Brazil-China Joint Mathematical Meeting

Foz do Iguaçu - PR -Brazil

July 17th - 21st

2023

Organizers

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Brazil-China Joint Mathematical Meeting
Foz do Iguaçu, Brazil
July 17th to 21st, 2023

https://sbm.org.br/jointmeeting-china/

Event schedule

BRAZIL ROOM

	Mon	Tue	Wed	Thu	Fri
07h30-08h30	Registration				
08h30-09h20	Opening ceremony	P2	D1	P5	P7
09h20-10h10	P1	P3	D2	P6	P8
10h10-10h40	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
10h40-12h30	S12	S12	D3	S1	C3
12h30-14h	Lunch	Lunch	Free time	Lunch	Lunch
14h-15h50	S8	S13		S1	S4
15h50-16h40	Coffee break & Poster session	Coffee break & Poster session		Coffee break & Poster session	P4
16h40-18h30	S6	S6		S6	Closing session
19h	Coquetel				
20h		Conference dinner			

PARAGUAY ROOM

	Mon	Tue	Wed	Thu	Fri
08h30-09h20	*********	*********	*******	*********	*********
09h20-10h10	*********	*********	*******	*********	*********
10h10-10h40	Coffee break	Coffee break	*******	Coffee break	Coffee break
10h40-12h30	S8	S8	*******	S13	S5
12h30-14h	Lunch	Lunch	Free time	Lunch	Lunch
14h-15h50	S7	S7		S5	C4
15h50-16h40	Coffee break & Poster session	Coffee break & Poster session		Coffee break & Poster session	S12
16h40-18h30	S7	S13		S5	*********

ARGENTINA ROOM

	Mon	Tue	Wed	Thu	Fri
08h30-09h20	*********	*********	*******	*********	*********
09h20-10h10	*********	*********	*******	*********	*********
10h10-10h40	Coffee break	Coffee break	*******	Coffee break	Coffee break
10h40-12h30	C1	S10	*******	S4	S9
12h30-14h	Lunch	Lunch	Free time	Lunch	Lunch
14h-15h50	S2	S10		S4	S9
15h50-16h40	Coffee break & Poster session	Coffee break & Poster session		Coffee break & Poster session	*********
16h40-18h30	C2	S11		S9	*********

Opening ceremony

Monday, 17th, 8:30am, Brazil Room

Diana Araujo Pereira
UNILA Rector

Márcia Barbosa
Secretary of Strategic Policies and Programs at MCTI

Gang Tian
President of the Chinese Mathematical Society

Paolo Piccione
President of the Brazilian Mathematical Society

Pablo Rodriguez
President of the Brazilian Society for Computational and Applied Mathematics

Jinyun Yuan
Organizing Committee

Lu Ping
Advisor for Scientific Technology Affairs at the Chinese Embassy

Plenary speakers

P1. Robert David Morris (IMPA)
Monday, 17th, 9:20am, Brazil Room *Chair: Jaqueline Mesquita (UnB)*

Title: An exponential improvement for diagonal Ramsey

Abstract: The Ramsey number $R(k)$ is the minimum n such that every red-blue colouring of the edges of the complete graph on n vertices contains a monochromatic clique on k vertices. It has been known that $2^{k/2} < R(k) < 4^k$ since the work of Erdos and Szekeres in 1935 and Erdos in 1947, but in the decades since the only improvements have been by lower order terms. In this talk I will describe a recent improvement of the upper bound of Erdos and Szekeres by a (small) exponential factor.

Based on joint work with Marcelo Campos, Simon Griffiths and Julian Sahasrabudhe.

P2. Xin Liu (Chinese Academy of Sciences)
Tuesday, 18th, 8:30am, Brazil Room *Chair: Pablo Rodríguez (UFPE)*

Title: Constraint Dissolving Approaches for a Class of Riemannian Optimization Problems

Abstract: We propose constraint dissolving approaches for optimization problems over a class of Riemannian manifolds. In these proposed approaches, solving a Riemannian optimization problem is transferred into the unconstrained minimization of a constraint dissolving function named CDF. Different from existing exact penalty functions, the exact gradient and Hessian of CDF are easy to compute. We study the theoretical properties of CDF and prove that the original problem and CDF have the same first-order and second-order stationary points, local minimizers, and Lojasiewicz exponents in a neighborhood of the feasible region. Remarkably, the convergence properties of our proposed constraint dissolving approaches can be directly inherited from the existing rich results in unconstrained optimization. Therefore, the proposed constraint dissolving approaches build up short cuts from unconstrained optimization to Riemannian optimization. Several illustrative examples further demonstrate the potential of the proposed approaches.

P3. Claudia Sagastizábal (University of Campinas (UNICAMP))
Tuesday, 18th, 9:20am, Brazil Room *Chair: Pablo Rodríguez (UFPE)*

Title: A nonsmooth optimization view of operator splitting methods

Abstract: Splitting methods are used in many areas of Mathematics. The technique turns out to be particularly useful for solving large-scale problems related to optimization, numerical analysis, computational mechanics and image processing. The basic idea follows the adagio "divide to conquer", substituting the original problem for a sequence of simpler problems, solved in parallel and coordinated by a proximal-like step. We shall discuss in detail a family of splitting methods, the Douglas-Rachford decomposition. The family includes the alternating direction method of multipliers (ADMM), popular in applications of statistical learning and distributed optimization. Thanks to a primal-dual approach adopted for the development, using tools of Variational and Convex Analysis, we extend the theory and applicability to these methods to a nonconvex setting. A Bundle Progressive Hedging algorithm, derived from the general theory, illustrates the interest of the approach for multistage stochastic programs.

P4. Weixiao Shen (Fudan University)
Friday, 21st, 3:50pm, Brazil Room *Chair: Carlos Gustavo Moreira (IMPA)*

Title: One-dimensional linear skew-products over circle expanding maps

Abstract: We study one-dimensional linear skew-products over circle expanding maps. We will briefly introduce the history of research in this direction. We will mainly discuss a recent transversality result and its application on ergodic optimization and the Hausdorff dimension problem of Weierstrass graphs. This is based on joint works with Rui Gao and with Haojie Ren.

P5. Jaqueline Godoy Mesquita (University of Brasília (UnB) and Brazilian Academy of Sciences (ABC))
Thursday, 20th, 8:30am, Brazil Room Chair: Everaldo Bonotto

Title: Results on functional differential equations with state-dependent delays and applications

Abstract: In this talk, I will present results concerning the existence and uniqueness of solutions for functional differential equations with state-dependent delays and present some applications. Also, I will discuss the neutral FDEs with state-dependent delays, presenting a linearized instability principle for these equations. This talk is based on the works [1] and [2].

References:

[1] H. Henríquez, J. G. Mesquita, H. C. dos Reis, Existence results for abstract functional differential equations with in nite state-dependent delay and applications, Mathematische Annalen, 2023, to appear.

[2] B. Lani-Wayda, J. G. Mesquita, Linearized Instability Principle for neutral FDEs with state-dependent delays, submitted.

P6. Jian Ding (Peking University)
Thursday, 20th, 9:20am, Brazil Room Chair: Everaldo Bonotto

Title: Recent progress on random field Ising model

Abstract: Random field Ising model is a canonical example to study the effect of disorder on long range order. In 70's, Imry-Ma predicted that in the presence of weak disorder, the long range order persists at low temperatures in three dimensions and above but disappears in two dimensions. In this talk, I will review mathematical development surrounding this prediction, and in particular I will describe the following recent works: (1) exponential decay (joint with Jiaming Xia) and correlation length (with Mateo Wirth) in two dimensions; (2) A new and simple proof for long range order in three dimensions at very low temperature (with Zijie Zhuang) and an extension of this to the entire low temperature regime (with Yu Liu and Aoteng Xia); (3) a recent general inequality for the Ising model (with Jian Song and Rongfeng Sun) with applications for random field Ising model and beyond.

P7. Milton Jara (Institute for Pure and Applied Mathematics (IMPA))

Friday, 21st, 8:30am, Brazil Room Chair: Maria Eulália Vares (Federal University of Rio de Janeiro)

Title: Quantitative methods in Markov chains

Abstract: We will show how to use entropy and martingales to derive quantitative versions of law of large numbers and central limit theorems for observables (a.k.a Birkhoff sums) of Markov chains. Our main application is a detailed description of non-equilibrium steady states of driven-diffusive systems. Joint work with Patricia Gonçalves (Lisbon), Rodrigo Marinho (Santa Marta) and Otávio Menezes (Salvador).

P8. Zhenlei Zhang (Capital Normal University)
Friday, 21st, 9:20am, Brazil Room Chair: Maria Eulália Vares (Federal University of Rio de Janeiro)

Title: Limit of Kahler-Ricci Flow

Abstract: Tian and Song-Tian proposed an analytic program to the minimal model program via Ricci flow. In many aspects the program describes the

limiting behavior of a Kahler-Ricci flow. In the talk I will survey the progress on this subject.

Distinguised Lectures

D1. Gang Tian (Chinese Mathematical Society)
Wednesday, 19th, 8:30am, Brazil Room *Chair: Paolo Piccione*

Title: Some progress on Ricci flow

D2. Efim Zelmanov (SUSTech University)
Wednesday, 19th, 9:20am, Brazil Room *Chair: Paolo Piccione*

Title: On Growth of Algebras

D3. Jinyun Yuan (Dongguan University of Technology)
Wednesday, 19th, 10:40am, Brazil Room *Chair: Paolo Piccione*

Title: China-Brazil cooperation.

Thematic sessions

S1. Recent results in nonlinear PDEs and applications

Organizers:
Alessio Fiscella (Università degli Studi di Milano-Bicocca)
Binlin Zhang (Shandong University of Science and Technology)

Thursday, 20th, 10:40am; Brazil Room

1. Marcos Tadeu Oliveira Pimenta (Universidade Estadual Paulista, Brazil)

   Title: On a quasilinear elliptic problem involving the 1-laplacian operator and a discontinuous nonlinearity

   Abstract: In this work, we study a quasilinear elliptic problem involving the 1-laplacian operator, with a discontinuous, superlinear and subcritical nonlinearity involving the Heaviside function $H(\cdot - \beta)$. Our approach is based on an analysis of the associated p-laplacian problem, followed by a thorough analysis of the asymptotic behavior or such solutions as $p \to 1^+$. We study also the asymptotic behavior of the solutions, as $\beta \to 0^+$ and we prove that it converges to a solution of the original problem, without the discontinuity in the nonlinearity.

2. Binlin Zhang (Shandong University of Science and Technology)

   Title: On a critical and singular Kirchhoff-type elliptic equation

   Abstract: In this talk, we discuss a three-dimensional Kirchhoff-type elliptic equation involving critical and singular nonlinearities. By combining variational methods with some delicate decomposition techniques, we obtain the existence of two positive solutions in the case of low perturbations of the singular nonlinearity, namely for small values of the parameter. Here we point out that our decomposition techniques could be applied to more elliptic equations with critical growth. This is a joint work with Chunyu Lei and Vicentiu D. Rădulescu.

3. Kaye Oliveira da Silva (Universidade Federal de Goiás, Brazil)

   Title: Non-compact perturbations of coercive functionals and applications

Abstract: We deal with parametrized problems of the following type:

$$\begin{cases} K'(u) - J'(u) - \lambda\Phi'(u) = 0, \\ u \in X, \end{cases}$$

where X is a Hilbert space $K, J, \Phi \in C^1(X), -J - \lambda\Phi$ is a "non-compact" perturbation of the coercive functional K, λ is a positive parameter. Combining variational properties of the energy functional with a careful analysis of its fibers, we will prove existence and multiplicity of solutions. In particular, we will consider the case when K is a Kirchhoff type operator, J is a critical term, and Φ a subcritical perturbation.

Thursday, 20th, 2:00am; Brazil Room

4. Valéria Neves Domingos Cavalcanti (Universidade Estadual de Maringá)

   Title: The viscoelastic wave equation: well-posedness and asymptotic behaviour

   Abstract: We present the well-posedness as well as the asymptotic behaviour of the energy functional related to the viscoelastic wave equation with past history and nonlinear source and damping terms.

5. Zhisu Liu (China University of Geoscience, China)

   Title: Nonlocal planar Schrödinger-Poisson systems in the fractional Sobolev limiting case

   Abstract: In this talk, we introduce the nonlinear Schrödinger equation for the s-fractional p-Laplacian strongly coupled with the Poisson equation in dimension two and with $p = 2/s$, which is the limiting case for the embedding of the fractional Sobolev space. We prove existence of solutions by means of a variational approximating procedure for an auxiliary Choquard equation in which the uniformly approximated sign-changing logarithmic kernel competes with the exponential nonlinearity. Qualitative properties of solutions such as symmetry and decay are also established by exploiting a suitable moving planes technique. This is a joint work with Daniele Cassani and Giulio Romani (Uninsubria, RISM).

6. Marcelo Moreira Cavalcanti (Universidade Estadual de Maringa)

   Title: Exponential decay for the quintic wave equation with locally distributed damping

Abstract: We study the stabilization and the wellposedness of solutions of the quintic wave equation with locally distributed damping. The novelty of this talk is that we deal with the difficulty that the main equation does not have good nonlinear structure amenable to a direct proof of a priori bounds and a desirable observability inequality. It is well known that observability inequalities play a critical role in characterizing the long time behaviour of solutions of evolution equations, which is the main goal of this study. In order to address this, we approximate weak solutions for regular solutions for which it is possible to obtain a priori bounds and prove the essential observability inequality. The treatment of these approximate solutions is still a challenging task and requires the use of Strichartz estimates and some microlocal analysis tools such as microlocal defect measures.

