XII Workshop on

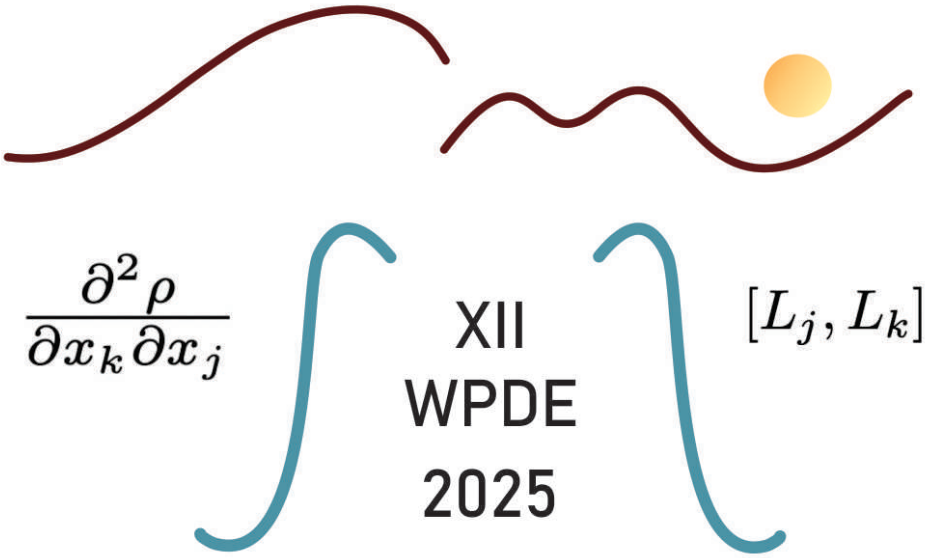
Geometric Analysis of PDEs and Several Complex Variables

Celebrating the mathematics of X. Huang

Program and book of abstracts

For up-to-date info, check:
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August 4 – 8, 2025
Serra Negra, SP, Brazil



Radio Hotel, Serra Negra
August 04 - 08

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Speakers

- Florian Bertrand (American University of Beirut)
- Nicholas Braun Rodrigues (State University of Campinas)
- Gregorio Chinni (Università di Bologna)
- Giuseppe Della Sala (American University of Beirut)
- Peter Ebenfelt (University of California at San Diego)
- Siqi Fu (Rutgers University)
- Xianghong Gong (University of Wisconsin – Madison)
- Alex Himonas (University of Notre Dame)
- Sung-Yeon Kim (Institute of Basic Science, Daejeon, S. Korea)
- Ilya Kossovskiy (Southern University of Sci. and Tech., China)
- Song-Ying Li (University of California at Irvine)
- Xiaoshan Li (Wuhan University)
- Gerardo Mendoza (Temple University)
- Hamid Meziani (Florida International niversity)
- Andreea Nicoara (Trinity College, Ireland)
- Stéphanie Nivoche (Université Côte d'Azur)
- Vinícius Novelli da Silva (University of São Paulo)
- Alberto Parmeggiani (Università di Bologna)
- Andrew Raich (University of Arkansas)
- Min Ru (University of Houston)
- Laurent Stolovitch (Université Côte d'Azur)

- Emil Straube (Texas A&M University)
- Ming Xiao (University of California at San Diego)
- Weixia Zhu (University of Vienna)

Poster session

- Alexandre Arias Junior (University of São Paulo)
- André Pedroso Kowacs (University of São Paulo)
- Antonio Victor da Silva Junior (Hamad bin Khalifa University)
- Bruno de Lessa Victor (Federal University of Santa Catarina)
- Camilo Campana (Federal University of Santa Catarina)
- Catarina Barbosa Machado (Federal University of São Carlos)
- Evandro Raimundo da Silva (University of São Paulo)
- Fernando de Ávila Silva (Federal University of Paraná)
- Giuliano Zugliani (State University of Campinas)
- Halit Sevki Aslan (University of São Paulo)
- Igor Ambo Ferra (Federal University of São Carlos)
- Isadora Vieira Coelho da Silva (University of São Paulo)
- Joel Coacalle (University of São Paulo)
- Luís Antônio Carvalho dos Santos (Federal University of São Carlos)
- Luis Fernando Ragognette (Federal University of Minas Gerais)
- Luís Márcio Salge (State University of Rio de Janeiro)
- Marcelo Rempel Ebert (University of São Paulo)
- Max Reinhold Jahnke (University of Cologne)
- Paulo Domingos Cordaro (University of São Paulo)
- Paulo Leandro Dattori da Silva (University of São Paulo)
- Rafael Kapp (Federal University of São Carlos)

