Stokes equations. In doing so, I will survey through some of the classical techniques used in the theory of partial differential equations. More specifically, I deal with the well-understood CLM equation [2], alongside its proposed viscosity models [4, 3], in connection with the framework of $3D$ vortex stretching, and the equation discussed in [1], due to its similarities with the SQG equation, which itself can be viewed as a $2D$ model for the $3D$ Euler equations. These topics are part of my ongoing undergraduate research project funded by Fapesp, under the supervision of Prof. Anne Caroline Bronzi, in the process $2018/05899-5$.

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Implicit Differential Equation applied to the Study of Rarefaction Curves

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Our aim is to recover the configuration of the rarefaction curves in quadratic systems of two conservation laws. We made a classication of generic implicit differential equations

$$a(x,y,t)dy^2 + 2b(x,y,t)dxdy + c(x,y,t)dx^2 = 0,$$

near points at discriminant function $\Delta(x,y) = b^2(x,y) - a(x,y)c(x,y)$ has a Morse singularity. We describe the configuration of solution are classified according to the types of singularities. Second, we consider here a system of two conservation laws of $U_t + F(U)_x = 0$, we show that the rarefaction curves are the integral curves of the implicit differential equation

$$fv(dy)^2 + (fu - gv)dudv - gu(du)^2 = 0,$$

Combining random searches, individual's memory, and population dynamics: analysis of population redistribution patterns for the exponential and logistic cases

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The reaction-diffusion equation is one of the possible ways for modeling animal movement, where the reactive part stands for the population growth and the diffusive part for random dispersal of the population. However, a reaction-diffusion model may not represent the spatial dynamics that we aim for because of the existence of distinct mechanisms that affect the movement, like spatial memory, which results in a bias for one direction of dispersal where we construct a model using an advective term on an advection-reaction-diffusion equation. Thus, considering the effects of memory on the population spread, we propose a model composed of a coupled partial differential equation system with two equations: one for the population dynamics and the other for the memory density distribution. For the population growth, we use either the exponential or logistic growth function. The analytic approach shows that for the exponential and logistic growth the minimum traveling wave speeds are the same with or without memory dynamics in which the variation of memory is infinitesimal. From the numerical analysis, we explore how the various values of the parameters, memory, growth rate, and carrying capacity, affect the population redistribution. Combining these parameters result in a redistribution pattern of the population associated with either diffusive or superdiffusive, and implies the dispersal is faster than the diffusion.

Keywords: Animal movement, spatial memory, population dynamics, mathematical model, reaction-diffusion-advection equation, normal diffusion, anomalous diffusion, exponential growth, logistic growth.

Cosine and sine functions on time scales

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Abstract cosine and sine functions defined on a Banach space are useful tools in the study of wide classes of abstract evolution equations. In this work, we introduce a definition of cosine and sine functions on time scales, which unify the continuous, discrete and cases which are between these ones. Our definition includes several types of time scales. For instance, real numbers set, integers numbers set, quantum scales, among others. We study the relationship between the cosine function on time scales and its infinitesimal generator, proving several properties concerning it. Also, we study the sine functions on time scales, presenting their main properties. Finally, we apply our theory to study the homogeneous and inhomogeneous abstract Cauchy problem on time scales in Banach spaces.

Joint work with Jaqueline G. Mesquita (U. de Brasília) and Rodrigo Ponce (U. de Talca, Chile).

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Asymptotically Linear Indefinite Problems in $\mathbb{R}^N$ via an Abstract Linking Theorem

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An abstract linking result for Cerami sequences is proved without assum- ing a compactness condition. It is applied directly in order to prove the exis- tence of critical points for a class of indefinite problems in infinite dimensional Hilbert Spaces. The main applications are given to Hamiltonian systems and Schrdinger equations. Here spectral properties of the operators are exploited and hypotheses of monotonicity on the nonlinearities are discarded.

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Geometric regularity for elliptic equations in double-divergence form

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In this poster, we examine the regularity theory for weak solutions to the double-divergence equation

$$\frac{\partial^2}{\partial x_i \partial x_j}\left(a^{ij}(x)u(x)\right) = f(x) \quad \text{in} \quad B_1, \tag{15}$$

and produce two classes of new results. First, we show that C^{1^-}-estimates are available for solution to (15) in their zero level-sets, if $a^{i,j}$ is merely $C^{\alpha}(B_1)$. Moreover, if $a^{i,j}$ is $W^{1,p}(B_1)$, $p > d$, we show $C^{1,1^-}$-estimates for solutions to (15), in their zero level-sets. Our techniques are based on geometric and approximation methods. This corpus of results is part of the author's PhD dissertation, produced under the direction of Prof. E. Pimentel.

Dynamics and Control of the Transmission of Cutaneous Leishmaniasis

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Cutaneous leishmaniasis (CL), a vector-borne disease, classified as a Neglected Tropical Disease, is spread over four continents and it is endemic over 98 countries and territories. Between 0.7 and 1.2 million of new cases are estimated to occur each year worldwide. The disease is transmitted by Phlebotomus species in the Old World and Lutzomyia species in the New World. In this work, we present a deterministic model for the transmission dynamics of CL. The model includes three hosts, namely, an incidental host for human, a primary reservoir host for rodent, and a secondary reservoir host for sandfly. In addition to involved hosts in the dynamic transmission of the disease, we incorporated into the model the deaths due to use of insecticides and rodenticides as control measures. The model has two equilibria; one disease free equilibrium, and one endemic equilibrium. The basic reproduction number, $\mathcal{R}$, computed using the next generation operator, do not explicitly include parameters relating to the dynamic transmission in the incidental host, and it is influenceable by the control values consisting of the use of insecticides and rodenticides. The local and global stability of equilibria are established, moreover, the threshold conditions for disease persistence are completely determined by the basic reproduction number. Sensitivity analyses of $\mathcal{R}$ with respect to the model parameters were carried out. We find that the rodenticide death rate followed by insecticide death rate, are the highly sensitive parameters. Moreover, the use of rodenticides as control measure can be successful in controlling CL.

Keywords: Control Measure, Deterministic Model, Leishmaniasis, Reproduction Number, Sensitivity Analysis, Stability Analysis.

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