Workshop TO CELEBRATE 55 years OF THE SBM

SOCIEDADE BRASILEIRA DE MATEMÁTICA

Abstract Book

UNICAMP · IMECC · SBM SOCIEDADE BRASILEIRA DE MATEMÁTICA

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Campus Map

Restaurants Map

Contents

General Information

Location

The congress will take place at IMECC Auditorium at the State University of Campinas.

Wi-Fi Connection

Rede: IMECC-EVENTOS
Senha: 20Imecc24

Useful Phone Numbers

In case of any health emergencies call 192 (SAMU).
Police number: 190.
IMECC's Math department: (19) 3521-5949 / 3521-5950 / 3521-6020
Security of the State University of Campinas: (19) 3521-4608

Meals and refreshments

There are several restaurants in the vicinity. Below, we present a selection of options:

1. **Restaurante da Adunicamp**. Av. Érico Veríssimo, 1479.

2. **Restaurante da Casa do Professor Visitante**. Av. Érico Veríssimo, 1251.

3. **Cantina do Instituto de Biologia**. R. Charles Darwin, esquina com Rua Sérgio Buarque de Holanda.

4. **Cantina do Bello**. R. Sérgio Buarque de Holanda, 911.

5. **Aulus Bar e Restaurante**. Av. Professor Atílio Martini, 939.

6. **Bardana Restaurante**. Av. Dr. Romeu Tortima, 1500.

Schedule

	Monday December 02	Tuesday December 03	Wednesday December 04	Thursday December 05	Friday December 06
08:25--09:00	*Registration and Welcome*	*Registration*	Free	*Registration*	Plenary Talk 32 *José Seade*
09:00--09:35	Plenary Talk 01 *Viviane Santos*	Plenary Talk 09 *Carlos Gustavo Moreira*		Plenary Talk 24 *Barbara Nelli*	Plenary Talk 33 *Jean-Paul Brasselet*
09:35--10:10	Plenary Talk 02 *Regis Varão*	Plenary Talk 10 *Noraí Rocco*	Plenary Talk 18 *Keti Tenenblat*	Plenary Talk 25 *Niky Kamran*	Plenary Talk 34 *Antonio Luiz Pereira*
10:10--10:40	Coffee-break	Coffee-break	Coffee-break	Coffee-break	Coffee-break
10:40--11:15	Plenary Talk 03 *César Camacho*	Plenary Talk 11 *Carlos Aragão*	Plenary Talk 19 *Ana Maria Luz*	Plenary Talk 26 *Ernani Ribeiro Junior*	**Round Table 03** *"Revista do Professor de Matemática"*
11:15--11:50	Plenary Talk 04 *Claudio Landim*	Plenary Talk 12 *Walcy Santos*	Plenary Talk 20 *Abramo Hefez*	Plenary Talk 27 *Yoshiharu Kohayakawa*	Eduardo Wagner (Editor/RPM)
11:50-12:25	Plenary Talk 05 *Frank Loray*	Plenary Talk 13 *Carlos Matheus*	Plenary Talk 21 *Fred Palmeira*	Plenary Talk 28 *Paulo Dattori*	Ana Catarina (Editor/RPM) Antonio Luiz Pereira (Editor/RPM)
12:25--14:00	Lunch	Lunch	Lunch	Lunch	Lunch
14:00--15:30	**Round Table 01** *"Profmat: história e perspectivas futuras"* Carmen Mathias Ana Paula Chaves Vanderlei Horita Chair: *Walcy Santos*	Plenary Talk 14 *Maria José Pacífico (14:20–14:55)* Plenary Talk 15 *Lorenzo Diaz (14:55--15:30)*	**Round Table 02** *"Quebrando Barreiras: Gênero, Diversidade e Inclusão na Matemática"* Luciana Elias (UFG) Manuela Souza (UFBA)	Plenary Talk 29 *Gregório Pacelli Bessa (14:20–14:55)* Plenary Talk 30 *Rafael Montezuma (14:55–15:30)*	**Round Table 04** *"Conhecimento pedagógico de conteúdo"* Jorge Lira* (UFC) Marcelo Firer (Unicamp) Chair: Walcy Santos (UFRJ)
15:30--16:05	Plenary Talk 06 *Boyan Sirakov*	Coffee-break & Poster session	Plenary Talk 22 *Zaqueu Ramos*	Coffee-break & Poster session	Coffee-break & Poster session
16:05--16:30	Coffee-break		Coffee-break		
16:30--17:05	Plenary Talk 07 *Bernhard Ruf*	Plenary Talk 16 *Jorge Vitório Pereira*	Plenary Talk 23 *Maral Mostafazadehfard*	Plenary Talk 31 *Eddy Gledson*	Closing
17:05--17:40	Plenary Talk 08 *João Marcos do Ó*	Plenary Talk 17 *Ludmil Kartzakov*			
17:40-18:30	*Opening*				
19:30		Cocktail			