- Renan Dantas Medrado (Federal University of Alagoas)
- Renata de Oliveira Figueira (State University of Campinas)
- Ricardo Paleari da Silva (State University of Paraná)
- Stefan Fürdös (University of Vienna)
- Victor Sandrin Biliatto (University of São Paulo)
- Wagner Augusto Almeida de Moraes (Federal University of Paraná)

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- Sérgio Luís Zani — University of São Paulo, Brazil

Program

Monday

09:00 – 09:50	M. Xiao
10:00 – 10:20	*Coffee break*
10:20 – 11:10	W. Zhu
11:20 – 12:10	I. Kossovskiy
15:00 – 15:50	A. Parmeggiani
16:00 – 16:20	*Coffee break*
16:20 – 17:10	G. Chinni

Tuesday

09:00 – 09:50	S. Nivoche
10:00 – 10:20	*Coffee break*
10:20 – 11:10	A. Meziani
11:20 – 12:10	S.-Y. Li
15:00 – 15:50	A. Nicoara
16:00 – 16:20	*Coffee break*
16:20 – 17:10	X. Gong
17:20 – 18:10	X. Li

Wednesday

09:00 – 09:50	L. Stolovitch
10:00 – 10:20	*Coffee break*
10:20 – 11:10	E. Straube
11:20 – 12:10	V. Novelli
Afternoon	Poster session

Thursday

09:00 – 09:50 M. Ru
10:00 – 10:20 *Coffee break*
10:20 – 11:10 S.-Y. Kim
11:20 – 12:10 A. Himonas

15:00 – 15:50 G. Mendoza
16:00 – 16:20 *Coffee break*
16:20 – 17:10 S. Fu
17:20 – 18:10 G. Della Sala

Friday

10:20 – 11:10 N. Braun Rodrigues
11:20 – 12:10 F. Bertrand

15:00 – 15:50 A. Raich
16:00 – 16:20 *Coffee break*
16:20 – 17:10 P. Ebenfelt

Talks

Florian Bertrand

On the 1-jet determination of stationary discs

Abstract: We know from the work of Lempert that stationary discs play an important role in the geometry of domains and their boundary. Such discs have been later considered and used by many authors, in particular in relation with the jet determination of CR automorphisms. In this context, the idea is to construct a family of stationary discs that enjoy relevant geometric properties. In this talk, I will focus on their 1-jet determination, present recent results and their consequences for nondegenerate CR submanifolds. This is joint work with F. Meylan.

Nicholas Braun Rodrigues

Regularity of infinitesimal automorphisms of involutive structures

Abstract: In this work, we prove that infinitesimal automorphisms of an involutive structure are smooth. For this, we build a regularity theory for sections of vector bundles over an involutive structure $(M, \mathcal{V})$ endowed with a connection compatible with $\mathcal{V}$, which we call $\mathcal{V}$-connection. We show that $\mathcal{V}$-sections, i.e. sections which are parallel with respect to $\mathcal{V}$ under the $\mathcal{V}$-connection, satisfy an analogue of Hans Lewy's theorem as formulated For CR functions on an abstract CR manifold by Berhanu and Xiao, and introduce certain (generically satisfied) nondegeneracy conditions ensuring their smoothness.

Gregorio Chinni

On the Gevrey regularity for a sum of squares in two variables

Abstract: We prove a Gevrey regularity result for an operator of the type "sum of squares of two vector fields" in two variables. We assume that Hörmander bracket condition is satisfied and proves that if $Pu = g$, g real analytic, then u is Gevrey s. The number s is explicitly computed from the minimum slope of the edges of the Newton polygon of f, where $P = D_x^2 + (f(x,y)D_y)^2$ and $f(0,0) = 0$. This is a joint work with Antonio Bove.

Giuseppe Della Sala

The Borel map on hypersurfaces of $\mathbb{C}^2$

Abstract: The Borel map $\mathfrak{b}_p$ on a real submanifold M of $\mathbb{C}^n$ assigns to each smooth CR function defined on M its (formal) Taylor expansion at a given point p. In certain situations, the behavior of the Borel map differs sharply from the case of holomorphic functions: for instance, if M is a strongly pseudoconvex hypersurface, then $\mathfrak{b}_p$ is surjective. This can be proved by exploiting the existence of smooth CR peak functions at p. However, in general the existence of such a function is not guaranteed if M is merely pseudoconvex. A refinement of previous constructions leads, nevertheless, to the proof of the surjectivity of $\mathfrak{b}_p$ by using families of "approximate" peaks, which in turns allows to get a bit closer to a complete picture for the class of real-analytic hypersurfaces of $\mathbb{C}^2$, in view of the various known results describing their geometry. This is ongoing work with P. Cordaro and B. Lamel.