7. Alessio Fiscella (Università degli Studi di Milano-Bicocca)

Title: Critical double phase problems

Abstract: In the last years, the interest toward operators with nonstandard growth has grown more and more, as nicely explained in the special issue [G. Mingione, V. Rădulescu, J. Math. Anal. Appl. (2021)]. Here, we discuss about recent results for critical elliptic problems driven by the so-called double phase operator, given by

$$\operatorname{div}\left(|\nabla u|^{p-2}u + a(x)|\nabla u|^{q-2}u\right) \quad \text{for } u \in W^{1,\mathcal{H}}(\Omega),$$

set on an appropriate Musielak-Orlicz Sobolev space $W^{1,\mathcal{H}}(\Omega)$, with

$$1 < p < q < \infty \text{ and } a \in L^{\infty}(\Omega) \text{ such that } a(x) \geq 0 \text{ a.e. in } \Omega.$$

Indeed, the elliptic behavior of this operator changes according to the sets on which the weight function a vanishes or not.

Our problems present some difficulties due to the presence of singularities and the lack of compactness of critical Sobolev embeddings for $W^{1,\mathcal{H}}(\Omega)$. Under suitable assumptions for weight a, exponents p and q, we are able to provide the existence and multiplicity of solutions for our problems, by applying different variational approaches. After retracing the path followed in my papers in collaboration with R. Arora (Indian Institute of Technology Varanasi), C. Farkas (Sapientia Hungarian University of Transylvania), P. Winkert (Technische Universität Berlin) and T. Mukherjee (Indian Institute of Technology Jodhpur), we conclude the talk presenting some open questions.

S2. Mathematical Aspects of Synthetic Aperture Radar Image Analysis
Monday, 19th, 2:00pm; Argentina Room

Organizers:
Anderson Adaime de Borba (Universidade Presbiteriana Mackenzie)
Rogerio Galante Negri (UNESP)

Speakers:

1. Timo Balz and Shuyi Yao (State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University, China)

   Title: Estimating the nature of scattering in SAR interferometry based on the stochastic properties of SAR time-series

   Abstract: SAR interferometry is a remote sensing tool for earth observation that can obtain large-scale and high-precision surface parameters, mainly in terms of elevation and deformation. The processing of interferometry includes many elements of applied mathematics. Interferometry requires the difference in the optical path of electromagnetic waves in at least two different time phases to model and infer the individual contributions associated with that difference. Interferometry uses the microwave portion of the electromagnetic spectrum, most commonly X-band, C-band and L-band, which are waves containing only a single frequency. The amplitude and phase (or phase difference) of an electromagnetic wave are the main physical quantities dealt with in interferometry, and these two physical quantities can be conveniently expressed together in complex numbers - the amplitude corresponds to the modulus of the complex number, and the phase corresponds to the argument, which can be converted to the form of the real and imaginary parts if the Euler formula is applied. Therefore, many mathematical operations for interferometry are performed in the complex number domain.

   It is not easy to obtain the desired information from the optical path difference, because this optical path difference may be caused by a combination of many different factors. In addition to deformation and elevation, the main ones include atmospheric delay differences, the position in range direction, and the disturbance of scatterer phase which is the most notorious - the first ones are deterministic and can be removed relatively well with a good functional model. The last one is mainly due to the fact that satellites cannot guarantee that the target will be observed from exactly the same angle every time, nor that the nature of the target will not change. Phase changes due to such disturbances do not have a functional model and are therefore considered to be random variables, thus the statistical theory in mathematics is required.

Within a SAR resolution cell, there may be different kinds of scatterers. The echoes received by a resolution cell are a coherent sum of all scatterer echoes within the cell, which can be described by the addition of complex numbers. For example, those scatterers with stable reflection characteristics and strong echoes are called dominant scatterers, and the echoes of such scatterers can be considered as deterministic. The echoes of other small scatterers combined are often not deterministic, but are prone to random variations. In order to mathematically deal with electromagnetic waves in the real-world with such random characteristics, it is necessary to assume a certain probability distribution. If the number of small scatterers is large enough, the part of

the echo will be describable using a complex circular Gaussian (CCG) distribution. If the echoes of the dominant scatterer are added, their amplitudes will follow the Rice distribution. The strength of the dominant scatterer is the main basis for distinguishing between point scatterers and DSs. The larger the component of the dominant scatterer in the echo, the closer the pixel is to the point-wise scatterer, and the closer the echo amplitude is to the normal distribution. The smaller the component of the dominant scatterer in the echo, the closer the pixel is to the distributed scatterer (DS), the closer the echo is to the CCG distribution, and the amplitude follows the Rayleigh distribution.

Point-wise scatterers are more stable and less disturbed, so they are easier to handle. The focus is on DSs. Due to its unstable nature, it is usually needed to average adjacent pixels to improve the signal-to-noise ratio. Assuming that the samples are from the same distribution, the phase variance will decrease as the number of samples increases by a factor close to the inverse of the number of samples. In the processing of time-series InSAR for DSs, a twosample statistical test is often used to determine whether two sequences come from the same distribution. Elements in an echo sequence from the same pixel are correlated with each other and are generally regarded as a random vector. Echoes of different pixels are considered as independent samples because they come from different targets. The stochastic properties of the random vectors following the CCG distribution can be represented by their complex covariance matrices. And the so-called coherence matrix in InSAR processing is in fact the complex correlation coefficient matrix, which is often used instead of the complex covariance matrix to describe the stochastic properties of a DS. With the information of these stochastic properties, we can estimate the required information using methods such as maximum likelihood estimation. The CCG distribution is most commonly used in DS processing. In recent years, as the resolution of SAR data increases, the number of small scatterers contained in the resolution cell in the case of DS becomes limited, deviating to some extent from the CCG distribution. The amplitude distribution of high-resolution data is often characterized by long-tailed and peaky. Common distributions used to fit high-resolution SAR data include

the K distribution, the Weibull distribution, and the log-normal distribution.

2. Peng Ren and Shaopeng Wei (College of Oceanography and Space Informatics, China University of Petroleum (East China))

   Title: Interrupted Sampling Repeatted Jamming Cancelling Using Dictionary Learning for SAR Imagery.

   Abstract: In electromagnetic countermeasures circumstances, synthetic aperture radar (SAR) imagery usually suffers severe quality degradation from modulated interrupt sampling jamming (MISRJ), which usually owes considerable coherence with the SAR transmission waveform together with periodical modulation patterns. This presentation gives a MISRJ suppression algorithm for SAR imagery with online dictionary learning. In the algorithm, the jamming modulation temporal properties are exploited with extracting and sorting MISRJ slices using fast-time autocorrelation. Online dictionary learning is followed to separate real signals from jamming slices. Under the learned representation, time-varying MISRJs are suppressed effectively.

3. Anderson Adaime de Borba (Universidade Presbiteriana Mackenzie (UPM) - Faculdade de Computação e Informática)

   Title: Information Fusion to PolSAR Images.

   Abstract: Polarimetric Synthetic Aperture Radar (PolSAR) sensors have reached an essential position in remote sensing. The images they provide have speckle noise, making their processing and analysis challenging tasks. In this context, the investigation of edge evidence fusion methods is essential to quantify and qualify the information obtained from each image channel. Getting this data enables the decision to use or discard the information from a given channel to improve the performance of edge detection. We discuss an edge detection method based on the fusion of evidences obtained in the intensity channels hh, hv, and vv of PolSAR multi-look images. The method to detect evidence of edges in each channel consists of detecting transition points in the thinnest possible range of data that covers two regions using maximum likelihood under the Wishart distribution. The methods of fusion of the information coming from each channel used are: simple average, multi-resolution discrete wavelet transform (MR-DWT), principal component analysis (PCA), Receiver operating characteristic (ROC) statistics, multi-resolution stationary (MR-SWT) wavelet transform, and a multi-resolution method based on singular value decomposition (MR-SVD). The six fusion methods were compared quantitatively e qualitatively, respectively, calculating the distance of the detected edges

to the edges defined in the Ground Reference images and by the presence of outliers. The results obtained with the analyses suggest that the PCA and MR-SVD methods provide the best results due to the precision in detecting edges and the low incidence of outliers.

S4. Dynamical Systems: Qualitative and Bifurcation Theory

Organizers:
Regilene Delazari dos Santos Oliveira (ICMC/USP)
Jackson Itikawa (Universidade Federal de Rondônia)

Thursday, 20th, 10:40pm; Argentina Room

1. Yulin Zhao (Sun Yat-sen University)

   Title: On the number of limit cycles in smooth and piecewise smooth generalized Abel equations

   Abstract: In this talk, we first briefly introduce some concepts related to smooth and piecewise smooth generalized Abel equations, and their limit cycles, Poincar'e map, and the relationship with the planar differential systems. Then, we introduce some important results in this field, especially about the maximum number of limit cycles which system can have.

2. Luis Fernando De Osorio Mello (Universidade Federal de Itajubá)

   Title: Global centers of the Kukles systems of degree three on the plane

   Abstract: A global center of a vector field on the plane is an equilibrium point having the whole plane filled of periodic orbits, except the equilibrium point itself. The characterization of vector fields on the plane with global centers is of great importance in the Qualitative Theory of Differential Equations. The classification of the Kukles systems of degree three having global centers will be presented in this talk. This is a joint work with F.S. Dias and C. Valls.

3. Dahisy Valadão de Souza Lima (Universidade Federal do ABC)

   Title: Algebraic-Topological Methods in Dynamical Systems

   Abstract: Algebraic-topological methods provide powerful tools for analyzing the behavior of dynamical systems, by studying the structure of the spaces upon which they operate. This talk focuses on the challenge of obtaining dynamical information concerning invariant sets, as well as the connections between them through the implementation of homological tools and covering actions. Furthermore, we also discuss some applications of these methods in the study of a specific dynamical system, namely the gradient flows associated to circle value Morse functions.

Thursday, 20th, 2:00pm; Argentina Room

4. Tang Yilei (Shanghai Jiao Tong University)

   Title: Limit cycles and global dynamics of Li'enard systems with Z_2-symmetry

   Abstract: In this talk, we present some recent results and methods for limit cycles in planar Li'enard differential systems with Z_2-symmetry, including existence, uniqueness, exact number, stability and hyperbolicity of limit cycles. Moreover, using these results for the limit cycles together with other qualitative method and techniques, we can obtain the exact number of limit cycles and further obtain the global dynamics and bifurcations in some polynomial and oscillator Li'enard systems.

5. Wilker Thiago Resende Fernandes (Universidade Federal de São João Del-Rei)

   Title: On the simultaneous existence of centers for some planar differential systems

   Abstract: In this talk we present results on the investigation of the simultaneous existence of two centers for planar polynomial differential systems of degree 3 and 4 possessing different types of symmetry. We present the normal forms for the systems and the conditions in its parameters for the existence of two simultaneous centers. We also present results on the isochronicity of such centers and on the global phase portraits of the respective systems in the Poincaré disk.

6. Pedro Campos Christo Rodrigues Pereira (Universidade Estadual de Campinas)

   Title: Integral manifolds in perturbative systems: an approach via Averaging Theory

   Abstract: Important information about the dynamical structure of a differential system can be revealed by looking into its invariant compact manifolds, such as equilibria, periodic orbits, and invariant tori. This knowledge is significantly increased if asymptotic properties of the trajectories nearby such invariant manifolds can be determined. In this presentation, we will discuss results providing sufficient conditions for the existence of invariant tori in the extended phase space of perturbative differential systems, along with stability properties of such tori. The conditions are given in terms of their so-called higher order averaged equations. Those

results are an extension to a wider class of differential systems of theorems due to Krylov, Bogoliubov, Mitropolsky, and Hale.

Friday, 21st, 2:00pm; Brazil Room

7. Claudio Aguinaldo Buzzi (Universidade Estadual Paulista, campus São José do Rio Preto)

   Title: Stability conditions in a class of refractive partially integrable vector fields

   Abstract: In this talk we will discuss some qualitative and geometric aspects of non-smooth dynamical systems theory. Our main goal is to study stability problems inside the class of 3-dimensional refractive piecewise smooth vector fields. Our concern is to study refractive vector fields that admit a first integral that leaves invariant any sphere centered at the origin. Global stability conditions on generic one-parameter families of refractive piecewise smooth vector fields on a two-dimensional sphere are presented and used to prove our main result, which establishes necessary conditions for the structural stability inside that class.

   Authors: It is a joint work with Ana Livia Rodero and Marco A. Teixeira.

8. Ingrid Sofia Meza Sarmiento (Universidade Federal de Itajubá)

   Title: Linear-like submersions on the plane

   Abstract: Let $p : \mathbb{R}^2 \to \mathbb{R}$ be a smooth function such that $\partial p/\partial x$ and $\partial p/\partial y$ have no common zeros in $\mathbb{R}^2$, i.e., p is a smooth submersion. Then the Implicit Function Theorem states that p defines a regular foliation on $\mathbb{R}^2$, denoted here by $\mathscr{F}(p)$, whose leaves are the connected components of the level sets of p. The main objective in this talk is to present global and local properties for the class of linear-like foliations that are given by the submersion functions

   $$p(x, y) = r(x) + s(x)y, \tag{1}$$

   where $r(x)$ and $s(x)$ are C^∞ real functions. Also, two applications of this study will be presented: the first one is related to the topological classification of submersion functions as in (1) and the other one is related to the Real Jacobian Conjecture.

   Joint with Francisco Braun (UFSCar – Brazil.)