*Online participation

Lectures

Half-space theorems for 1-surfaces of $\mathbb{H}^3$

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Abstract

We study strong half-space theorems for the classes of complete 1-surfaces with bounded curvature, parabolic 1-surfaces, and stochastically complete H-surfaces with $H < 1$ immersed in the hyperbolic space $\mathbb{H}^3$. We also address the intersection problem for 1-surfaces immersed in a complete Riemannian three-manifold P with Ricci curvature bounded from below by -2. A splitting result is established when the distance between the 1-surfaces is realized and $\mathrm{Ric}_P \geq -2$, and a Frankel's type theorem for 1-surfaces with bounded curvature immersed in P when $\mathrm{Ric}_P > -2$.

Márcio Gomes Soares, Presidente SBM, 1993-1997

Jean-Paul Brasselet

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Abstract

Nesta apresentação relembrarei a trajetória acadêmica de Márcio Gomes Soares, tanto do ponto de vista cientfico quanto dos prêmios e homenagens e quanto de seus amigos.

Abstract

In this presentation I will remember the academic carrer of Marcio Gomes Soares, from a scientific point of view, from the awards and honors and from the friends.

The classical and semiclassical paths of Mauricio Peixoto

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Abstract

We review the latest work of Mauricio Peixoto, where his deep knowldege of geometric aspects related to solutions of differential equations, which had led him to the concept of focal decomposition, was applied to semiclassical approximations of great importance in quantum physics. We also describe his scientific trajectory and try to give a measure of the importance of his scientific legacy.

Jacob Palis, the Tireless Conjecturer

Lorenzo J. Díaz
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Abstract

I will talk about the scientific environment of dynamical systems in Rio de Janeiro between 1985 and 1999, a period of great intensity activity within the Brazilian dynamical community. During these years, various advancements emerged, initially taking different directions and with loosely connected themes. Mañé proved the stability conjecture, while Palis and Takens wrote a foundational book on homoclinic bifurcations and dimension, and strange attractors attracted attention after the results of Benedicks and Carleson. Meanwhile, Jacob was actively formulating conjectures that provided a framework for these developments, inspiring and guiding many researchers in the field of dynamics, myself included, something for which I am grateful.

Uniqueness of tangent planes at infinite and applications

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Abstract

The main goal of this talk is to prove the uniqueness of the asymptotic planes of complete translating solitons with finite genus, width, and entropy. If time allows, we will also provide some applications of this uniqueness result. This is joint work with Francisco Martin and Niels M. Moller.

References

[1] E. S. Gama, F. Martín, and N. M. Møller. Finite entropy translating solitons in slabs. Preprint arXiv:2209.01640, 2022.

[2] E. S. Gama, F. Martín, and N. M. Møller. Uniqueness of tangent planes at infinite time for collapsed self-translating solitons. To appear.

An overview on quasi-Einstein manifolds

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Abstract

It is known by the classical book "*Einstein Manifolds*" (Besse, 1984) that quasi-Einstein manifolds correspond to a base of a warped product Einstein metric. Another interesting motivation to investigate quasi-Einstein manifolds derives from the study of diffusion operators by Bakry and Emery (1985), which is linked to the theories of smooth metric measure space, static spaces and Ricci solitons.

In this talk, we discuss the geometry of quasi-Einstein manifolds. Initially, we review the motivation, some examples and classical results for this kind of manifold. Next, we present some recent classification results including contributions of researchers that work in Brazil. Finally, we discuss some open problems.

A Tribute to Keti Tenenblat's Outstanding Contributions to Differential Geometry and PDEs

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Abstract

Over the course of her distinguished research career, Keti Tenenblat has made a series of deeply influential contributions in the areas of differential geometry and PDEs. These include the discovery of the generalization to higher dimensions of the classical theorem of Bäcklund on transformations of pseudo-spherical surfaces, the introduction and the extensive study of the rich class of differential equations describing pseudo-spherical surfaces, which serves as a universal geometric model for integrable non-linear differential equations in two variables, extensions to Finsler geometry of the classical Bernstein theorems on complete minimal graphs, and much more. We will give a non-exhaustive but motivated survey of some of these remarkable achievements.