Peter Ebenfelt

Bergman metrics of constant curvature and Bergman-negligible subsets

Abstract: A classical theorem by Qi-Keng Lu from 1965 states that if D is a bounded domain in $\mathbb{C}^n$ such that its Bergman metric is complete and has constant holomorphic sectional curvature, then D is biholomorphic to the unit ball $\mathbb{B}^n \subset \mathbb{C}^n$. There have been recent developments, notably by X. Dong–B. Wong and X. Huang–S.-Y. Li, on classifying bounded domains D whose Bergman metrics have constant holomorphic sectional curvature but are not necessarily complete. We shall discuss this more general classification problem and present some new result in this direction obtained by the speaker jointly with J. Treuer and M. Xiao, including a definitive result for bounded domains: *The Bergman metric of a bounded domain $D \subset \mathbb{C}^n$ has constant holomorphic sectional curvature if and only if D is biholomorphic to the unit ball $\mathbb{B}^n$ minus a Bergman-negligible subset.* The terminology *Bergman-negligible subset* will be explained in the talk.

Siqi Fu

Hearing pseudoconvexity in complex projective space

Abstract: For a bounded pseudoconvex domain Ω in $\mathbb{C}^n$, it follows from Hörmander's L^2-existence theorem for the $\bar{\partial}$-operator that the spectrum of the $\bar{\partial}$-Neumann Laplacian is positive on (p,q)-forms for all $0 \leq p \leq n$ and $1 \leq q \leq n$. The converse of Hörmander's theorem also holds, as a consequence of sheaf cohomology theory, under the assumption that the interior of the closure of Ω is the domain itself. The study of existence and regularity for the $\bar{\partial}$-operator in $\mathbb{CP}^n$ encounters several difficulties, chief among them the lack of strongly plurisubharmonic exhaustion functions. In this talk, we show how one can determine pseudoconvexity/pseudoconcavity of domains in $\mathbb{CP}^2$ from the spectrum of the $\bar{\partial}$-Neumann Laplacian. This talk is based on joint work with Mei-Chi Shaw.

Xianghong Gong

A homotopy formula for a_q domains in complex manifolds

Abstract: We construct a global homotopy formula for a_q domains in a complex manifold. The homotopy operators in the formula will gain $1/2$ derivative in Hölder-Zygmund spaces Λ^r when the boundaries of the domains are in Λ^{r+3} with $r > 0$. This is joint work with Ziming Shi.

Alex Himonas

Solving KdV type equations with analytic initial data

Abstract: The study of global analyticity in the space variable for Korteweg-de Vries type equations has a long history. The first results for gKdV were obtained in 1986 by Kato and Masuda via a general theorem on abstract nonlinear evolution equations, by using a class of Liapunov functions. For the radius of spatial analyticity of KdV and mKdV, they proved lower bounds with exponential decay. These results were improved in later years by many authors, obtaining lower bounds with polynomial decay, by using multilinear estimates in Bourgain spaces and almost L^2 conservation laws. In this talk we shall discuss some progress on this important problem. Even for the well-known and well-studied KdV, the persistence of its radius of spatial analyticity remains an open question. The talk is based on work with S. Selberg, H. Kalisch, G. Petronilho, F. Yan, R. Barostichi, and R. Figueira.

Sung-Yeon Kim

Rationality of proper holomorphic maps between bounded symmetric domains

Abstract: In this talk, we study the rationality of a proper holomorphic map $f\colon \Omega \to \Omega'$ between irreducible bounded symmetric domains Ω and Ω' that maps Shilov boundary to Shilov boundary. More precisely, we show that if Ω and Ω' are of type one with rank greater or equal to two and $f\colon \Omega \to \Omega'$ extends smoothly to the boundary sending Shilov boundary to Shilov boundary, then f is of the form $f = \imath \cdot F$, where $F = F_1 \times F_2\colon \Omega \to \Omega'_1 \times \Omega'_2$, Ω'_1, Ω'_2 are bounded symmetric domains, $F_1\colon \Omega \to \Omega'_1$ is a rational proper holomorphic map, $F_2 : \Omega \to \Omega'_2$ is not proper, and $\imath\colon \Omega'_1 \times \Omega'_2 \to \Omega'$ is a totally geodesic holomorphic isometric embedding with respect to canonical Kähler-Einstein metrics. Moreover if Ω is not of tube type, then f is a rational map.