9. Murilo Rodolfo Cândido (Universidade Estadual Paulista, campus de Presidente Prudente)

   Title: Periodic solutions, Averaging Theory, Lyapunov-Schmidt reduction, k-hyperbolicity

   Abstract: In this talk, we establish a parallel between the historical background of the averaging method used to find periodic solutions and the new averaged method-based techniques for detecting periodic solutions. Motivated by Hilbert's 16th problem, the averaging method was a successful technique for providing lower bounds for periodic solutions on planar vector fields, which created some paradigms in the use of this method. However, we show that avoiding these paradigms when studying n-dimensional systems ($n \geq 3$) can reveal a new class of periodic solutions. The Jacobian matrix related to these new periodic orbits is k-hyperbolic, and we provide new tools for studying their stability. We also show that these orbits are natural candidates for passing through a fold bifurcation, which means that their number can double and affect estimates for the lower bound of periodic solutions provided for three-dimensional systems. We then present a natural generalization of the $16th$ Hilbert problem for higher-dimensional systems and provide some average method-based techniques for studying this new problem.

S5. Delay and functional differential equations

Organizers:
Jaqueline Godoy Mesquita (Universidade de Brasília)
Eduard Toon (Universidade Federal de Juiz de Fora)
Fuke Wu (Huazhong University of Science and Technology)

Thursday, 20th, 2:00pm, Paraguay Room Chair: Jaqueline Mesquita

1. Everaldo de Mello Bonotto (Universidade de São Paulo)

   Title: Periodic solutions for a class of neutral functional differential equations

   Abstract: In this lecture, we provide sufficient conditions for the existence and uniqueness of periodic solutions for a class of neutral functional differential equations of type

   $$\frac{d}{dt}(x(t) - A(t, x_t)) = f(t, x_t)$$

   defined almost everywhere in $\mathbb{R}$. Further, we study the existence and uniqueness of periodic solutions for this class of NFDEs under impulse perturbations.

2. Fuke Wu (Huazhong University of Science and Technology)

   Title: Fully-coupled two-time-scale stochastic functional differential equations with infinite delay

   Abstract: This paper examines the fully-coupled two-time-scale stochastic functional differential equations (SFDEs) with infinite delay. The system under consideration involves a slow component and a fast component. This paper aims to establish the averaging principle. To overcome the difficulty due to the infinite delay and the coupling of the segment process, some properties as the Hölder continuity and tightness on a space of continuous functions have to be investigated for the segment process.

3. Shangjiang Guo (China University of Geosciences)

   Title: Equivariant Normal Forms for Semilinear FDEs in Banach Spaces

   Abstract: This talk is concerned with equivariant normal forms of semilinear functional differential equations (FDEs) in general Banach spaces. The analysis is based on the theory previously developed for autonomous delay differential equations and on the existence of invariant manifolds.

As an important application of equivariant normal forms, we not only establish equivariant Hopf bifurcation theorem for semilinear FDEs in general Banach spaces, but also in a natural way derive criteria for the existence, stability, and bifurcation direction of branches of bifurcating periodic solutions. We employ these general results to obtain the existence of infinite many small-amplitude wave solutions for a delayed Ginzburg-Landau equation on a two-dimensional disk with the homogeneous Dirichlet boundary condition.

4. Dingshi Li (Southwest Jiaotong University)

   Title: Periodic Measures of Stochastic Delay Lattice Systems

   Abstract: In this talk, the periodic measures of the stochastic delay reaction-diffusion lattice systems are investigated. Under a general condition, we prove the existence of periodic measures when the time-dependent terms of the system are periodic in time. Under further assumptions on the nonlinear terms, we show the set of all periodic measures of the perturbed system is weakly compact. Finally, we prove every limit point of a sequence of periodic measures of the stochastic delay system must be a periodic measure of the limiting system as the noise intensity or the time delay goes to zero. This lecture is based on a joint work with Bixiang Wang and Xiaohu Wang.

Thursday, 20th, 4:40pm, Paraguay Room Chair: Jaqueline Mesquita

5. Xiang Lyu (Shanghai Normal University)

   Title: Global stability of stationary solutions for a class of semilinear stochastic functional differential equations with additive white noise

   Abstract: This talk gives a criterion for the existence and the global stability of stationary solutions for a class of semilinear stochastic functional differential equations with additive white noise. More precisely, under the condition that the global Lipschitz constant of nonlinear term f is less than the absolute value of the top Lyapunov exponent for the linear flow Φ with f being monotone or anti-monotone, and the time delay is not very big, we show that the infinite-dimensional stochastic flow possesses a unique globally attracting random equilibrium in the state space of continuous functions, which produces the globally stable stationary solution. In the meantime, we show some fundamental properties of infinite-dimensional random dynamical systems generated by stochastic functional differential equations and remove the assumption of boundedness for f, which generalizes the result of Jiang and Lv [SIAM J. Control Optim., 54 (2016), pp.

2383-2402].

Friday, 21st, 10:40am; Paraguay Room Chair: Everaldo Bonotto

6. Eduard Toon (Universidade Federal de Juiz de Fora)

   Title: Stability, boundedness and controllability of solutions of measure functional differential equations

   Abstract: Generalized ordinary differential equations (we write generalized ODEs), introduced by J. Kurzweil in 1957, are known to encompass several other types of equations as measure functional differential equations, for instance. In this paper, we obtain converse Lyapunov theorems for generalized ODEs and, in particular, for measure functional differential equations which, in turn, encompass impulsive functionals differential equations as well as functional dynamic equations on time scales. We also relate uniform stability to boundedness of solutions. As an application, we establish necessary and sufficient conditions for a system of non–homogeneous nonlinear generalized ODEs defined in a Banach space and for a system of non–homogeneous measure functional differential equations to be asymptotically controllable. We include an example which illustrates the main results.

7. Ma To Fu (UnB)

   Title: Exponential stability of viscoelastic waves under small delays

   Abstract: This talk is concerned with viscoelastic waves featuring small delays on the velocity. We show there exists a class of admissible memory kernels that is necessary and sufficient for exponential stability.

S6. Recent Advances and Applications in Integral and Convex Geometric Analysis
Monday, 17th, 4:40pm; Brazil Room
Tuesday, 18th, 4:40pm; Brazil Room
Thursday, 20th, 4:40pm; Brazil Room

Organizers:
Jiazu Zhou (Institute of Mathematics, Southwest University)
Baocheng Zhu (Shanxi Normal University)

Speakers:

1. Jingbo Dou (Shaanxi Normal University)

   Title: Sharp affine weighted L2 Sobolev inequalities on the upper half space

   Abstract: In this talk, I present some sharp affine weighted L^2 Sobolev inequalities on the upper half space involving a divergent operator with degeneracy on the boundary. Our approach is direct to analyze the L^2 structure of gradient norm and employ sharp weighted L^2 Sobolev inequality on the upper half space, which does not depend on the geometric structure of Euclidean space such as L_p Busemann Petty centroid inequalities. The extremal functions and best constants are showed by the affine invariance and results of sharp weighted L^2 Sobolev inequality on the upper half space. This is a joint work with Yunyun Hu and Caihui Yue.

2. Jin Li (Shanghai University)

   Title: Tensor valuations

   Abstract: A valuation (scissors congruence invariant) is an additive map originating from Dehn's solution to the Hilbert third problem. In this talk, I will present some classifications of tensor-valued valuations which have interesting connections with the cross-product.

3. Detang Zhou (Universidade Federal Fluminense)

   Title: TBA

   Abstract: TBA

4. Chao Xia (Xiamen University)

Title: Heintze-Karcher inequality and Alexandrov's theorem for capillary hypersurfaces

Abstract: Heintze-Karcher's inequality is an optimal geometric inequality for embedded closed hypersurfaces, which can be used to prove Alexandrov's soap bubble theorem on embedded closed CMC hypersurfaces in the Euclidean space. In this talk, we introduce a Heintze-Karcher-type inequality for hypersurfaces with boundary in the half-space. As application, we give a new proof of Wente's Alexandrov-type theorem for embedded CMC capillary hypersurfaces. Moreover, the proof can be adapted to the anisotropic case, which enable us to prove an Alexandrov-type theorem for embedded anisotropic capillary hypersurfaces. This is based on joint works with Xiaohan Jia, Guofang Wang and Xuwen Zhang.

5. Li Sheng (Sichuan University)

Title: Extremal metrics on Toric manifols

Abstract: An example of Apostolovet al. indicate that the condition of K-stability may not be correct one for general polarised manifolds. Szekelyhidi modified definition of K-stability by filtration and stated a variant of the Yau-Tian-Donaldson conjecture. We will give an introudction to extremal metrics and K-stability, and talk about our results on this variant of YTD conjecture for toric manifolds. This is jointed with Li An-Min and Lian Zhao.

6. Ning Zhang (Huazhong Universoty of Science and Technology)

Title: Uniqueness of 2-dimensional convex bodies by non-central sections

Abstract: In this talk, we will present a recent work in the symmetry of two-dimensional convex curves with respect to a circular arc, which gives a positive answer to part of the uniqueness of 2- dimensional convex bodies by non-central sections.

7. Qun Chen (Wuhan University)

Title: On the existence and uniqueness of Dirac-harmonic maps with curvature term

Abstract: Dirac-harmonic maps with curvature term is a geometric variational model originated in the supersymmetric nonlinear sigma model, the Euler-Lagrange equation couples a system of second order elliptic PDE/ODEs and a Dirac equation, both of them are nonlinear. In this

talk, we will present recent results on the existence and uniqueness of the solutions.

8. Xinyue Cheng (Chongqing Normal University)

   Title: Volume comparison theorems and their applications in Finsler measure spaces

   Abstract: In this talk, we will mainly introduce the important research progress of volume comparison theorems in Finsler geometry. As the applications, we will introduce some important inequalities on Finsler manifolds with the weighted Ricci curvature bounded from below.

9. Ma, Dan (Shanghai Normal University)

   Title: $SL(n)$ covariant tensor valuations

   Abstract: The study and classification of geometric notions that are compatible with transformation groups are important tasks in geometry as proposed in Felix Klein's Erlangen program in 1872. As many functions defined on geometric objects satisfy the inclusion–exclusion principle, the property of being a valuation is natural to consider in the classification of those functions. Valuations also have their origins in Dehn's solution of Hilbert's Third Problem in 1901. In this talk, beginning with lower-order cases, I will present some recent progress on classifications of SL(n) covariant tensor valuations. This is based on joint work with Jin Li and Chunna Zeng.

10. Wanjun Ai (Southwest University)

    Title: A Geometric Constructive Proof for the 2D Discrete Minkowski Problem

    Abstract: This presentation will focus on the 2-dimensional discrete Minkowski problem. The problem seeks to identify the necessary and sufficient conditions for a polygon with n facets in R^2, whose outer unit normals are $u_1, u_2, \dots u_n \in S^1$, to exist. Additionally, the facet with outer unit normal u_i must have a length of a_i, where $a_1, a_2, \dots, a_n > 0$. The problem was originally solved by Minkowski in 1897. However, in this talk, we will present a geometric constructive proof that offers new insights into the problem. This approach is based on special reflections and proposes the study of a new type of flow on 2-dimensional polygons.

11. Baocheng Zhu (Shanxi Normal University)

    Title: Dual Brunn-Minkowski theory for unbounded closed convex sets

    Abstract: In this talk, we will discuss the dual Brunn-Minkowski theory for unbounded closed convex sets in C, where C is a pointed closed convex cone with nonempty interior in n-dimensional Euclidean space. In particular, we introduce the q-th dual curvature measures for a class of unbounded closed convex sets, and propose the corresponding dual Minkowski problem. We will also talk about the solutions to this problem.

S7. Algebraic Representation Theory and Applications
Monday, 17th, 2:00pm; 4:40pm; Paraguay Room
Tuesday, 18th, 2:00pm; Paraguay Room

Organizers:
Jiping Zhang (Peking University & SUSTech)
Ivan Shestakov (University of São Paulo)
Vyacheslav Futorny (SUSTech and University of São Paulo)

Speakers:

1. Adriano Adrega de Moura (Universidade Estadual de Campinas)

   Title: On Prime, Real, and Imaginary Modules for Quantum Affine Algebras

   Abstract: One of the most challenging problems in the realm of the category of finite-dimensional representations of a quantum affine algebra is that of understanding the factorization of each simple module as a tensor product of other simple modules. The modules which do not admit non-trivial such decomposition are said to be prime. On the other hand, a simple module is said to be real or imaginary according to whether its tensor square remains simple or not, respectively. Achieving a classification of these three classes of modules is still far from reach. We will present recent developments, based on joint works with Clayton Silva and Matheus Brito, regarding the construction of new examples in these classes of modules.

2. Jethro William van Ekeren (IMPA)

   Title: Intersections of transverse slices and isomorphisms of W-algebras

   Abstract: Affine W-algebras are certain infinite dimensional algebras arising in representation theory and completely integrable systems, constructed from Kac-Moody algebras via quantised Drinfeld-Sokolov reduction. Their associated varieties recover well-studied examples of Poisson varieties such as nilpotent orbits, transverse slices and their intersections. We use techniques from the theory of modular forms and representation theory to prove isomorphisms between these algebras, recovering many known and previously unknown isomorphisms at the level of associated varieties. Joint work with T. Arakawa and A. Moreau.