New birational invariants

Ludmil Katzarkov

Abstract

In this talk we will introduce new birational invariants. Many examples of obstruction to rationality and G rationality will be considered.

Algumas contribuições de Imre Simon

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Abstract

Imre Simon, sétimo presidente da SBM, eleito para o biênio 1981/1983, atuou em diversas frentes científicas, acadêmicas e administrativas e seu legado permeia várias comunidades e instituições. Discutiremos nesta palestra, planejada para um público matemático não-especializado, um pouco de sua trajetória, algumas de suas contribuições científicas mais acessíveis e um pouco de seu impacto no panorama atual.

Subvariedades bi-algébricas exóticas em espaços de módulos de diferenciais Abelianas

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Abstract

O trabalho recente de Bruno Klingler e Leonardo Lerer trouxe o ponto de vista bi-algébrico para o contexto dos espaços de módulos de diferenciais Abelianas com o intuito de estudar as propriedades transcendentes dos períodos desses objetos. Em particular, Klingler e Lerer provaram que toda curva bi-algébrica num espaço de módulos de gênero dois é linear e, em geral, esse ainda é o caso em gênero qualquer quando a chamada condição (*) é satisfeita. Nesta palestra, vamos discutir um trabalho em conjunto com Bertrand Deroin descrevendo curvas e superfícies bi-algébricas não-lineares em espaços de módulos de diferenciais Abelianas de gênero alto.

Min-max widths in Riemannian geometry

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Abstract

The min-max theory for the area functional is a Morse theory on the space of surfaces contained in a three-dimensional Riemannian manifold. The theory experienced remarkable developments in the past decades, and found deep applications in differential geometry. The min-max widths are invariants that naturally emerge as special critical values of the area functional. It is very interesting to compare these numbers to other geometric quantities, such as the volume and curvature bounds of the ambient manifold.

In this talk, we discuss some classification results of Riemannian manifolds involving the min-max widths of the area functional. We also discuss a new notion of width of curves, generalizing the classical one for plane curves.

Uma homenagem ao Elon

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Abstract

Vamos falar sobre o grande matemático brasileiro Elon Lages Lima, e sobre a sua importância fundamental para o desenvolvimento da Matemática no Brasil. Falaremos sobre seus brihantes trabalhos de pesquisa, que tiveram muita inuência em áreas como Topologia, Geometria e Análise, sobre seus mais de 40 livros, que tiveram um papel fundamental para a pós-graduação em Matemática no Brasil e na América Latina e seu paper central para a divulgação da Matemática e para a formação de professores de Matemática em todo o país. Também contaremos algumas histórias sobre o Elon e sobre a sua grande inuência matemática e pessoal sobre o palestrante.

Invariants of Blowup Algebras of Ladder Determinantal Ideals

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Supported by SBM.

Abstract

We calculate the regularity and a-invariant of blowup algebras derived from modules that are direct sums of two-sided ladder determinantal ideals. We establish conditions that guarantee the Gorenstein property of these blowup algebras and identify cases in which they form F-regular rings in positive characteristic. Additionally, we determine the multiplicity of these algebras. Our results also facilitate the calculation of reduction numbers for modules in this class.

This is a joint work with Alessandra Costantini, Louiza Fouli, Kriti Goel, Kuei-Nuan Lin, Haydee Lindo, Whitney Liske.

References

[1] K-N. Lin and Y.-H. Shen. *Blowup algebras of ladder or interval determinantal modules (2024).* Available at arXiv:2408.01903.

[2] A. Conca and M. Varbaro. *Square-free Gröbner degenerations.* Invent. Math. **221** (2020), 713–730.

Special Weingarten surfaces with convex boundary

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Abstract

An oriented surface Σ immersed in $\mathbb{R}^3$ is called a *Special Weingarten surface* if its principal curvatures κ_1, κ_2 satisfy a relation

$$W(\kappa_1, \kappa_2) = 0, \tag{1}$$

where $W : \mathbb{R}^2 \to \mathbb{R}$ is a function of class C^1 and

$$\frac{\partial W}{\partial \kappa_1} \frac{\partial W}{\partial \kappa_2} > 0, \tag{2}$$

holds on the subset of $\mathbb{R}^2$ given by $W^{-1}(\{0\})$. The class of Special Weingarten surfaces clearly includes surfaces with constant mean curvature and surfaces with positive Gaussian curvature. In the 1950's, A.D. Alexandrov, H. Hopf, S. Chern, P. Hartman & A. Wintner investigated closed Special Weingarten surfaces, extending results known for constant mean curvature surfaces. We aim to study the topology and geometry of Special Weingarten surfaces with convex planar boundary. This is joint work with Giuseppe Pipoli and Marcos Paulo Tassi.