Ilya Kossovskiy

Stokes Phenomenon in CR geometry

Abstract: In our joint work with Shafikov (2016), we proved that the formal versus holomorphic equivalence problems in CR geometry are distinct. This shows, in particular, that CR geometry enjoys the Stokes Phenomenon: the existence of additional holomorphic invariants supplementing a formal normal form. Describing the Stokes phenomenon explicitly has been an open problem since then. In our joint work with Laurent Stolovitch, we make a significant progress in solving this problem. In particular, we show that the respective (formal versus holomorphic) moduli space of analytic CR hypersurfaces in $\mathbb{C}^2$ is, somewhat surprisingly, finite-dimensional (and generically empty). The construction that we use is based on the Multisummability theory in Dynamical Systems.

Song-Ying Li

Manifolds with constant holomorphic sectional curvature in Bergman metrics

Abstract: In this talk, we study domains in $\mathbb{C}^n$ or Stein manifolds M such that their Bergman metrics have constant holomorphic sectional curvature κ. We prove a niformization theorem when $\kappa \leq 0$. We will also provide some other informations. This is joint work with X. Huang (Rutgers).

Xiaoshan Li

Semi-classical asymptotics of partial Bergman kernels on $\mathbb{R}$-symmetric complex manifolds with boundary

Abstract: Let M be a relatively compact connected open subset with smooth connected boundary of a complex manifold M'. Let $(L, h) \to M'$ be a positive holomorphic line bundle over M'. Suppose that M' admits a holomorphic $\mathbb{R}$-action which preserves the boundary of M and lifts to L. We establish the asymptotic expansion of a partial Bergman kernel associated to a package of Fourier modes of high frequency with respect to the $\mathbb{R}$ -action in the high powers of L. As an application, we establish an $\mathbb{R}$-equivariant analogue of Fefferman's and Bell-Ligocka's result about smooth extension up to the boundary of biholomorphic maps between weakly pseudoconvex domains in $\mathbb{C}^n$. Another application concerns the embedding of pseudoconcave manifolds. This talk is based on a joint work with George Marinescu and Chin-Yu Hsiao.

Gerardo Mendoza

Equivariant elliptic cohomology

Abstract: Let $\mathcal{N}$ be a compact manifold with an elliptic structure $\mathcal{V}$ whose real subbundle is the span of a given vector field $\mathcal{T}$ which preserves some Riemannian metric. I plan to discuss the cohomology spaces of an open subset $\Omega \subset \mathcal{N}$ whose boundary $\mathcal{X}$ is smooth and invariant under $\mathcal{T}$. The basic assumptions are that $\mathcal{V}$ dominates a $\mathcal{T}$-invariant non-degenerate definite CR structure and $\mathcal{X}$ has a nonnegative Levi form whose kernel is spanned by $\mathcal{T}$.

Abdelhamid Meziani

Hypocomplex structures satisfying a Łojasiewicz inequality

Abstract: In this talk we will discuss solvability of a class of equations determined by complex structures with degeneracies that have first integrals that satisfy a Łojasiewicz property. The results deal with equations determined by a vector field in $\mathbb{R}^2$ and with an application to a system of equations in $\mathbb{R}^{2n}$.

Andreea Nicoara

Biholomorphic invariance of q-type

Abstract: It is easy to see that the D'Angelo 1-type is invariant under biholomorphic mappings. However, its higher dimension generalizations, the D'Angelo q-type and the Catlin q-type, involve sets of linear forms in their definitions, and such linear forms are not necessarily mapped to linear forms by biholomorphic mappings. In spite of this difficulty, it turns out that both the D'Angelo and the Catlin q-types are indeed biholomorphic invariants. Joint work with Vasile Brinzanescu (Simion Stoilow Institute of Mathematics of the Romanian Academy) that answers a question posed by Dmitri Zaitsev.