3. John William MacQuarrie (Universidade Federal de Minas Gerais)

   Title: Extensions of algebras and preservation of the finitude of the fini-

tistic dimension

Abstract: An extension of (unital, associative) algebras is simply an algebra A with subalgebra B. I will discuss two projects relating the homological properties of A and B under certain assumptions on the extension. In a sequence of articles, Cibils, Lanzilotta, Marcos e Solotar prove that both the finitude of the global dimension and of the support of the Hochschild homology are preserved by what they call "bounded extensions". In joint work with Kostiantyn Iusenko, we extend this result to a wider class of extensions that includes certain infinite dimensional extensions of interest to us (we allow, for instance, (completed) path algebras with loops and cycles). We also add to the list the preservation of the finitude of the finistisic dimension. These results have the form "A has a property iff B does". The second project, joint work with Fernando dos Reis Naves, considers the question "If A has finite finitistic dimension, when can we say that B does too?": in this case the hypotheses on the extension can be weakened considerably.

4. Luis Enrique Ramirez (UFABC)

   Title: Tableaux realizations of simple highest weight modules

   Abstract: Simple highest weight gl(n)-modules can be realized as subquotients of universal Gelfand-Tsetlin modules, however, this realizations may have basis with non-diagonalizable action of the Gelfand-Tsetlin subalgebra making the description more complicated. This situation is a consequence of fixing a Gelfand-Tsetlin subalgebra for the description. In this talk we compare realizations of simple highest weight gl(n)-modules with respect to different Gelfand-Tsetlin subalgebras

5. Efim Zelmanov (SUSTech University)

   Title: Superconformal algebras over affine algebraic varieties

   Abstract: This is a joint work with C. Martinez and Z. Zhang. Classical superconformal algebras can be realized as subsuperalgebras of $W(1:n) = DerF[t^{-1}, t, \xi_1, \dots, \xi_n]$. We introduce superalgebras of the types W, K, CK with an arbitrary associative commutative algebra instead of Laurent polynomials and prove that they are finitely presented. As a corollary we get that all known superconformal algebras are finitely presented.

6. Changchang Xi (Capital Normal University)

   Title: Tachikawa's second conjecture, orthogonal modules, and recolle-

ments

Abstract: In the representation theory of algebras the famous but not yet solved Nakayama conjecture states that a finite-dimensional algebra is self-injective if its dominant dimension is infinite. To deal with this conjecture, Tachikawa decomposed it into two conjectures in 1970's. His second conjecture says that if M is an orthogonal module over a self-injective algebra then M is projective. Up to date, Tachikawa's second conjecture, however, also remains open. In this talk, we investigate this conjecture by establishing recollements of triangulated (or derived module) categories. In particular, we show that Tachikawa's second conjecture holds true for symmetric algebras if and only if each indecomposable symmetric algebra has no stratifying ideals apart from itself and 0. Moreover, we show that the Nakayama conjecture is true for Morita-Gorenstein algebras. This talk reports joint works with Chen and with Chen and Fang.

7. Yu Qiu (Tsinghua University)

   Title: Quadratic differentials as stability conditions: collapsing subsurfaces

   Abstract: We introduce a new class of triangulated categories, which are Verdier quotients between 3-Calabi-Yau categories from (decorated) marked surfaces. Such quotients categorify collapsing subsurfaces. As an application, we show that the moduli spaces of framed quadratic differentials with arbitrary order zeros and arbitrary higher order poles can be realized as the spaces of stability conditions of these new categories. This is a joint work with Barbieri, Möller and So (arxiv:2212.08433).

8. Lizhong Wang (School of mathematical sciences, Peking university)

   Title: On varieties of finite groups

   Abstract: In this talk, we will introduce the variety X_G of a finite group G defined by the group determinant of G and show that the group G is determined by its variety X_G. The variety X_G and its components are classified. We will also present the properties of morphisms between variety X_G and character varieties of G and try to give the geometric characterization of super character theory. At last, we will focus on the action of G on X_G and the quotient of X_G. The variety X_G is a new object to study the group G. This is a joint work with Prof.Jiping Zhang.

9. Zhicheng Feng (Southern University of Science and Technology)

Title: Inductive conditions of Alperin weight conjecture

Abstract: In the representation theory of finite groups, the local-global conjectures make predictions as to how fundamental representation-theoretic invariants should be locally controlled. Alperin weight conjecture is one of the major local-global conjectures; it asserts that the number of simple modules of the group algebra of a finite group may be determined by counting the number of conjugacy classes of the so-called weights for the group. This conjecture is central to the modern representation theory and has been reduced to certain "inductive" conditions on simple groups. In this talk we will discuss recent developments in the inductive investigation of the Alperin weight conjecture.

10. Iryna Kashuba (SUSTech)

Title: A moment map for Jordan algebras

Abstract: We study the variety of complex n-dimensional Jordan algebras, $Jor(n)$, using techniques from Geometric Invariant Theory. The variety in question, $Jor(n)$ is a rational representation of a complex reductive linear algebraic group $GL(n, C)$, however the action of $GL(n, C)$ on $Jor(n)$ is very unpleasant from the point of view of invariant theory since every point of $Jor(n)$ is unstable, which makes it very difficult to study the quotient space $Jor(n)/GL(n, C)$. Nevertheless, Kirwan and Ness have showed that the moment map associated to this action can be used to study the orbit space of the set of unstable vectors. We use it to construct a Morse-type stratification of $Jor(n)$ into finitely many invariant smooth subvarieties, with respect to the energy functional associated to the canonical moment map. This is joint work with Claudio Gorodski (USP) and Maria Eugenia Martin (UFPR).

11. Kostiantyn Iusenko (IME-USP)

Title: Extensions of algebras and preservation of homological properties

Abstract: This talk is a continuation of a presentation by John MacQuarrie, focusing on the homological properties of extensions of (unital, associative) algebras. In the first part, we explore the extent to which Han's property holds for pseudocompact algebras. While it fails in general, we demonstrate its validity for specific classes of profinite group algebras. Additionally, we investigate the conditions under which one can control the finitude of the relative global dimension when studying homological properties of extensions. In the second part of the talk, we present several results in this direction. The results presented in this talk are based

on joint projects with John MacQuarrie, Guilherme da Costa Cruz, and Roger Ramirez Primolan.

12. Juan Camilo Arias Uribe (University of São Paulo)

Title: Crystal bases and imaginary Verma modules

Abstract: Crystal bases were introduced independently by M. Kashiwara (from an algebraic viewpoint, see [8], [9]) and G. Luzstig (from a geometric viewpoint, see [10], [11]) for (standard) Verma modules and integrable highest weight modules. They are a powerful tool to understand the representation theory of quantum groups providing many applications, in particular, to the representation theory of classical Lie algebras. For affine Lie algebras, there exists a finite number (strictly bigger than 1) of inequivalent Weyl orbits of closed partitions of the root system, they are parametrized by subsets X of the simple roots. Each subset X allow us to construct a Verma-like module. In case X consists of all the simple roots we recover the standard Verma modules, in case X is empty we have a new family of Verma modules called *imaginary Verma modules* (see [7], [6]). The study of crystal bases for imaginary Verma modules begun in the work of B. Cox, V. Futorny and C. Misra (see [3], [4], [5]) where they constructed such bases for imaginary Verma modules of the affine Lie algebra $\mathfrak{sl}_2$. In this talk, we will present the construction of crystal bases for imaginary Verma modules associated to any untwisted affine Lie algebra. Moreover, we construct a semisimple category with the imaginary Verma modules as its simple objects and showed that crystal bases exists in this category. The results presented in this work are a joint work with V. Futorny and K. Misra and with V. Futorny and A. Oliveira (see [1], [2]).

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Algebras, Quantum Groups And Related Topics. 713 pp. 47-59, (2018).

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S8. Probability

Organizers:
Luiz Renato Fontes (Universidade de São Paulo)
Roberto Fernandez (New York University Shanghai)

Monday, 17th, 10:40am; Paraguay Room

1. Lun Zhang (Fudan University)

   Title: On the gap probability of the tacnode process

   Abstract: The tacnode process is a universal determinantal point process arising from non-intersecting particle systems and tiling problems. It is the aim of this work to explore the integrable structure and large gap asymptotics for the gap probability of the thinned/unthinned tacnode process over $(-s, s)$. We establish an integral representation of the gap probability in terms of the Hamiltonian associated with a system of differential equations. With the aids of some remarkable differential identities for the Hamiltonian, we also compute large gap asymptotics, up to and including the constant term in the thinned case. As direct applications, we obtain expectation, variance and a central limit theorem for the associated counting function. Joint work with Luming Yao.

2. Guilherme Silva (FAPESP/Universidade de São Paulo)

   Title: Deformations of point processes and universality

   Abstract: The classical universality results in random matrix theory reveal that in the large matrix limit, eigenvalues of various random matrix models, despite exhibiting distinct macroscopic behaviors, possess the same microscopic behavior. Moreover, the limiting microscopic point processes are universally observed point processes like the Airy, Bessel or Sine point processes.

   However, and as we plan to explain, it is indeed possible to generate deformations of eigenvalues in a natural way, maintaining their macroscopic behavior while introducing new universal microscopic limits. Among some interesting features, these novel limits establish a connection between random matrix theory and growth processes, such as the narrow wedge solution to the KPZ equation.

   The talk is based on joint works with Promit Ghosal, with Leslie Molag and Lun Zhang, and with Tom Claeys.

3. Renato Soares dos Santos (Federal University of Minas Gerais (UFMG))

   Title: Weakly self-avoiding random walk in a random potential

   Abstract: We consider a model of a simple random walk influenced by two competing types of interaction: an attractive one towards high values of a random potential, and a self-repellent one measured by its self-intersections (in the spirit of the weakly self-avoiding random walk). We identify the log asymptotics of the partition function of the model and also the typical path behaviour giving the main contribution to the partition function. The latter comes out of a variational formula and shows concentration on a random finite number of points, each occupied for a positive fraction of time. Joint work with Wolfgang König, Nicolas Pétrélis and Willem van Zuijlen.

4. Santiago Saglietti (Pontificia Universidad Católica de Chile)

   Title: Tightness of the Cover Time of Wired Planar Domains

   Abstract: We consider a continuous time simple random walk on a subset of the square lattice with wired boundary conditions: the walk transitions at unit edge rate on the graph obtained from the lattice closure of the subset by contracting the boundary into one vertex. We study the cover time of such walk, namely the time it takes for the walk to visit all vertices in the graph. Taking a sequence of subsets obtained as scaled lattice versions of a nice planar domain, we show that the square root of the cover time normalized by the size of the subset is tight around $1/\sqrt{\pi}\log N - 1/(4\sqrt{\pi})\log\log N$, where N is the scale parameter. This proves an analog, for the wired case, of a conjecture by Bramson and Zeitouni. The proof is based on comparison with the extremal landscape of the discrete Gaussian free field. Joint work with Marek Biskup and Oren Louidor.

Monday, 17th, 2:00pm; Brazil Room

5. Pablo Groisman (University of Buenos Aires and New York University Shanghai)

   Title: The Kuramoto Model on Random Dynamic Graphs

   Abstract: The Kuramoto model in a graph G is a system of ODEs representening coupled oscillators. Each oscillator has its own natural frequency and on top of that any two oscillators that are linked by an edge tend to synchronize their phases. For a given graph, we are interested in

understanding the set of initial conditions for which the oscillators tend to synchronize their frequencies and under which conditions all the phases are synchronized as time goes to infinity. We will pose this issue for a series of random graphs that are allowed to change as time goes on.

6. Weijun Xu (Peking University)

   Title: Weak universality of some singular stochastic PDEs

   Abstract: Some interesting stochastic PDEs arising from probabilistic models are classically ill-posed in the sense that they involve products of distributions. Hence, their solution theories require renormalisations by infinite quantities. We will use KPZ and dynamical Phi^4_3 as two examples to illustrate the meanings of these infinite quantities, and show that the renormalised equations do describe the macroscopic behaviour of a large class of probabilistic models.

7. Tertuliano Franco (Universidade Federal da Bahia)

   Title: Out of equilibrium joint fluctuations for current and occupation time in the symmetric exclusion process

   Abstract: "We present a full picture of the out of equilibrium joint fluctuations for current and occupation time in the symmetric exclusion process in dimension one. The main tools developed for that are a Kipnis-Varadhan type inequality necessary to handle the occupation time and a multiple point space time correlation estimate necessary to prove the tightness for the current. Curiously, as a corollary we obtain that, in equilibrium, current and occupation time are independent for any fixed time (but they are not independent as processes). Talk based on a joint work with D. Erhard and T. Xu.

8. Tiecheng Xu (IME-UFBA)

   Title: Non-equilibrium fluctuations of the occupation time and current in one-dimensional SSEP

   Abstract: In this talk I will discuss how to derive the CLT of the occupation time and current, for the simple symmetric exclusion process(SSEP) on $\mathbb{Z}$ starting from a Bernoulli product measure associated to a smooth profile. We develop a new method, which can be thought as the Kipnis-Varadhan inequality in the non-equilibrium settting, to deal with the scaling limit of the occupation time. The proof of the scaling limit of the current is based on some sharp estimates on the correlations of multiple points

at multiple times, and a gradient estimate on the transition probability of SSEP. These estimates seem to be new and could be of independent interests. Joint work with Dirk Erhard(UFBA) and Tertuliano Franco(UFBA).

Tuesday, 18th, 10:40am; Paraguay Room

9. Maria Eulália Vares (Federal University of Rio de Janeiro)

   Title: Comments on the contact process in dynamic random environments

   Abstract: I will report on results for some variants of the classical contact process. The focus will be on a specific class of examples originated by considering dynamic random environments, as the situation introduced by Linker and Remenik [1] and considered in [2], and on a class of percolative structures inspired by the Harris graphical construction, considered in [3]. Depending on time, I hope to discuss ongoing work in both directions.