Jacob Palis: O Construtor de Pontes Científicas

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Abstract

Esta apresentação abordará a contribuição fundamental de Jacob Palis para a internacionalização da ciência matemática no Brasil. Destacaremos sua incansável dedicação em conectar o Brasil com centros de excelência ao redor do mundo, promovendo parcerias internacionais, incentivando o intercâmbio de pesquisadores e atraindo a atenção global para a matemática brasileira. A atuação de Palis não só ampliou o impacto da pesquisa nacional, mas também consolidou o Brasil como um ator relevante na comunidade científica internacional, construindo um legado duradouro para as futuras gerações de matemáticos.

Singularities, Dynamics, and Algebraic Geometry

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Abstract

Márcio Gomes Soares' research on the theory of holomorphic foliations played a significant role in connecting distinct areas of mathematics: singularity theory and dynamical systems, fields that flourished in the 1970s, and algebraic geometry, one of mathematics' most classical branches. This talk will review some of Soares' foundational contributions to the theory of holomorphic foliations, which profoundly influenced modern perspectives in the field. Specifically, we will highlight his insights into three distinct problems: the algebraic leaves of generic foliations, the global behavior of Kupka singularities, and bounds on the degree of algebraic leaves.

A pesquisa de Márcio Gomes Soares sobre a teoria das folheações holomorfas desempenhou um papel decisivo na aproximação de áreas distintas da matemática: teoria das singularidades e sistemas dinâmicos, áreas que floresceram na década de 1970, e geometria algébrica, uma das mais clássicas áreas da matemática. Esta palestra revisará algumas das contribuições fundamentais de Soares, que influenciaram profundamente a teoria moderna das folheações holomorfas. Em particular, apresentaremos algumas de suas ideias sobre três problemas: folhas algébricas de folheações genéricas, comportamento global das singularidades de Kupka e cotas para o grau de folhas algébricas.

The scienic contributions of Aron Simis to mathematics in Brazil

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Abstract

The purpose of this talk is to highlight the main scientific contributions of the commutative algebraist Aron Simis to Brazilian mathematics. We will discuss about his works in commutative algebra, his role in human resource development and the creation of research groups, as well as his tenure as the director of SBM.

Tribute to Geraldo Ávila

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`Partially supported by SBM`

Abstract

In this talk we will pay tribute in memory of Geraldo Severo de Souza Ávila, who was one of the presidents of the Brazilian Mathematics Society. We will address his education, his academic and administrative life and his contributions to mathematics and to the Brazilian Mathematics Society. The talk will be presented in Portuguese.

Reflections on Three Decades of
Collaborative Research with Djairo de Figueiredo

Bernhard Ruf

Abstract

We look back on joint research over the last 30 years. Results on the following topics will be discussed:
– superlinear Sturm-Liouville equations
– elliptic equations in $\mathbb{R}^2$ with critical growth
– Trudinger-Moser inequalities
– superlinear elliptic systems in Orlicz spaces
– non-variational elliptic systems: a priori bounds and fixed point methods

References

[1] de Figueiredo, D.J., Ruf, B., *On a superlinear Sturm-Liouville equation and a related bouncing problem*, Journ. reine angew. Math. **441**, 1991

[2] de Figueiredo, D.J., Ruf, B., *On the periodic Fucik spectrum and a superlinear Sturm-Liouville equation*, Proc. Royal Soc. Edinb. **123A**, 1993

[3] de Figueiredo, D.G., Miyagaki, O.H., Ruf, B., *Elliptic equations in $\mathbb{R}^2$ with nonlinearities in the critical growth range*, Calc. Var. and PDE, **3**, 1995

[4] de Figueiredo, G., Ruf, B., *On the existence and non-existence of solutions for elliptic equations with critical growth in $\mathbb{R}^2$*, Comm. Pure Appl. Math., **48**, 1995

[5] de Figueiredo, D.G., do Ó, J.M., Ruf, B., *On an inequality by N. Trudinger and J. Moser and a related elliptic equation*, Comm. Pure Appl. Math. **55** (2002), 1-18

[6] de Figueiredo, D.G., do Ó, J.M., Ruf, B., *Critical and subcritical elliptic systems in dimension two*, Indiana University Math. J. **53** (2004),1037-1054

[7] de Figueiredo, D.G., Ruf, B., *On elliptic systems with nonlinearities of arbitrary growth*, Mediterranean J. Math. **1**, (2004), 417-431

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[10] de Figueiredo, D.G., do Ó, J.M., Ruf, B., *Non variational elliptic systems in dimension two: a priori bounds and existence of positive solutions*, J. Fixed Point Theory Appl. **4** (2008), no. 1, 77 96.