Stéphanie Nivoche

Kolmogorov widths asymptotics in different holomorphic function spaces

Abstract: Given a domain D in $\mathbb{C}^n$ and K a compact subset of D, we denote $\mathcal{A}_K^D$ the compact set in $C(K)$, of all restrictions in K of holomorphic functions on D bounded by 1. The sequence $(d_m(\mathcal{A}_K^D))_{m\in\mathbb{N}}$ of Kolmogorov m-widths of $\mathcal{A}_K^D$ provides a measure of the degree of compactness of the set $\mathcal{A}_K^D$ in $C(K)$ and the study of its asymptotics has a long history, essentially going back to Kolmogorov's work on ϵ-entropy of compact sets in the 1950s. The precise statement of this problem is

$$\lim_{m\to\infty} \frac{-\log d_m(\mathcal{A}_K^D)}{m^{1/n}} = 2\pi \left(\frac{n!}{C(K,D)}\right)^{1/n}, \tag{1}$$

where $C(K, D)$ is the Bedford-Taylor relative capacity of K in D.

We give a new proof of the asymptotics (1) for D strictly hyperconvex and K non-pluripolar. We proceed by a two-pronged approach establishing sharp upper and lower bounds for the Kolmogorov widths. The lower bounds follow from concentration results for the eigenvalues of a certain family of Toeplitz operators, while the upper bounds follow from an application of the Bergman-Weil formula together with an exhaustion procedure by special holomorphic polyhedra.

We'll also give the asymptotics of these widths in the context of Hardy and Bergman spaces, as well as in some Fock spaces.

Vinícius Novelli da Silva

A comparison principle between certain Levi-flat compact CR manifolds and systems of real vector fields

Abstract: In this talk, we discuss a comparison principle between Levi-flat CR structures on certain manifolds and an associated system of real vector fields. We are able to relate properties of global hypoellipticity of the associated differential operators, even when acting on forms of higher degree. We also show an isomorphism between the cohomology complexes of both structures, and discuss this relation in several models. This work is part of the author's PhD thesis, supervised by Paulo Cordaro.

Alberto Parmeggiani

Geometric radiation

Abstract: I will describe some joint work in progress with Federico Ferri about regularity of perturbations of Riemannian metrics. I will be treating a "toy" model on a $2d$ Riemannian manifold that shows some of the difficulties one faces when studying higher dimensional cases.

Andrew Raich

Harmonic analysis and estimates for $\Box_b$ on CR manifolds with quadrics as local models

Abstract: We establish the L^p-Sobolev theory for the $\bar{\partial}_b$ operator and prove sharp pointwise estimates on the complex Green operator and $\Box_b$-harmonic projection operators on abstract compact CR manifolds M of higher codimension whose directional Levi forms are nondegenerate. The technique is to approximate M by an appropriate quadric manifold and use powerful harmonic analysis machinery and normal coordinates to pass the results that we have already proven on the quadrics onto the abstract CR manifolds. We also discuss a construction of such CR manifolds. This work is joint with Al Boggess.

Min Ru

Campana's orbifold conjecture for numerically equivalent divisors

Abstract: In this talk, we will discuss the recent joint work with Julie Tzu-Yueh Wang about the Campana's orbifold conjecture. The result we obtained is as follows: Let X be a complex non-singular projective variety of dimension n. Let $D_1, \ldots, D_{n+1}$ be $\mathbb{Z}$-linearly independent effective divisors in $\mathrm{Div}(X)$ and $D \doteq D_1 + \ldots + D_{n+1}$ be a normal crossing divisor of X such that (X, D) is of general type. Assume furthermore that they are numerically parallel. Let Δ be an orbifold divisor with $\mathrm{Supp}(\Delta) = \mathrm{Supp}(D)$ and let $f : \mathbb{C} \to (X, \Delta)$ be an orbifold entire curve. Then there exists a positive integer l such that if f has multiplicity at least l along D_i, $1 \leq i \leq n+1$, then f must be algebraically degenerate. We will first discuss the motivations, recall the brief history and know results, and then outline the ideas behind the proof of the mentioned result.

Laurent Stolovitch

Local rigidity of group actions of isometries on compact Riemannian manifolds

Abstract: In this work in collaboration with Zhiyan Zhao, we consider perturbations of isometries on a compact Riemannian manifold M. We investigate the smooth (resp. analytic) rigidity phenomenon of groups of these isometries. As a particular case, we prove that if a finite family of smooth (resp. analytic) small enough perturbations is simultaneously conjugate to the family of isometries via a finitely smooth diffeomorphism, then it is simultaneously smoothly (resp. analytically) conjugate to it whenever the family of isometries satisfies a Diophantine condition. Our results generalize the rigidity theorems of Arnold, Herman, Yoccoz, Moser, etc. about circle diffeomorphisms which are small perturbations of rotations as well as Fisher-Margulis's theorem on group actions satisfying Kazhdan's property (T).