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10. Eric Endo (NYU Shanghai)

    Title: Local Central Limit Theorem for Long-Range Models at High Temperatures

    Abstract: The Local Central Limit Theorem is a result that provides a more refined result than the Central Limit Theorem. Both of them were vastly studied for random variables generated by models coming from Statistical Mechanics. Several papers such as [1, 2, 3] proved that, under certain conditions for the potentials, if the Central Limit Theorem holds for random fields defined on the lattice, then the Local Central Limit Theorem will hold as well.

    Considering a sufficiently high-temperature regime, we prove in [4] that for a sequence of Gibbs measures with two-body long-range, absolutely summable potentials on the lattice with spins taking lattice distributed values, for which the Integral Central Limit Theorem is satisfied, then the

Local Central Limit Theorem also holds for that sequence. Our result complements [1], where some families of absolutely summable long-range potentials that fail the condition in [1] still satisfy the result at sufficiently high temperatures.

References
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11. Roberto Fernández (NYU-Shanghai)

Title: High-temperature cluster expansion for classical and quantum spin lattice systems with multi-body interactions

Abstract: We develop a novel cluster expansion for finite-spin lattice sys- tems subject to multi-body quantum – and, in particular, classical – interactions. Our approach is based on the use of "decoupling parameters", advocated by Park, which relates partition functions with successive additional interaction terms. Our treatment, however, leads to an explicit expansion in a β-dependent effective fugacity that permits an explicit evaluation of free energy and correlation functions at small β. To determine its convergence region we adopt a relatively recent cluster summation scheme that replaces the traditional use of Kikwood-Salzburg-like integral equations by more precise sums in terms of particular tree-diagrams.

S9. Moduli spaces of sheaves and complexes

Organizers:
Marcos Jardim (Universidade Estadual de Campinas)
Jason Lo (California State University)
Cristian Martinez (Universidad del Rosario)
Ziyu Zhang (ShanghaiTech University)

Thursday, 20th, 4:40pm; Argentina Room

1. Cristian Martinez (Universidad del Rosario)

   Title: C-instanton objects

   Abstract: On a Fano threefold X of Picard number one, we introduce the notion of C-instanton object. These are objects in the derived category of X, which are stable with respect to stability conditions on a suitable chamber C. Our definition is inspired by the works of Comaschi-Jardim and Faenzi, and the examples of vertical semistable objects provided in Jardim-Maciocia-Martinez. After a motivation for our definition, we will focus on the cases of the projective space and the quadric threefold and prove that there is a chamber C such that C-instantons have monad-type descriptions. Examples of C-instanton objects will be provided, including some that do not fit any previous definitions of instantons. Additionally, we will show that the classical rank 2 instanton bundles in the projective space are indeed C-instanton objects for any suitable chamber C. Finally, we will prove the existence of acyclic extensions for C-instantons on any Fano threefold of index 2. This is joint work with Gaia Comaschi, Marcos Jardim, and Dapeng Mu, members of the Gauge Theory and Algebraic Geometry (GTAG) research group at the University of Campinas.

2. Fei Xie (University of Edinburgh)

   Title: Derived categories of quadric bundles of relative even dimension

   Abstract: I will discuss derived categories of families of even dimensional quadric hypersurfaces, more precisely, their non-trivial semiorthogonal components called residual categories. When the family has only simple degeneration (fibers have corank at most 1), the residual category is a twisted derived category of some scheme. The scheme can be constructed as the relative moduli space of spinor sheaves, or via the relative moduli space of maximal isotropic subspaces. I expect the same result holds when fibers of corank 2 are allowed, and will provide constructions

of the scheme étale locally, as well as when the base is a smooth surface and threefold. I will explain the difficulty for the general construction and possible ideas to overcome it.

3. Misha Verbitsky (IMPA)

Title: Perverse coherent sheaves on hyperkahler manifolds and Weil conjectures

Abstract: Let (M, I, J, K) be a compact hyperkahler manifold, and$L = aI + bJ + cK$ a general complex structure. All complex subvarieties of (M, L) are even-dimensional, which allows one to define the middle perversity, constructing a self-dual t-structure on its category of coherent sheaves. All coherent sheaves on (M, L) are semistable, and the category of coherent sheaves on (M, L) admits a full embedding to the category of coherent sheaves on any its deformation (and is essentially independent on the deformation), hence the notion of the perverse coherent sheaf makes sense on algebraic hyperkahler manifolds as well. Just like for the constructible sheaves, the perverse coherent sheaves are extensions of simple perverse coherent sheaves, which are always stable. In Beilinson–Bernstein–Deligne (BBD), the Weil conjectures were interpreted as a theorem about purity of a direct image of a pure perverse sheaf. Instead of fixing the Frobenius action, as in the BBD setup, we fix the lifting of the sheaf to the twistor space; such a lifting is unique for stable sheaves, and exists for all semi-stable sheaves. The role of the weight filtration is played by the $O(i)$-filtration on the sheaf restricted to the rational curves in the twistor space. The hyperkahler version of "Weil conjectures" predicts that the weights are increased under derived direct images, and the direct images of pure perverse sheaves remain pure, which is actually true, at least in the smooth case.

Friday, 21st, 10:40am; Argentina Room

4. Charles Almeida (UFMG)

Title: Moduli space of torsion free sheaves on projective spaces

Abstract: In this talk we will present a construction of new irreducible components of the moduli space of rank 2 semistable torsion free sheaves on the 3-dimensional projective space, whose generic point corresponds to non-locally free sheaves. As applications, we compute the number of irreducible components of the moduli space of torsion free sheaves, with Chern classes first, second and third Chern classes equal to -1, 2 and 0 respectively. Additionally, we will establish criteria in order for a torsion

free sheaf with small Chern classes to be smoothable into a locally free sheaf.

5. Yun Shi (Brandeis University)

   Title: Stability of line bundles and deformed-Hermitian-Yang Mills equation for some elliptic surfaces

   Abstract: Donaldson and Uhlenbeck-Yau established the classical result that on a compact Kahler manifold, an irreducible holomorphic vector bundle admits a Hermitian metric solving the Hermitian-Yang-Mills equation if and only if the vector bundle is Mumford-Takemoto stable. Motivated by the characterization of supersymmetric B-branes in string theory and mirror symmetry, Collins-Yau asked if a line bundle admits a solution of the deformed Hermitian-Yang-Mills (dHYM) equation is equivalent to it is stable with respect to certain Bridgeland stability conditions. In this talk, we will discuss a partial answer to this question for a set of line bundles on a Weierstrass elliptic K3 surface. This is joint work with Tristan Collins, Jason Lo, and Shing-Tung Yau.

6. Leonardo Roa-Leguizamon (Universidad de los andes)

   Title: On the Hilbert scheme of the moduli space of torsion free sheaves on surfaces

   Abstract: The aim of this talk is to determine a bound of the dimension of an irreducible component of the Hilbert scheme of the moduli space of torsion-free sheaves on surfaces. Let X be a non-singular irreducible complex surface and let E be a vector bundle of rank n on X. We use the m-elementary transformation of E at a point $xinX$ to show that there exists an embedding from the Grassmannian variety $\mathbb{G}(E_x, m)$ into the moduli space of torsion-free sheaves $\mathfrak{M}_{X,H}(n; c_1, c_2 + m)$ which induces an injective morphism from $X \times M_{X,H}(n; c_1, c_2)$ to $Hilb_{\mathfrak{M}_{X,H}(n;c_1,c_2+m)}$. DOI: 10.1017/S0017089523000010 Glasgow Mathematical Journal.

Friday, 21st, 2:00pm; Argentina Room

7. Abdelmoubine Amar Henni (UFSC)

   Title: Torsion free instanton sheaves on the blow-up of P3 at a point

   Abstract: We consider an extension of the instanton bundles definition, given by Casnati– Coskun–Genc–Malaspina, for Fano threefolds, in order

to include non locally-free ones on the blow-up X, the $P3$ at a point. With the proposed definition, we prove that any reflexive instanton sheaf must be locally free, and that the strictly torsion free instanton sheaves have singularities of pure dimension 1. We construct examples and study their μ-stability. Furthermore, these sheaves will play a role in (partially) compactifying the 'tHooft component of the moduli space of instantons, on X. Finally, examples of these are shown to be smooth and smoothable.

8. Dapeng Mu (Instituto de Matemática, Estatística e Computação Científica (IMECC, UNICAMP))

   Title: Stable pairs and connectedness for moduli space of rank 2 sheaves on $P3$

   Abstract: We consider stable pairs on $P3$ introduced by Huybrechts-Lehn. A stable pair consists of a sheaf and a section, and they are parameterized by a family of rational polynomials. We will show that for a class of a rank 2 sheaf, there are two specific choices of the polynomial, for which the moduli spaces of semistable pairs are fibered over the moduli space of rank 2 semistable sheaves and fibered over the Hilbert scheme of curves. In the later moduli space, every semistable pair corresponds to a curve with an extension class, which sheds some light on generalizing Serre correspondence into a family. These two moduli spaces are related by finite many wall-crossings. We will provide explicit descriptions of the wall-crossings for certain classes. In particular, those wall-crossings preserve the connectedness of moduli spaces. We expect that this is true for any general class of a rank 2 sheaf, which indicates the connectedness for moduli of rank 2 semistable sheaves since Hilbert schemes are always connected.

9. Victor do Valle Pretti (Universidade de São Paulo)

   Title: Bridgeland stability of some even instantons

   Abstract: The moduli of instantons bundles over a Fano threefold have been under investigation by many authors during the last 50 years. Their relation with exceptional collections and monads is already proven to be useful in many situations, such as the ADHM equations and D.Faenzi's work, for example. We will present how to prove they're stable in the sense of Bridgeland and obtain their moduli space as an open subset of the moduli of Bridgeland stable objects. This is done by finding a region where Bridgeland and quiver stability coincide, hence also obtaining general information about these moduli spaces. The general theory behind this association was proven by E.Macr'i. Here we provide a systematic way of describing the quiver regions for any smooth projective variety, if

they exist.

S10. Optimization on Riemannian Manifolds

Organizers:
Orizon Pereira Ferreira (Universidade Federal de Goiás)
Juliano de Bem Francisco (Universidade Federal de Santa Catarina)
Douglas Soares Goncalves (Universidade Federal de Santa Catarina)

Tuesday, 18th, 10:40am; Argentina Room Chair: Orizon Pereira Ferreira

1. Xin Liu (Chinese Academy of Sciences)

   Title: Decentralized Optimization Over the Stiefel Manifold by an Approximate Augmented Lagrangian Function

   Abstract: We study the decentralized optimization problem over the Stiefel manifold, which is defined on a connected network of d agents. The objective is an average of d local functions, and each function is privately held by an agent and encodes its data. The agents can only communicate with their neighbors in a collaborative effort to solve this problem. In existing methods, multiple rounds of communications are required to guarantee the convergence, giving rise to high communication costs. In contrast, this paper proposes a decentralized algorithm, called DESTINY, which only invokes a single round of communications per iteration. DESTINY combines gradient tracking techniques with a novel approximate augmented Lagrangian function. The global convergence to stationary points is rigorously established. Comprehensive numerical experiments demonstrate that DESTINY has a strong potential to deliver a cutting-edge performance in solving a variety of testing problems.

2. Juliano de Bem Francisco (UFSC)

   Title: Nonmonotone feasible arc search algorithm for minimization on Stiefel manifold

   Abstract: In this talk we present a new numerical method for solving the minimization problem over the Stiefel manifold, that is, the set of matrices of order $n \times p$ (here $p \leq n$) with orthonormal columns. Our approach consists in a nonmonotone feasible arc search along a sufficient descent direction in order to assure convergence to stationary points, regardless the initial point considered. The feasibility of the iterates is maintained through a kind of the Cayley transform and thus our scheme can be seen as a retraction-based algorithm for minimization with orthogonality constraints. We emphasize that, at each retraction to maintain feasibility, our scheme solves a $p \times p$ linear system, which lead it a computational

complexity of $O(np^2) + O(p^3)$. In sum, we present a general algorithmic framework for minimization on Stiefel manifold, give its global convergence properties and report numerical experiments on interesting applications.

3. Harry F. Oviedo (Centro de Investigación en Matemáticas)

   Title: Spectral residual method for nonlinear equations on Riemannian manifolds

   Abstract: In this work, the spectral algorithm for nonlinear equations (SANE) is adapted to the problem of finding a zero of a given tangent vector field on a Riemannian manifold. The generalized version of SANE uses the tangent vector field as a search direction and a continuous real-valued function that adapts this direction and ensures that it verifies a descent condition for an associated merit function. To speed up the convergence of the proposed method, we incorporate a Riemannian adaptive spectral parameter in combination with a non-monotone globalization technique. The global convergence of the proposed procedure is established under some standard assumptions. Numerical results indicate that our algorithm is very effective and efficient solving tangent vector field on different Riemannian manifolds and competes favorably with a Polak–Ribiére–Polyak method recently published and other methods existing in the literature.