[11] de Figueiredo, D.G., do Ó, J.M., Ruf, B., *Elliptic equations and systems with critical Trudinger Moser inequalities*, Discrete Contin. Dyn. Syst. **30** (2011), no. 2, 455-476.

Indices and Residues of Holomorphic Foliations

José Seade

Abstract

The classical theorem of Poincaré-Hopf about the index of vector fields on smooth manifolds gave rise to a vast literature concerning indices of vector fields and Baum-Bott residues for singular holomorphic foliations. In this talk we will review some of the foundational aspects of this theory and glance at Marcio Soares' important contributions to the theory.

Elliptic regularity estimates with optimized constants

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Abstract

We revisit the classical theory of linear second-order uniformly elliptic equations in divergence form whose solutions have Hölder continuous gradients, and prove versions of the generalized maximum principle, the $C^{1,\alpha}$-estimate, the Hopf-Oleinik lemma, the boundary weak Harnack inequality and the differential Harnack inequality, in which the constant is optimized with respect to the norms of the coefficients of the operator and the size of the domain. Our estimates are complemented by counterexamples which show their optimality. We also give applications to the Landis conjecture and spectral estimates.

Joint work with Philippe Souplet (Université Sorbonne Paris Nord).

The legacy of Manfredo P. do Carmo

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Abstract

A brief summary of Manfredo?s academic life and his contribution to the development of Differential Geometry in Brazil will be presented.

Poster Session

Traffic flow models: pointwise and integro-differential analisys

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Abstract

When we study conservation laws, one of the first models that we see is the traffic, that is a closed highway, where over time the accumulation of vehicles leads to a traffic jam. In real-world models, it's natural to assume that our modelling is not fully precise. One way to account for this uncertainty is to introduce a probabilistic term into our equation. So we will consider that we know only the mean of the distribution, so we achieve a integro differential conservation law. Here we compare the two approaches of modelling and show your respective solutions using numerical methods and develop the analytical theory about existence and uniqueness of solution.

Global Existence in a ChemotaxisNavier-Stokes Model with Potential Consumption

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Abstract

The present work deals with a KellerSegel-NavierStokes system with potential consumption, under homogeneous boundary conditions of Neumann type for both the cell density, n, and the chemical c, and of Dirichlet type for the velocity field u, over a bounded three-dimensional domain. The cases where there is no presence of a fluid flow, or the consumption is of linear type have been dealt with. This work then handles the so far open question of whether there exist (global) solutions for this system. The solution is obtained through a semidiscretization approach and a regularization of the system, using suitable truncations. Minimal conditions for the boundary of the domain are required.

Multiple nodal solutions for a critical Choquard equation

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Abstract

In this talk, our goal is to investigate the existence of multiple nodal solutions to the following class of problems

$$left\{ \begin{array}{l} -\Delta u + V(x)u = (I_\alpha * |u|^{2^*_\alpha})|u|^{2^*_\alpha - 2}u + \lambda g(u) \quad \text{in} \quad \mathbb{R}^N; \\ u \in H^1(\mathbb{R}^N), \end{array} \right.$$

where I_α represents the Riez potential, V is a continuous potential, $N \geq 3$, $0 < \alpha < N$, $\lambda > 0$, $2^*_\alpha =$

Teoria Geométrica dos Invariantes aplicada a classificação de curvas

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Abstract

Dada uma coleção de objetos X e uma relação de equivalência, um problema de classificação visa descrever o conjunto das classes de equivalência dessa relação. Em diversas situações, esse problema pode ser interpretado a partir da ação de um grupo G sobre um conjunto X, onde dois elementos são considerados equivalentes se pertencem a mesma órbita dessa ação. Quando G e X admitem estrutura de esquema, gostaríamos que o espaço de órbitas X/G dessa ação também admitisse tal estrutura, o que em geral não acontece. Nesse trabalho, estudamos o papel da Teoria Geométrica dos Invariantes na construção de um quociente que possua estrutura de esquema, e as restrições impostas por esse método.

Cohomogeneity one hypersurfaces into symmetric spaces

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Abstract

The goal of this work is to present some classic results in the classification of hypersurfaces of cohomogeneity 1 into symmetric spaces.