Emil Straube

Diederich-Fornaess index and regularity of the complex Green operator

Abstract: Let Ω be a smooth bounded pseudoconvex domain in $\mathbb{C}^n$. If Ω satisfies a (strong) comparability condition for the Levi eigenvalues, then DF-index one implies Sobolev regularity for the complex Green operator. This is joint work with Tanuj Gupta.

Ming Xiao

On the mathematical works of Xiaojun Huang

Weichia Zhu

CR transversality of holomorphic maps between real hypersurfaces

Abstract: In this talk, I will discuss the history of the CR transversality problem and share our recent progress on real hypersurfaces when the target manifold is a hyperquadric. In particular, we consider holomorphic maps F from Levi non-degenerate real hypersurfaces $M_\ell \subset \mathbb{C}^n$ to a hyperquadric $\mathbb{H}^N_\ell$ with the same signature ℓ and $N - n < n - 1$. We show that F is either CR transversal to $\mathbb{H}^N_\ell$ or maps a neighborhood of M_ℓ in $\mathbb{C}^n$ into $\mathbb{H}^N_\ell$. Furthermore, in the case where $\ell' > \ell$, we prove that if F is not CR transversal at $0 \in M_\ell$, then it must be transversally flat. This talk is based on joint work with X. Huang.

Poster session

Alexandre Arias Junior

On the Cauchy problem for Schrödinger type equations in Gelfand-Shilov spaces

Abstract: We consider the following Schrödinger type operator

$$S = D_t - \Delta_x + \sum_{j=1}^{n} a_j(t,x) + a_0(t,x) \tag{2}$$

where the coefficients are assumed to be complex-valued, continuous with respect to time and smooth and bounded with respect to space. It is well-known that the well-posedness of the Cauchy problem associated with (2) in $L^2(\mathbb{R}^n)$, $H^\infty(\mathbb{R}^n)$ or Gevrey-type spaces, is related to some restrictions on the imaginary part of the first order coefficients. In this work we shall give a sufficient decay condition on the first order coefficients to well-posedness in Gelfand-Shilov spaces. The optimality of the result is also discussed through some particular examples.

Halit Sevki Aslan

On the Cauchy problem for semilinear thermoelastic plate systems in the L^q framework

Abstract: We consider semilinear thermoelastic plate systems with general power nonlinearities in the whole space $\mathbb{R}^n$. By applying the Fourier analysis, some sharp $(L^q \cap L^m) - L^q$ estimates of solutions (with any $1 \leqslant m \leqslant q \leqslant +\infty$) to the classical thermoelastic plate system are derived, which cover all known results in $\mathbb{R}^n$. Then, we investigate global in time existence of small data L^q solutions (with any $q \in [1, +\infty]$) and blow-up of weak solutions for the semilinear thermoelastic plate systems under suitable conditions on the power exponents, which justify critical exponents for several classes of nonlinearities.

Fernando de Ávila Silva

Global solvability for certain classes of complexes of pseudo-differential operators on $\mathbb{T}^N$

Abstract: We characterize the global solvability of a complex of pseudo-differential operators associated with an overdetermined system of operators defined on the torus. We establish connections between the global solvability of the complex and the global solvability of its normal form, namely, a suitable system with constant coefficients.

Victor Sandrin Biliatto

Weighted Lebesgue solutions for elliptic PDEs with measure data

Abstract: This poster is a summary of new results regarding the solvability of PDEs associated to elliptic linear differential operators with complex coefficients and measure data in weighted Lebesgue spaces. Building on recent advances, conditions on the measure data and the weights that ensure solvability are presented. The endpoint case of bounded solutions is of particular interest, as the proof relies on a new weighted L^1 Stein-Weiss type inequality on measures for a special class of vector fields. This is a joint work with Joel Coacalle and Tiago Picon (FFCLRP-USP).

Camilo Campana

Approximation results for generalized analytic functions

Abstract: The primary contribution of this work is a Mergelyan type approximation theorem for solutions of the generalized Vekua equation $Lu = Au + B\overline{u}$ where L belongs to a class of degenerate elliptic planar vector fields and $A, B \in L^p$. We call these solutions generalized analytic functions. As an application, we study the behavior of radial limits of generalized analytic functions on the disk and solve a Riemann-Hilbert type problem for the equation $Lu = Au + B\overline{u} + f$ on the upper half-plane. Joint work with J. Hounie (UFSCar).