Tuesday, 18th, 2:00pm; Argentina Room Chair: Douglas S. Gonçalves

4. Glaydston de Carvalho Bento (Universidade Federal de Goiás)

   Title: Fenchel Conjugate via Busemann Function on Hadamard Manifolds

   Abstract: In this lecture, will be introduced a Fenchel-type conjugate, given as the supremum of convex functions, via the Busemann functions. Due the absence of non-constant affine functions in Hadamard manifolds and taking into account that the Busemann functions are smooth convex functions with constant gradient, our study ensures that our proposal of Fenchel conjugate seems to be the most adequate to cover the absence of approximations by non-constant affine functions. Besides, it is possible to evidence the influence of the sectional curvature in obtaining the main results. In particular, we have illustrated that the difference between a proper, lsc, convex function and its biconjugate is a constant that depends on the sectional curvature of the manifold, showing that in general a Fenchel-Moreau type theorem is directly influenced by the sectional curvature.We also present at least one application formulated in terms of the

Fenchel's conjugate.

5. João Carlos de Oliveira Souza (Federal University of Piauí)

   Title: An inertial proximal point method for difference of maximal monotone vector fields in Hadamard manifolds

   Abstract: We propose an inertial proximal point method for variational inclusion involving difference of two maximal monotone vector fields in Hadamard manifolds. We prove that if the sequence generated by the method is bounded, then every cluster point is a solution of the non-monotone variational inclusion. Some sufficient conditions for boundedness and full convergence of the sequence are presented. The efficiency of the method is verified by numerical experiments comparing its performance with classical versions of the method for monotone and non-monotone problems.

6. Orizon Pereira Ferreira (UFG)

   Title: The difference of convex algorithm on Riemannian manifolds

   Abstract: We propose a classical and simplified Riemannian version of the difference of con- vex algorithm (DCA) to solve a minimization problem involving the difference of convex (DC) function. Equivalence between classical and simplified Riemannian versions of the DCA is stablished. We also prove that under mild assumptions the Riemannian version of the DCA is well defined and every cluster point of the sequence generated by the proposed method, if any, is a critical point of the objective DC function. Some duality relations between the DC problem and its dual are also established.

S11. Nonlinear water waves: rigorous analysis and scientific computing
Tuesday, 18th, 4:40pm, Argentina Room

Organizers:
Roberto Ribeiro Santos Junior (Federal University of Paraná)
Marcelo Velloso Flamarion Vasconcellos (Rural Federal University of Pernambuco)

Speakers:

1. David Eugenio Andrade Pérez (Universidad del Rosario)

   Title: On the CSY equation and its application to freak waves.

   Abstract: In this presentation, we introduce a new statistical model called the CSY equation, developed by Crawford, Saffman, and Yuen, to describe random fields of deep water waves. This model shows the instability of narrow-banded wave spectra to inhomogeneous disturbances. Through an examination of the non-linear evolution of the wave field resulting from this instability, the model prdicts a significant increase in the probability of freak wave occurrences. This is joint work with Prof. Michael Stiassnie (Technion) and Prof. Raphael Stuhlmeier (University of Plymouth).

2. Roberto Ribeiro-Jr (Federal University of Paraná)

   Title: Flow structure beneath waves with constant vorticity under normal electric fields

   Abstract: Waves with constant vorticity and electrohydrodynamics flows are two topics in fluid dynamics that have attracted much attention from scientists for both the mathematical challenge and their industrial applications. Coupling of electric fields and vorticity is of significant research interest. The majority of works on this topic have focused on the shape of the free surface, and integral properties such as wave energy and momentum. In this talk, we will discuss our numerical study concerning the flow structure beneath waves with constant vorticity on a dielectric fluid under the effect on normal electric fields. Our results indicate that electric fields act as a mechanism that helps the emergence stagnation points. This is joint work with Marcelo Flamarion, Tao Gao, and A. Doak.

S12. Mathematical problems in general relativity
Monday, 17th, 10:40am; Brazil Room
Tuesday, 18th, 10:40am; Brazil Room
Friday, 21st, 3:50am; Paraguay Room

Organizers:
Sérgio Almaraz (Universidade Federal Fluminense)
Xuecheng Wang (Tsinghua University)
Shiwu Yang (Peking University)
Xiao Zhang (Guangxi University and Chinese Academy of Sciences)

Speakers:

1. Zhoujian Cao (Chinese Academy of Sciences)

   Title: Gravitational Wave Memory and its stochastic background

   Abstract: Gravitational wave memory is an outstanding theoretical prediction of general relativity. It may give an insight to fundamental physics such as quantum gravity. Along with the development of gravitational wave astronomy, the gravitational wave memory may be detected in the near future. In this talk I will introduce the physical picture of gravitational wave memory and its relation to fundamental physics. Also I will talk about the possible detection methods of gravitational wave memory and the implications to astrophysics.

2. Frederico Vale Girão (Universidade Federal do Ceará (UFC))

   Title: Positive mass and Penrose inequalities for submanifolds in space forms

   Abstract: I will discuss work with collaborators (mainly Levi Lopes de Lima and Alexandre de Sousa) regarding the positive mass and Penrose inequalities for submanifolds in Euclidean and in hyperbolic space. Naturally connected to these inequalities are the so-called Alexandrov-Fenchel inequalities, which we shall also discuss.

3. Jiongyue Li (Sun Yat-sen University)

   Title: Radiation fields for semilinear Dirac equations with spinor null forms

   Abstract: We will talk about the scattering theory of half spin waves by using the radiation fields. We first define the radiation fields for semilinear Dirac equations. Then we prove a nonlinear isomorphism map between

the weighted energy space of the initial data and a weighted energy space of Dirac radiation fields. The proof is based on a careful study of the linear Dirac radiation fields combined with a functional framework. This is a joint work with JIN JIA.

4. Chuxiao Liu (Guangxi University)

   Title: Spherically symmetric Einstein-scalar-field equations for wave-like decaying null infinity

   Abstract: We show that the spherically symmetric Einstein-scalar-field equations for wave-like decaying null infinity have unique local solutions and unique global solutions for small initial data. We also generalize Christodoulou's global generalized solutions to the wave-like decaying initial data. We emphasize that this decaying condition is sharp. This talk is based on the joint work with Xiao Zhang.

5. Benedito Leandro Neto (Universidade Federal de Goiás)

   Title: On the geometry of electrovacuum spaces in higher dimensions

   Abstract: A classical question in general relativity is classifying regular static black hole solutions of the static Einstein-Maxwell equations (or electrovacuum system). We prove some classification results for an electrovacuum system such that the electric potential is a smooth function of the lapse function. We particularly show that an n-dimensional locally conformally flat electrovacuum space satisfying (1.8) must be in the Majumdar-Papapetrou class. Moreover, we prove that an n-dimensional electrovacuum space satisfying (1.7) with fourth-order divergence-free Weyl tensor and zero radial Weyl curvature is locally a warped product manifold with (n-1)-dimensional Einstein fibers. Finally, a three-dimensional electrovacuum space satisfying (1.7) with a third-order divergence-free Cotton tensor is also classified.

6. Xiaoning Wu (Chinese Academy of Sciences)

   Title: Some new results of black hole uniqueness

   Abstract: TBA.

7. Wei Yuan (Sun Yat-sen University)

   Title: Conformally variational Riemannian invariants and their related

topics

Abstract: It is well known that scalar curvature plays a fundamental role in general relativity. As its analogue, conformally variational Riemannian invariants (CVIs) is a category of fundamental scalar-type curvatures which shares many excellent properties in both conformal and Riemannian geometry. In this talk, I will give a brief introduction about our working frame about CVIs and present some interesting results about the geometric and analytic theory about CVIs. Hopefully, these theories can be helpful in the development of general relativity and other fields of mathematical physics. This talk is based on a series of work joint with Jeffrey S. Case from Penn State University and Yueh-Ju Lin from Wichita State University.

8. Rondinelle Marcolino Batista (UFPI)

Title: Modified Hawking mass and local rigidity of free boundary surfaces in mean convex three-manifolds

Abstract: In this lecture, we presente a local rigidity result for free boundary minimal two-disk that locally maximize the modified Hawking mass on a Riemannian three manifold M with positive lower bound on its scalar curvature and mean convex boundary. Under strict stability of it assumptions, we prove that a neighborhood of it in M is isometric to one of the half de Sitter-Schwarzschild metrics. This is a joint work with Barnabé Lima (UFPI) and João Silva (UFPI).

S13. Geometric Flows
Tuesday, 18th, 2:00pm; Brazil Room
Tuesday, 18th, 4:40pm; Paraguay Room
Thursday, 20th, 10:40am; Paraguay Room

Organizers:
Xiaohua Zhu (Peking University)
Detang Zhou (Universidade Federal Fluminense)
Zhenlei Zhang (Capital Normal University, China)

Speakers:

1. Yuxing Deng (Beijing Institute of Technology)

   Title: 4D noncollapsed steady Ricci solitons

   Abstract: Steady Ricci solitons are important singularity models of the Ricci flow. In this talk, we will talk about some recent progress and problems on 4D steady Ricci solitons.

2. Eddygledson Gama (Universidade Federal Rural do Semi-Árido)

   Title: Finite Entropy Translating Solitons in Slabs

   Abstract: In this lecture, we are going to talk about translating solitons of the mean curvature flow in R3 of finite entropy, finite topology in a slab. As a first goal, we prove that it possible enumerate connected components of slices to define asymptotic invariants $\omega \pm (\Sigma) \in N$, which count the numbers of "wings". Analyzing these, we give a method for computing the entropies for such classes of solitons. In particular, we conclude that the entropy is always a positive integer number. Finally, combining the concept of wing numbers with Morse theory for minimal surfaces, we prove the translating pitchforks constructed by Hoffman-Martín-White is the unique complete embedded simply connected translating solitons contained in a slab with entropy 3 and containing a vertical line.

3. Wenshuai Jiang (Zhejiang University)

   Title: Singular set of elliptic equations with weak regular coefficients

   Abstract: In this talk, we will first review some results about nodal set and singular set of elliptic equations. Then we will discuss the Hausdorff measure estimates of these sets with weak regular coefficients. The proof depends on an almost monotone estimate for frequency. This is a

joint work with Yiqi Huang.

4. Man-Chun Lee (The Chinese University of Hong Kong)

   Title: Gap Theorems on Riemannian manifold using Ricci flow

   Abstract: In the Kähler geometry, the optimal gap theorem states that com- plete non-compact Kähler manifolds with non-negative bisectional curvature and curvature decay faster average quadratic must be flat. In this talk, we will discuss the generalisation to the Riemannian case using Ricci flow. This is based on joint work with P.-Y. Chan.

5. Ernani Ribeiro Jr. (Universidade Federal do Ceará)

   Title: Rigidity of four-dimensional Kähler-Ricci solitons

   Abstract: In this talk, we discuss four-dimensional gradient shrinking Ricci solitons close to a Kähler model. The first theorem could be considered as a rigidity result for the Kähler-Ricci soliton structure on $S^2 \times R^2$. Moreover, we show that if the quotient of norm of the self-dual Weyl tensor and scalar curvature is close to that on a Kähler metric in a specific sense, then the gradient Ricci soliton must be either half-conformally flat or locally Kähler. This is a joint work with Xiaodong Cao (Cornell University) and Hung Tran (Texas Tech University).

6. Graham Smith (Universidade Federal do Rio de Janeiro)

   Title: Eternal mean curvature flows in perturbations on the unit 3-sphere

   Abstract: Inspired by ideas of B. White and R. Ye, we use a singular perturbation argument to construct eternal mean curvature flows of tori in the unit 3 sphere. Not only are such flows interesting in their own right, but they also have interesting applications to the study of the differential topology of the space of smoothly embedded tori in the 3-sphere. This is joint work with C. Magaño.

7. Keti Tenenblat (Universidade de Brasília)

   Title: On the self-similar solutions to the curvature flow for curves

   Abstract: Self-similar solutions to the curvature flow for curves will be considered on the sphere, on the 2-dimensional hyperbolic space and on the 2-dimensional light cone. On the light cone the curvature flow will also

be related to the inverse curvature flow. In each case, the geometry of the curves will be described. The talk is based on papers in collaboration with Hiuri F. Dos Reis and Fabio N. da Silva.

8. Feng Wang (Zhejiang University)

   Title: On the Kahler-Ricci flow on spherical Fano manifolds

   Abstract: Spherical varieties is a large class of varieties with symmetry. The relations between the geometric properties and combinatorial data have been investigated extensively. In this talk, I will present the recent progress of the Kahler-Ricci flow on spherical Fano manifolds.

9. Chao Xia (Xiamen University)

   Title: Heintze-Karcher inequality and Alexandrov's theorem for capillary hypersurfaces

   Abstract: Heintze-Karcher's inequality is an optimal geometric inequality for embedded closed hypersurfaces, which can be used to prove Alexandrov's soap bubble theorem on embedded closed CMC hypersurfaces in the Euclidean space. In this talk, we introduce a Heintze-Karcher-type inequality for hypersurfaces with boundary in the half-space. As application, we give a new proof of Wente's Alexandrov-type theorem for embedded CMC capillary hypersurfaces. Moreover, the proof can be adapted to the anisotropic case, which enable us to prove an Alexandrov-type theorem for embedded anisotropic capillary hypersurfaces. This is based on joint works with Xiaohan Jia, Guofang Wang and Xuwen Zhang.

10. Ronaldo Freire de Lima (UFRN)

    Title: Weingarten Flows in Riemannian Manifolds

    Abstract: Given orientable Riemannian manifolds M^n and $\overline{M}^{n+1}$, we consider flows $F_t : M^n \to \overline{M}^{n+1}$, called Weingarten flows, in which the hypersurfaces $F_t(M)$ evolve in the direction of their normal vectors with speed given by a function W of their principal curvatures, called a Weingarten function, which is homogeneous, monotonic increasing with respect to any of its variables, and positive on the positive cone. We obtain existence results for flows with isoparametric initial data, in which the hypersurfaces $F_t : M^n \to \overline{M}^{n+1}$ are all parallel, and $\overline{M}^{n+1}$ is either a simply connected space form or a rank-one symmetric space of noncompact type. Finally, we prove that the avoidance principle holds for Weingarten flows

defined by odd Weingarten functions, and also that such flows are embedding preserving.