Introdução à Geometria Simplética

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Abstract

Neste projeto de Iniciação Científica foi realizada uma introdução à Geometria Simplética com foco nos resultados clássicos da teoria e em desenvolvimentos recentes. Exemplo de trabalho recente é o artigo "Adjoint orbits of semisimple Lie groups and Lagrangean submanifolds", de autoria de E. Gasparim, L. Grama e San Martin, L. A. B. , em que foi demonstrada uma equivalência (a nível simplético) entre órbitas (co)adjuntas de grupos de Lie semisimples e fibrados cotangentes de variedades flag G/P_{H_0}. Inspirado nesse trabalho, como aplicação do conteúdo estudado durante o projeto foi demonstrado um caso particular do Teorema 2.1 do artigo citado anteriormente, classificando as órbitas (co)adjuntas regulares de $SL(2,)$ (equipadas com a forma de Kostant- Kirilov-Souriau) como o fibrado cotangente de S^1 (equipado com a forma canônica do fibrado cotangente).

A Contribuição do Crochê para a Geometria Hiperbólica

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Abstract

O Crochê é um tipo de artesanato confeccionado utilizando apenas linha e uma agulha com um gancho na ponta. As peças feitas com esta técnica, com os pontos sobrepostos e agrupados, a forma da contagem dos pontos, os contornos e a diversidade de peças que se pode produzir com este modo artesanal, permite uma relação intrínseca com a Matemática. Diante destas considerações, este trabalho, que é parte de uma dissertação, tem como principal objetivo apresentar de que maneira os modelos de crochê em 3D, criados em 1997 pela professora de matemática letã, Daina Taimina, podem representar, de forma menos abstrata, os conceitos da Geometria Hiperbólica, que visam facilitar o ensino e a aprendizagem desta nova geometria. Para alcançar tal feito, além do estudo das peças, foram realizadas revisões bibliográficas sobre o tema e a confecção de modelos de crochê inspirados nas peças criadas por Taimina. Nesse sentido, o estudo pretende contribuir com as pesquisas sobre o assunto, uma vez que foram encontrados poucos trabalhos acadêmicos nacionais tratando de tal tema, que apresenta substancial importância para o desenvolvimento de novas ciências.

An extension of Liebmann's Theorem

Flávio França Cruz
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Abstract

The classical Liebmann?s Theorem asserts that a compact connected convex surface in R 3 with constant mean curvature (CMC) is a totally umbilical sphere. In this work, we introduce an extension of the Liebmann?s Theorem, focusing on surfaces with boundaries. Specifically, we demonstrate that a locally convex, embedded compact connected CMC surface, bounded by a convex curve, lives in a half space of R 3 . In particular, we conclude that spherical caps are the only locally convex, embedded compact connected nonzero CMC surface bounded by a circle.

Spectrum of elliptic homogeneous differential operators in dimension n on real scales of localized Sobolev spaces

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Abstract

Main goal of this work is to study the spectum of elliptic homogeneous PDEs with constant coefficients on $H_0^{s+m}(\Omega; E) \subset H_{loc}^s(\Omega; E)$. The operator that we used as a prototype for this study is the following

$$\Delta : H_0^2(0, \pi) \subset L_{loc}^2(0, \pi) \to L_{loc}^2(0, \pi),$$

where Δ is the Laplacian and the topology on $H_0^2(0, \pi)$ is induced by $L_{loc}^2(0, \pi)$.

Fractional evolution equations at interpolation scales and applications

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Abstract

This work is dedicated to the study of linear and semilinear evolution equations with Caputo fractional derivative, and linear part governed by a sectorial operator. In the first case, we study estimates on the families of linear operators associated with the problem in abstract interpolation scales and sufficient conditions to global well-posedness and spatial regularity of mild solutions. In the semilinear situation, we study the existence and uniqueness of local mild solutions to the problem and their possible continuation to a maximal interval of existence. We also study the problem of spatial regularity and continuous dependence with respect to initial data. Finnaly, we study applications of the abstract results to diffusionwave equations and fractional plate equations.

A characterization for uniformly convex real two-dimensional Banach spaces in the sence of the Bis hop-PhelpsBollobás theorem

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Abstract

This work aims to show that a real two-dimensional Banach space X is uniformly convex if and only if the pair (X, Y) has the BPBp for every Banach space Y.