Luís Antônio Carvalho dos Santos

Title: Propagation of regularity for a class of systems of real vector fields on torus

Abstract: We characterize the global hypoellipticity, almost hypoellipticity and solvability for a class of systems of real vector fields on the $(n+1)$-dimensional torus as well as the same properties about the sum of squares associated to the system. The key result is a theorem about propagation of regularity for solutions of the system. This is a joint work with Igor Ambo Ferra (UFSCar).

Joel Coacalle

Cancellation Conditions and Boundedness of Inhomogeneous Calderón-Zygmund Operators on Local Hardy Spaces associate with Spaces of Homogeneous Type

Abstract: In this work, we present sufficient conditions for the boundedness of inhomogeneous Calderón-Zygmund type operators on local Hardy spaces associated to spaces of homogeneous type in the sense of Coifman & Weiss (Bull. AMS, 1977) for $0 < p \leq 1$. A new approach to atoms and molecules for local Hardy spaces in this setting is introduced with special moment conditions.

Paulo Domingos Cordaro

Top-degree local solvability for $\overline{\partial}_b$ on hypersurfaces in the complex space

Abstract: It has been conjectured, more than 30 years ago, in papers written with J. Hounie and F. Treves, that top-degree local solvability for $\overline{\partial}_b$ on a real-analytic hypersurface $0 \in \mathcal{M} \subset^{n+1}$, near the origin, is equivalent to the existence of an open neighborhood $0 \in U \subset \mathcal{M}$ such that at no point of U the Levi form is definite. In a joint project carried out with Vinícius Novelli, we established the valid of this conjecture when $\mathcal{M}$ is rigid and the determinant of the Levi matrix does not vanish identically. Our method of proof also seems very suitable to attack the question even when determinant of the Levi matrix is identically zero.

Evandro Raimundo da Silva

Convergence of the Baouendi-Treves Approximation Formula in Besov and Triebel-Lizorkin spaces

Abstract: In this work we show the convergence of the Baouendi-Treves approximation formula in the Besov and Triebel-Lizorkin spaces. As an application, we obtain a result on the holomorphic extension of $F^m_{p,2}$ CR functions to one side of an $\Omega \subset \mathbb{C}^{n+1}$ hypersurface, for $m = 0, 1, \ldots$, generalizing a well-known theorem of Hans Lewy to $F^m_{p,2}$ (Triebel-Lizorkin) spaces.

Paulo Leandro Dattori da Silva

A differential complex on the product of compact Lie groups

Abstract: We characterize the global solvability, in each level of the complex, of a differential complex associate to an involutive system of real vector fields defined on the product of a n-dimensional torus and a compact Lie group. Our results are linked to an certain algebric condition. Additionally, we compute the induced cohomology groups. This is a joint work with Fernanda Martins Simão (ICMC-USP).

Marcelo Rempel Ebert

Sharp $L^p - L^q$ estimates for evolution equations with damped oscillations

Abstract: In this work we derive sharp $L^p - L^q$ estimates, $1 \leq p \leq q \leq \infty$ (including endpoint estimates as $L^1 - L^1$ and $L^1 - L^\infty$) for dissipative wave-type equations, under the assumption that the dissipation dampen the oscillations but it does not cancel them. We assume that the phase function w is homogeneous of some degree $\sigma > 0$ and that its Hessian matrix has maximal rank, including the critical case $\sigma = 1$, while the dissipative term $a(\xi) > 0$ may be inhomogeneous. The critical case includes waves with viscoelastic or structural damping, damped double dispersion equations and plate equations with rotational inertia, and so on. We also obtain the analogous results for fractional Schrödinger-type equations with a potential.

Igor Ambo Ferra

On the global solvability of pseudodifferential operators

Abstract: We present recent results that give a complete characterization for the global solvability of $P = D_t + c(t, D_x)$ acting on the (n+m)-dimensional torus $\mathbb{T}^n \times \mathbb{T}^m$, where (t, x) denotes the variables of this ambient. Our characterization generalizes classical results on this subject and also presents a novelty about this study since it relies not only in an usual diophantine condition about the averages of the discrete symbol of $c(t, D_x)$ but also in a notion that we call super-logarithmic oscillation of these symbols.

Renata de Oliveira Figueira

Evolution of the radius of analyticity for the higher dispersion mKdV equation with damping

Abstract: In this work, we consider the initial value problem for the modified Korteweg–de Vries equation with generalized dispersion (mKdVm) and a damping term. In the framework of Gevrey–Sobolev spaces, we establish local well-posedness in $G^{\sigma,s}(\mathbb{R})$ and show that the local solution extends globally in time. Moreover, we prove that the radius of spatial analyticity $\sigma(t)$ admits a uniform positive lower bound as time goes to infinity, highlighting the stabilizing effect of the damping term on the analytic regularity of solutions.