11. José Nazareno Vieira Gomes (Universidade Federal de São Carlos)

Title: Mean curvature flow in an extended Ricci flow background

Abstract: In this work, we consider a functional related to mean curvature flow in an ambient space which evolves by an extended Ricci flow from the perspective introduced by Lott when studying mean curvature flow in a Ricci flow background. This functional is the weighted extended version of the Gibbons-Hawking-York action on Riemannian metrics in compact manifolds with boundary. We compute its variational properties, from which naturally arise boundary conditions to the analysis of its time-derivative under Perelman's modified extended Ricci flow. In this time-derivative formula an extension of Hamilton's differential Harnack expression on the boundary integrand appears. We also derive the evolution equations for both the second fundamental form and the mean curvature under mean curvature flow in an extended Ricci flow background. In the special case of gradient solitons to the extended Ricci flow, we discuss mean curvature solitons and establish Huisken's monotonicity-type formula. We show how to construct a family of mean curvature solitons and establish a characterization of such a family. Finally, we present examples of mean curvature solitons in an extended Ricci flow background.

Contributed-talks

C1. Session 1
Monday, 17th, 10:40am; Argentina Room

Chair: Douglas Soares Gonçalves (UFSC)

Speakers:

1. Xinwei Liu (Hebei University of Technology)

   Title: A primal-dual interior-point relaxation method for nonlinear programs

   Abstract: We present a primal-dual interior-point relaxation method for nonlinear programs with general equality and nonnegative constraints. In each iteration, our method approximately solves a mini-max subproblem. A new smoothing approach is introduced to develop our relaxation method and promote convergence of the method. Under suitable conditions, it is proved that our method can be globally convergent and locally quadratically convergent to the KKT point of the original problem. The preliminary numerical results on a well-posed problem for which many interior-point methods fail to find the minimizer and a set of test problems from the CUTEr collection show that our method is efficient.

2. Amanda Caroline Silva (Universidade Federal de Minas Gerais)

   Title: A switching reconstruction problem for signed graphs

   Abstract: Let G be a graph. Consider the multiset of all *unlabelled* graphs obtained by deleting a vertex v of G together with all the edges incident with v. This multiset is called the collection of vertex-deleted subgraphs or the deck of G. The Reconstruction Conjecture asserts that every finite simple graph, with at least three vertices, is determined, up to isomorphism, by its collection of unlabelled vertex-deleted subgraphs. This conjecture was first formulated in 1941, by Kelly and Ulam.

   In 1964, Harary proposed the edge reconstruction conjecture, an edge analogue of the Reconstruction Conjecture. This conjecture says that a finite simple graph with at least four edges is determined, up to isomorphism, by its collection of unlabelled edge-deleted sub- graphs, also called the edge deck.

   We will consider a variation of the reconstruction problems. Let X be a finite simple graph. We call (G, X) signed graph with underlying unsigned graph X. We set G as the spanning subgraph of X such that each edge in G is a positive edge in X and each edges in $E(X)\backslash E(G)$ is a negative

edge in X. We denote by $(G, X)_e$ the graph obtained by switching the sign on e. The multiset $\{(G, X)_e | e \in E(G)\}$ is called signed deck.

Problem: Is (G, X) determined, up to isomorphism, from the signed deck?

Important questions about reconstruction problems is ask about the reconstructibility of classes of graphs, that is, given a class of graphs, any graph in this class is determined, up to isomorphism, from the deck? For example, regular graphs, disconnected graphs and trees are reconstructible (see [2]). Our main goal is show that if (G, X) is a signed graph such that G is a spanning tree, then (G, X) is reconstructible from the signed deck.

References

[1] J. A. Bondy, R. L. Hemminger Graph reconstruction—a survey. J. Graph Theory, 1, 227-268, 1977.

[2] P. J. Kelly, A congruence theorem for trees. Pacific Journal of Mathematics, 7, 961-968, 1957.

3. Elvis Alexander Aguero Vera (UNILA)

Title: Impact of a rigid sphere onto an elastic membrane

Abstract: We study the axisymmetric impact of a rigid sphere onto an elastic membrane theoretically and experimentally. We derive governing equations from first principles and impose natural kinematic and geometric constraints for the coupled motion of the sphere and the membrane during contact. The free boundary problem of finding the contact surface, over which forces caused by the collision act, is solved by an iterative method. This results in a model that produces detailed predictions of the trajectory of the sphere, the deflection of the membrane, and the pressure distribution during contact. Our model predictions are validated against our direct experimental measurements. Moreover, we identify new phenomena regarding the behaviour of the coefficient of restitution for low impact velocities, the possibility of multiple contacts during a single rebound, and energy recovery on subsequent bounces. Insight obtained from this model problem in contact mechanics can inform ongoing efforts towards the development of predictive models for contact problems that arise naturally in multiple engineering applications.

4. Di Liu (IMPA)

Title: A successive centralized circumcentered-reflection method for the convex feasibility problem

Abstract: In this talk, we present a successive centralization process for the circumcentered-reflection scheme with several control sequences

for solving the convex feasibility problem in Euclidean space. Assuming that a standard error bound holds, we prove the linear convergence of the method with the most violated constraint control sequence. Moreover, under additional smoothness assumptions on the target sets, we establish the superlinear convergence. Numerical experiments confirm the efficiency of our method.

C2. Session 2
Monday, 17th, 4:40pm; Argentina Room

Chair: Jonny Ardila (UNILA)

Speakers:

1. Benigno Oliveira Alves (Universidade Federal da Bahia)

   Title: Isoparametric Functions and Mean Curvature in manifolds with Zermelo navigation

   Abstract: The generalized Zermelo navigation problem looks for the shortest time paths in an environment, modeled by a Finsler manifold (M, F), under the influence of wind or current, represented by a vector field W . The main objective of this paper is to investigate the relationship between the isoparametric functions on the manifold M with and without the presence of the vector field W.

2. Newton Mayer Solórzano Chávez (UNILA)

   Title: On cylindrical symmetric projectively flat Finsler metrics

   Abstract: We study the cylindrical symmetric Finsler metrics. We obtain the system of differential equations of such metrics which are projectively flat. We give a family of solutions of this system. Examples are included.

C3. Session 3
Friday, 21st, 10:40pm; Brazil Room

Chair: Rômulo Maia Vermersch (UFSC)

Speakers:

1. Rodrigo dos Santos Pacheco (Universidade Federal do Paraná)

   Title: Equality between the first optimal Riemannian and Euclidean constants of r-entropy

   Abstract: Let (M, g) be a compact, smooth, boundless Riemannian manifold with dimension $n \geq 2$ and parameters $1 < r \leq p < n$ and $1 \leq \tau \leq \{2, p\}$. Let us consider the Euclidean optimal inequality of r-entropy:

   $$\int_{\mathbb{R}^n} |u|^r \log |u|^r dx \leq \frac{nr}{np - nr + pr} \log \left(A_e(p, r) \int_{\mathbb{R}^n} |\nabla u|^p dx \right),$$

   for all $u \in W^{1,p}(\mathbb{R}^n)$ such that $\|u\|_{L^r(\mathbb{R}^n)} = 1$. Let be the Riemannian inequality of r-entropy, that is, for every function $u \in H^{1,p}(M)$ such that $\|u\|_{L^r(M)} = 1$,

   $$\int_M |u|^r \log |u|^r dv_g \leq \frac{npr}{tau(r(p-n) + np)} \log \left(A \left(\int_M |\nabla_g u|^p dv_g \right)^{\frac{\tau}{p}} + B \left(\int_M |u|^p dv_g \right)^{\frac{\tau}{p}} \right).$$

   Defining the first optimal Riemannian constant of r-entropy by:

   $A_{ent} = \inf\{A \in \mathbb{R};$ exists $B \in \mathbb{R}$ such that the r-entropy inequality is valid$\}$,

   we prove that the first optimal Riemannian constant of r-entropy does not depend on the metric g, and

   $$A_{ent}^{\frac{p}{\tau}} = A_e(p, r),$$

   where $A_e(p, r)$ is the Euclidean optimal r-entropy constant.

2. Duokui Yan (Beihang University)

   Title: Normalized solutions of nonlinear Schrodinger equations with critical exponential growth

   Abstract: We are concerned with the following nonlinear Schrödinger equation

   $$\begin{cases} -\Delta u + \lambda u = f(u) \text{ in } \mathbb{R}^2, \\ u \in H^1(\mathbb{R}^2), \quad \int_{\mathbb{R}^2} u^2 dx = \rho, \end{cases}$$

where $\rho > 0$ is given, $\lambda \in \mathbb{R}$ arises as a Lagrange multiplier and f satisfies an exponential critical growth. Without assuming the Ambrosetti-Rabinowitz condition, we show the existence of normalized ground state solutions for any $\rho > 0$. The proof is based on a constrained minimization method and the Trudinger-Moser inequality in $\mathbb{R}^2$.

3. André Magalhães de Sá Gomes (UNICAMP)

   Title: On Rigidity of Curvature Bounds of Quotient Spaces Of Isometric Actions

   Abstract: Let $G \curvearrowright M$ be an isometric action of a Lie Group on a complete orientable Riemannian manifold. We disintegrate absolutely continuous measures with respect to the volume measure of M along the principal orbits of $G \curvearrowright M$ and define a functional on the probability measures with support on the principal orbits of the action to further prove that the convexity properties of this functional guarantees necessary and sufficient conditions to the Ricci curvature of M to be bound below by a given real number K.

4. Rômulo Maia Vermersch (UFSC)

   Title: Local entropy theory on the space of probability measures

   Abstract: Let (X, T) be a topological dynamical system consisting of a compact metric space X and a continuous surjective map $T : X \to X$. By using local entropy theory, we prove that (X, T) has uniformly positive entropy if and only if so does the induced system $(M(X), T)$ on the space of Borel probability measures endowed with the weak* topology. This result can be seen as a version for the notion of uniformly positive entropy of the corresponding result for topological entropy due to Glasner and Weiss.

C4. Session 4
Friday, 21st, 2:00pm; Paraguay Room

Chair: Orizon Pereira Ferreira (Universidade Federal de Goiás)

Speakers:

1. Ling Zhou (Southwestern University of Finance and Economics)

Title: Distributed Inference in the Cox Proportional Hazards Model via the Ordinary Differential Equation Approach

Abstract: Partial likelihood is the method of choice for parameter estimation and inference in the Cox proportional hazards model for time-to-event survival data, where the risk set plays an important in the formulation of the likelihood function. In a distributed data setting without a centralized operation, sharing subject-level raw survival data across study sites is prohibited, so it is impossible to calculate overall individual ranks of survival times for all subjects collected from different sites. This impairs the conventional partial likelihood method in the paradigm of distributed inference. In this work, we propose a solution to overcome this open technical problem. Utilizing the ordinal differential equation representation of the Cox model, we consider a semiparametric likelihood estimation and inference in that the risk set is no longer needed in our statistical analytics. As a result, a distributed inference is established in the semiparametric framework where key large sample theoretical guarantees are justified. Numerical implementation and illustration are given to evaluate the performance of our distributed inference methodology. We also apply the proposed method to analyze a graft survival data.

2. Yun Yang (Northeastern University, Shenyang, China)

Title: The heat flow in affine-related geometry

Abstract: In this talk, I will present some results about the heat flow in affine-related geometry. The local existence, uniqueness, and long-term behavior of this general-affine heat flow are considered, and a complete classification of the solitons for general affine heat flow is provided.

Poster sessions

Monday 17th, from 3:50pm to 4:40pm; Mezanino

1. Ana Livia Rodero (ICMC/USP)

   Title: On the existence and nonexistence of isolated invariant cones for some polynomial classes of 3-D PSVF with invariant spheres

   Abstract: Let $\mathcal{X}$ be the class of 3-dimensional piecewise smooth vector fields (PSVF) that admits the fist integral $H(x, y, z) = x^2 + y^2 + z^2$ which leaves invariant any sphere centered at the origin.

   In this presentation, it will be shown that a linear vector field in the class $\mathcal{X}$ does not admit isolated invariant cones. It also will be provided that quadratic homogeneous vector fields in this class can present isolated and non-isolated invariant cones. It shows an important difference between piecewise linear and quadratic homogeneous vector fields in our class of interest. These results are part of [1].

   References

   [1] C. A. Buzzi, A. L. Rodero, J. Torregrosa 3-dimensional piecewise linear and quadratic vector fields with invariant spheres, Preprint, 2023.

2. Anderson José de Oliveira (Federal University of Alfenas)

   Title: Algebraic characterization associated with the genus 3 of $C_{2,8}$ channel quantization

   Abstract: For the development of a more reliable and less complex digital communication system, we can use an important topological invariant known as genus g of an oriented compact surface, where the set of points (set of signals) is. In this work it will be considered the steps to be followed in the analysis and interpretation of the quantization problem related to the $C_{2,8}$ channel, where the Fuchsian differential equations and the generators of the Fuchsian groups associated with the specific case $g = 3$ are presented. In order to obtain these results, it is necessary to determine the genus g of each surface which this channel may be embedded. After that, the procedure is to determine the algebraic structure (Fuchsian group generators) associated with the fundamental region of each surface. For this, there is an associated linear second order Fuchsian differential equation whose linearly independent solutions provide the generators of this Fuchsian group. The objective of this work is to present the specific case, related to the genus $g = 3$, due some specificities. These structures were identified into two situations, obtaining a characterization associated

with the quantization of the channel.