Geometric properties of disintegration of measures

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Abstract

The disintegration of a measure over a partition of the space on which it is defined is a method of rewriting this measure as a combination of probability measures, which are concentrated on the elements of the partition. There are several reasons to study such possible combinations of measures. In Ergodic Theory, for example, the disintegration of a measure is directly related to the ergodic decomposition of invariant measures, which are crucial objects encoding the asymptotic behaviour of dynamical systems. In this talk, we will explore a connection between disintegration of measures and geometric properties of probability spaces. In particular, we will address disintegration from the perspective of an optimal transport problem: by analyzing the disintegration of transport plans, we define disintegration maps, and with these objects, we will study the regularity and absolute continuity of disintegration of measures.

Generalized Stochastic Equations

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Abstract

The theory of generalized ordinary differential equations (ODEs) is known to be a very powerful theory that not only includes ordinary and functional differential equations, but also includes impulsive and measure differential equations, integral equations as well as dynamical equations on time scales as special cases. The purpose of this work is to provide a similar environment for operator-valued stochastic differential equations (SDEs).In our approach, we use a modified version of Kurzweil?s original definition of his integral by replacing full divisions by belated partial divisions. This allows us to extend the ItôHenstock integral to include a larger class of SDEs, which can contain highly oscillatory (operator valued) functions of unbounded variation.

Fluxo de Curvas Planas: Aplicações de EDPs na Geometria Diferencial

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Abstract

Estruturas geométricas no plano, em superfícies suaves e em variedades diferenciáveis, são o foco do estudo na área de Geometria Diferencial, a qual possui vastas aplicações em outros ramos da ciência. Com isso em vista, no presente projeto, foram estudados diversos conceitos fundamentais de curvas planas a fim de compreender o curve-shorteningflow (CSF), umfluxo em R2responsável por deformar uma curva fechada e simples na direção do campo normal de tal forma que essa variação seja proporcional à função curvatura.

Bundle type sub- Riemannian structures on holonomy bundles

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Abstract

In this work we estimate the Gromov-Hausdorff distance between principal G-bundles and certain reductive homogeneous G-spaces. In addition, we prove that every reduction of the structure group G to a closed connected subgroup gives rise to a sequence of Riemannian metrics on the total space for which the underlying sequence of metric spaces converges, in the Gromov- Housdorff topology, to a normal reductive homogeneous G-space.

Transitividade frequente no shift de Bernoulli

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Abstract

O projeto teve como objetivo principal o estudo do shift de Bernoulli em dois símbolos, um exemplo clássico de sistema dinâmico caótico, no sentido de Devaney. No presente trabalho, é apresentada uma interessante construção de um ponto cuja órbita sob o shift visita, com frequência positiva, todo conjunto aberto do espaço.

Limit theorems for a stochastic rumor process with multiple repetitions

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Abstract

We formulate a generalization of the Maki-Thompson model for the propagation of a rumor within a homogeneously mixing population. In the classical model, people are subdivided into three classes: "spreaders", "ignorants" and "stiflers", and the rumor is transmitted by directed contacts between spreaders and other individuals. When the contacted individual is an ignorant, he/she becomes a spreader, while in the other two cases the initiating spreader becomes a stifler. In our model, we assume that each ignorant becomes a spreader only after hearing the rumor a predetermined number of times. The motivation comes from the socalled illusion of truth effect, according to which people start to believe that dubious or false information is correct after repeated exposure to it. We establish a Law of Large Numbers and a Central Limit Theorem for the ultimate proportions of individuals in the different classes of the population. Joint work with Alejandra Rada, Cristian F. Coletti, and Pablo M. Rodriguez.

Some Hardy-Littlewood-Sobolev type inequalities and its applications

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Abstract

In this work we establish a weighted Hardy- Littlewood-Sobolev inequality with general kernels on the upper half space and study the extremal functions of the optimal constant. We also investigate the regularity, asymptotic estimates, symmetry and nonexistence results of the positive solutions of the corresponding Euler-Lagrange system. As an application, we derive some Liouville type results for the Hartree type equations on the half space. Furthermore, we present some reversed Hardy- Littlewood-Sobolev inequalities on different dimensional space. The extremal functions can be attained by the rearrangement technique, and classify all extremal functions for the critical exponent via the method of moving spheres.

A Semi-Discrete Lagrangian- Eulerian Scheme for 3D Hyperbolic Conservation Laws in Tetrahedral Grids

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Abstract

In this work we present a semidiscrete Lagrangian- Eulerian scheme for threedimensional scalar and systems of hyperbolic conservation laws in tetrahedral grids, using the novel concept of the noflow curves. This method allows us to obtain numerical solutions to the equations using only the flux function, without the need to calculate or approximate the Jacobian, eigenvalues or eigenvectors to compute the numerical flux or the stability condition. We also present preliminary results showing evidence that the scheme converges to the entropy solution for scalar hyperbolic conservation laws and hyperbolic systems, using wellknown physics models.

A Semi-Discrete Lagrangean-Eulerian Numerical Scheme for Scalar KdV and mKdV type Problems

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Abstract

In this work, we present an extended formulation of the semi-discrete Lagrangian- Eulerian numerical method for initial value problems related to KdV and mKdV type equations. This new scheme is applied to onedimensional scalar problems with a convex flux function, as in the KdV case, and a non-convex flux function, as in the mKdV case. This numerical scheme has the characteristic of obtaining numerical solutions using noflow curves, which eliminates the need for the flux function's derivative to determine the numerical flux and stability condition. We also present numerical results for some KdV and mKdV type problems, showing strong numerical evidence of the method's convergence.

Global solution and blow-up of critical heat equation with nonlocal interaction

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Abstract

We consider the nonlocal critical heat equation

$$u_t - \Delta u = \left(|x|^{-\mu} * |u|^{2^*_\mu} \right) |u|^{2^*_\mu - 2} u,$$

where $\Omega bset \mathbb{R}^N$, $N \geq 3$, $0 < \mu < N$ and $2^*_\mu = (2N - mu)/(N-2)$ is the critical exponent in the sense of the Ha rdy-Littlewood- Sobolev inequality. We discuss the existence and decay of global solutions and blowup in finite time. Moreover, the existence of unbounded global solutions is given. In addition, we study the uniform bound and asymptotic behaviour of global solutions.

Moderates and Consensus Formation in the Deffuant Model

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Abstract

Understanding the conditions for consensus formation is a pivotal topic in social, behavioral, economic, and other sciences. Opinion dynamics, particularly in the mathematical sense, provides valuable insights into this phenomenon. The Deffuant model describes consensus formation where pairs of agents interact only if their opinions differ by no more than a given threshold, leading to an approximation of their beliefs. Traditionally, this model is defined on a graph $G = (\mathbb{Z}, E)$ with $E = \{(x, x+1) : x \in \mathbb{Z}\}$ and initial opinions uniformly distributed on the unit interval. In our research, we extend the model to $\mathbb{Z}^2$ and explore various initial distributions to assess the role of moderates — agents with opinions inside the opinion spectrum —and extremists in achieving consensus. We aim to determine the critical quantity of moderates necessary for consensus formation. Numerical evidence suggests that in populations with a high tolerance to interact, even a small number of moderates can significantly impact the speed of achieving agreement.

Lipschitz Geometry of Mixed Pham-Brieskorn Singularities and Surfaces

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Abstract

We give conditions for topological and bi-Lipschitz equivalences within a class of mixed singularities of Pham-Brieskorn type. We then derive the construction of topologically trivial infinite families with distinct bi-Lipschitz types. We also investigate the same problem applied to the mixed surfaces defined by these singularities in the two complex variables case and deduce conditions for inner, outer, and ambient bi-Lipschitz equivalences.

Henstock Kurzweil Integral and Applications

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Abstract

In this work, we will investigate the development of some types of integral, such as Henstock-Kurzweil: A function $f : I \to \mathbb{R}^n$ is said to be êxtitHenstock-Kurz weil-Integrable on I if there exists a vector $B \in \mathbb{R}^n$ such that for every $\epsilon > 0$, there exists a gauge γ_ϵ on I such that if $\dot{P} := (I_i, t_i)_{i=1}^n$ is any tagged partition of I such that $l(I_i) < \gamma_\epsilon(t_i)$ for $i = 1, ..., n$, then

$$||S(f; \dot{P})B|| \leq \epsilon$$

The model proposed by Henstock started from the investigation of an integration process with the objective of reconstructing a derived function, and is responsible for covering a broader class of functions than those present in the Riemann and Lebesgue models, without the need to work with measure theory, as for Lebesgue Integrable functions. At the same time, but completely independent, Jaroslav Kurzweil introduced in 1957 an equivalent concept of integration to investigate continuous dependence results This type of integration naturally pays more attention to the tags than the more traditional integration concept, so, the definition is constructed by allowing the $ma_\epsilon > 0$, used in the definition of the Riemann integral, be any positive function, this allows a wider class of functions to be integrable. Using this type of integral it is possible to study many important problems in physics with highly oscillating behaviour such as Kapitza's pendulum.