3. Antonio Wilson Rodrigues da Cunha (Universidade Federal do Piauí)

   Title: Obstructions on the scalar curvature of Einstein solitons via weak maximmum principle

   Abstract: In this poster we will present some conditions that assure that the scalar curvature of Einstein solitons must be constant, forcing that Einstein soliton must indeed be a Ricci soliton and, in some special cases, trivial. In addition, we obtain some sufficient conditions for the validity of a weak maximum principle for the weighted Laplacian over the soliton. As a consequence, we get triviality and uniqueness results, as well as estimates for the scalar curvature.

4. Beatriz Catarene Rabelo de Carvalho (USP)

   Title: Phase portraits of completely symmetric centers

   Abstract: The symmetries have applications in mathematics and in many areas of physics [2]. For example, the existence of a special type of symmetry serves as a tool in the problem known as the Center-Focus problem. In this work, we classify the phase portraits of the symmetric vector fields with respect to the group of four involutions $\{i_1, i_2, -id, id\}$, so-called completely symmetric centers vector fields in [3], where $i_1 : (x, y) \mapsto (-x, y)$, $i_2 : (x, y) \to (x, -y)$ and id is the identity in the plane, showing that these phase portraits are two kind of global centers in the Poincaré disc [1].

5. Claudio Gomes Pessoa (IBILCE/UNESP)

   Title: On the Dulac's problem for monodromic singular points from planar piecewise analytical differential systems

   Abstract: Consider an analytical function $f\colon V subset \mathbb{R}^2 \to \mathbb{R}$ having 0 as its regular value, a switching manifold $\Sigma = f^{-1}(0)$ and a piecewise analytical vector field $X = (X^+, X^-)$, i.e. $X^{\pm}$ are analytical vector fields defined on $\Sigma^{\pm} = \{p \in V : \pm f(p) > 0\}$. We characterize when the vector field X has a monodromic singular point in Σ, called Σ-monodromic singular point. Moreover, under certain conditions, we show that a Σ-monodromic singular point of X has a neighborhood free of limit cycles.

6. Emanuel Mendonça Viana (Instituto Federal de Educação, Ciência e Tecnologia do Ceará - IFCE)

   Title: Critical metrics on 4-manifolds with harmonic anti-self dual Weyl tensor

   Abstract: In this poster, we study 4-dimensional simply connected, compact critical metric of the volume functional with harmonic anti-self dual Weyl tensor. We show that a 4-dimensional simply connected, compact critical metric of the volume functional with harmonic anti-self dual Weyl tensor and satisfying a suitable pinching condition is isometric to a geodesic ball in a simply connected space form R4, H4 or S4.This work can be found at the link: https://doi.org/10.1016/j.geomphys.2021.104434

Tuesday 18th, from 3:50pm to 4:40pm; Mezanino

7. Giovana Melo dos Santos (State University of Maringá)

   Title: The Constrained Knapsack Problem

   Abstract: "The Knapsack Problem (KP) is a classic Operations Research problem widely studied in Optimization. Numerous versions of the KP exist with additional hypotheses included. We present in this work three exact algorithms to solve the Hunger Games Problem (HGP), a constrained version of the Knapsack Problem (KP), which can be seen as a special case of the Capacitated Team Orienteering Problem (CTOP) and interpreted as the Elementary Shortest Path Problem with Resource Constraints. The HGP is stated as follows: a girl, Katniss, needs to survive one night in the forest and has n items available in her surroundings. Each item has a weight and a survival value. Katniss looks forward to maximizing her chance of survival being capable of carrying at most K kg in her knapsack and having at most T minutes to collect items. The desirable solution, the optimal set of items that respect the restrictions of capacity and maximum travel time and maximizes the survival value, can be derived exactly. We modeled and solved the HGP using linear and integer programming and dynamic programming approaches, including a label correcting algorithm, in the Julia language and JuMP modeling language."

8. Halyson Irene Baltazar (Universidade Federal do Piauí)

   Title: Critical metrics of the volume functional with harmonic Weyl tensor

   Abstract: The aim of this poster is to explain about the space of smooth Riemannian structures on compact manifolds with boundary that satisfies a critical point equation associated with a boundary value problem, that is, critical metrics of the volume functional introduced by Miao and Tam. Here, we will give the complete classification of such critical metrics with harmonic Weyl tensor, which improves the corresponding classification for complete locally conformally flat case, due to Miao and Tam.

9. Iullia Gorginian (IMPA)

   Title: Flat hypercomplex nilmanifolds are quaternionic-solvable

   Abstract: A hypercomplex structure on a Lie algebra is a triple of integrable complex structures satisfying the quaternionic relations. We call a hypercomplex nilpotent Lie algebra quaternionic-solvable if there exists a solvable filtration by quaternionic-invariant subalgebras. In the previous work we showed that for a general complex structure L induced by quaternions, there are no complex curves in a complex manifold (N, L). We conjectured that all hypercomplex structures on nilpotent Lie algebras are quaternionic-solvable. In this work we prove the following theorem. Let N be a hypercomplex nilmanifold with the flat Obata connection. Then the corresponding Lie algebra is quaternionic-solvable.

10. Júlia Demori Guizardi (Universidade Estadual de Maringá)

    Title: Efficient updates to matrix factorization

    Abstract: "Let Ax = b be a matrix system. The LU factorization and QR factorization are very efficient ways to solve linear systems. Both of them consist in factorizing A into two matrices, inducing the solution of the system to be a plainer job. They also allow to modify A and still being able to find the solution of the system without the need to factorize the new coefficient matrix. In these work, the two updating forms were studied and implemented using Julia language. The algorithms are quite efficient as they have low running time and low memory cost."

11. Lucas Roberto de Lima (UFABC)

Title: Speed of Convergence in First-Passage Percolation on Random Geometric Graphs

Abstract: First-passage percolation models are stochastic processes that model the spread of information or disease through a network. We consider random geometric graphs, which are constructed by a Poisson point process where two vertices are connected if they are within a fixed distance r of each other. We analyze the time it takes for the disease to spread and the main result is a quantitative shape theorem for the process, which improves our previous result under additional conditions. The analysis is based on techniques from probability theory and geometry. This work is being conducted in collaboration with C.F. Coletti and D. Valesin.

12. Luke Naylor (University of Edinburgh)

Title: Explicit formulae for bounds on ranks of Bridgeland pseudo-semistabilizers for complexes of sheaves on surfaces

Abstract: Furthering work done by Benjamin Schmidt who built software to list all pseudo-semistabilizers when there are known to be finitely many for a given Chern character, I work on optimizing this process which can sometimes be quite slow. This is not only useful for narrowing down the possibilities for Bridgeland-semistabilizers on Picard rank 1 surfaces, but also has applications for finding Lambda semistabilizers on threefolds when the associated wall intersects a certain characteristic curve. The main area of optimization is reducing the range of ranks which are tested for pseudo-semistabilizers, as currently the range is much much larger than the range which end up actually having pseudo-semistabilizers. Some results lead to practical formulae usable when finding objects by hand, others more complicated, better used for software.

13. Márcio Ricardo Alves Gouveia (IBILCE - UNESP)

Title: Hiperbolicity of renormalizaton for dissipative gap mappings

Abstract: "A gap mapping is a discontinuous interval mapping with two strictly increasing branches that have a gap between their ranges. They are one-dimensional dynamics systems, which arise in the study of certain higher dimensional flows, for example the Lorenz flow and the Cherry flow. Here we prove hyperbolicity of renormalization acting on C^3 dissipative gap mappings, and show that the topological conjugacy classes

of infinitely renormalizable gap mappings are C^1 manifolds."

Thursday 20th, from 3:50pm to 4:40pm; Mezanino

14. Marta Helena de Oliveira (Universidade Federal de Uberlânida)

    Title: A simple mathematical model to predict skin wound retraction time

    Abstract: Non-healing wounds are an important health problem. It is a multidisciplinary research area with has many challenges and open problems which can be analyzed and solved via mathematical techniques. In order to contribute to the optimization of the laboratory experimentation process we propose, in this work, a simple mathematical model to estimate the time required for rats skin wound healing. This model is based on biological experiments of the second intention wound on the Wistar rats back considering four different treatments: Lanette Cream (negative control), Collagenase (positive control), 10% Hydroalcoholic Extract (10% HE), and 10% Oil-resin (10% OR) Copaifera Langsdorffii. The wounds treated by Copaifera Langsdorffii creams were scared in 14 days, according to empirical data, however, the results of the controls during the laboratory experiments were not possible to obtain and we used the mathematical model as a tool to predict it. The wounds area reduction over time can be determined through the macroscopic analysis of it. The wounds boundaries were delimited by photos planimetry and the percentage of wound area retraction was calculated. The empirical data of wound retraction in a normal skin wound healing process have nonlinear, sigmoidal, and increasing dynamics. This leads us to apply Verhulst's logistic equation to model the wound retraction percentage (y) as a function of time (t). The constants r and k are the growth rate and saturation level (nontrivial equilibrium point), respectively. At the beginning of the process, there is no wound retraction area thus the initial value is y(0)=0 for all cases. Analytic techniques solved the ordinary differential equation, and the Levenberg-Marquardt method estimated the parameters for all treatments. These values allowed us to analyze the intrinsic characteristics of each cream and the fit result is illustrated in the figure (1).

15. Otavio Henrique Perez (ICMC-USP)

    Title: Some properties of linear and nonlinear regularizations of piecewise smooth vector fields

Abstract: Consider a planar piecewise smooth vector field $Z = (X, Y)$ whose descontinuity locus Σ is a smooth curve that divides a neighbourhood of $0 \in \mathbb{R}^2$ in two open regions. In each open region, it is defined a smooth vector field. We study *linear* and *nonlinear* regularizations of Z, and the transition function φ adopted in the linear regularization may be monotonic or not. It is a well-known fact that the regularized vector field Z_ε^φ is a slow-fast system. The contribution of this work is to relate properties of Z_ε^φ with properties of the transition function φ, and to study slow-fast singularities that arise from these regularizations.

This work is supported by S ao Paulo Research Foundation (FAPESP) grant 2021/10198-9.

16. Paulo Henrique Reis Santana (UNESP - São José do Rio Preto)

    Title: Polycycles on non-smooth planar vector fields

    Abstract: We extend the main results about polycycles (also known as graphs) of planar smooth vector field to planar non-smooth vector fields (also known as piecewise vector fields, or Filippov systems). The polycycles considered here may contain hyperbolic saddles, semi-hyperbolic saddles, saddle-nodes and tangential singularities of any degree. We determine when the polycycle is stable or unstable. We prove the bifurcation of at most one limit cycle in some conditions and at least one limit cycle for each singularity in other conditions. We also give the bifurcation diagram of the polycycles composed of a hyperbolic saddle and a quadratic-regular tangential singularity.

17. Ricardo Martins Mendes Guimaraes (State University of Campinas - UNICAMP)

    Title: On the self-similar blowup for the non-dissipative generalized SQG equation

    Abstract: We consider locally self-similar solutions for the inviscid generalized SQG equation in R^2. Under an L^q growth assumption on the self-similar profile and its gradient, we identify appropriate ranges of the self-similar parameter where the profile is either identically zero (no blowup), or its L^p asymptotic behavior can be characterized, for suitable p. This is a joint work with A. Bronzi (Unicamp) and C. Mondaini (Unicamp).

18. Tiago Rodrigo Perdigão (UFABC)

Title: Zero-time discontinuity mapping (ZDM) and Poincaré-section discontinuity mapping (PDM) for regular grazing points of order 4.

Abstract: One of the most common analyzed types of discontinuity-induced bifurcations (DIBs) in applications is caused by a limit cycle of a flow becoming tangent to (i.e. grazing) with a discontinuity variety. We investigated the study of bifurcations of grazing-type periodic orbits, locally in the vicinity of a regular grazing point of order 4, for this, we consider the calls applied to ZDM (Zero Time Discontinuity Mapping) and PDM (Poincaré Discontinuity Mapping). Thus, in this work we will demonstrate the expressions for the Zero Time Discontinuity Mapping (ZDM) and for the Poincaré-section discontinuity mapping (PDM), for a regular grazing point of order 4.

19. Xue Gao (Hebei University of Technology)

Title: A golden ratio Bregman proximal gradient algorithm for nonconvex optimization problems with abstract set

Abstract: This presentation focuses on solving the nonconvex nonsmooth minimization problem over abstract set, whose objective function is the sum of a proper lower semicontinuous convex function and a smooth nonconvex function, and the differentiable part is freed from the restrictive assumption of global Lipschitz gradient continuity. By combining the proximal regularization and extrapolation strategies, we propose a golden ratio Bregman proximal gradient algorithm (GBPG for short), where the geometry of the abstract set and the function is captured by employing generalized Legendre function. In theory, we prove that each bounded sequence generated by GBPG globally converges to the critical point of the considered problem, under the assumption that the underlying function satisfies the Kurdyka-Lojasiewicz property. Finally, to illustrate computational effectiveness of our algorithm GBPG, we apply it to solve the standard phase retrieval and the Poisson linear inverse problems and make comparisons with some existing methods.

20. Yingjian Liu (IMPA)

Title: Log-Holder continuity of Lyapunov exponents of random $GL(2)$-cocyles

Abstract: The Lyapunov exponents of random GL(2)-cocycles are pointwise Log-Holder continuous functions of the underlying probability measure.