Stefan Fürdös

Regularity of analytic PDEs in general Ultradifferentiable Classes

Abstract: We investigate the regularity properties of analytic (pseudo)differential operators with respect to general ultradifferentiable classes. In particular we generalize Treves' Theorem on the characterisation of hypoellipticity of differential operators with analytic coefficients by proving that such operators are exactly smooth hypoelliptic if and only if they are ultradifferentiable hypoelliptic.

Max Reinhold Jahnke

A class of globally analytic hypoelliptic operators on compact Lie groups

Abstract: We obtain global analytic hypoellipticity for a class of differential operators that can be expressed as $P = \sum_{j=1}^{\nu} X_j^2 + X_0 + a$ with real-analytic coefficients on compact Lie groups such that the vector fields satisfy Hörmander's finite type condition; there exists a closed subgroup whose action leaves the vector fields invariant; and the operator must be elliptic in directions transversal to the action of the subgroup. This paves the way for further studies on the regularity of sums of squares on principal fiber bundles.

Rafael Kapp

Weighted Laplacian and Hardy Spaces in the Unitary Disc

Abstract: In this work we study the problems of α-harmonic extensions of elements in $h^p(\mathbb{T})$ and H^p-norm estimates of derivatives for such extensions, under suitable conditions. This is a joint work with Luis Antônio Carvalho dos Santos (UFSCar).

André Pedroso Kowacs

Global Hypoellipticity and Solvability with Loss of Derivatives on the Torus

Abstract: This paper provides a complete characterization of global hypoellipticity and solvability with loss of derivatives for Fourier multiplier operators on the n-dimensional torus. We establish necessary and sufficient conditions for these properties and examine their connections with classical notions of global hypoellipticity and solvability, particularly in relation to the closedness of the operator's range. As an application, we explore the interplay between these properties and number theory in the context of differential operators on the two-torus. Specifically, we prove that the loss of derivatives in the solvability of the vector field $\partial_{x_1} - \alpha\partial_{x_2}$ is precisely determined by the well-known irrationality measure $\mu(\alpha)$ of its coefficient α. Furthermore, we analyze the wave operator $\partial_{x_1}^2 - \eta^2\Delta_{\mathbb{T}^n}$ and show how the loss of derivatives depends explicitly on the parameter $\eta > 0$.

Bruno de Lessa Victor

Relations between different types of Hypoellipticity: a systematic approach

Abstract: We give a systematic treatment to the concept of hypoellipticity, putting it into an abstract form which allows us to deal with several different notions within the same framework. We then investigate when a notion of hypoellipticity implies another one and, in particular, when it can be extended for more general spaces. We also present a relation between certain types of hypoellipticity and local solvability (for the transpose) for a family of operators. Joint work with Luis F. Ragognette (UFMG).

Catarina Barbosa Machado

Poincaré type inequality for localizable Hardy-Sobolev spaces

Abstract: In this work, we discuss a version of Poincaré type inequality for Sobolev-Hardy spaces for $0 < p \leq 1$ and as application we present a local div-curl type inequalities for higher order elliptic linear differential operators. This is a joint work with Tiago Picon (USP).

Renan Dantas Medrado

Pullback of Ultradistributions and Gevrey Wave-Front Sets

Abstract: We develop a theory for pulling back ultradistributions through Gevrey maps, extending the classical definition for functions. Using transversality conditions, we establish continuity and control over the s-wave-front set. As an application, we study the Gevrey wave-front set for solutions of a locally integrable structures restricted to maximally real submanifolds.

Wagner Augusto Almeida de Moraes

Global Solutions for Systems of Strongly Invariant Operators on Closed Manifolds

Abstract: In this work, we investigate the global hypoellipticity and solvability for systems of linear operators $\mathbb{P} = (P_1, \ldots, P_n)$ defined on closed manifolds. Our approach is based on Fourier analysis associated with an elliptic pseudo-differential operator, focusing on the class of strongly invariant operators, which commute with the fixed elliptic operator. We establish necessary and sufficient conditions for the global hypoellipticity and solvability of the system $\mathbb{P}$ in terms of asymptotic estimates on its matrix symbol $\sigma_{\mathbb{P}} = (\sigma_{P_1}, \ldots, \sigma_{P_n})$. These results generalize previous characterizations for a single operator and deal with the problem of non-commutativity among the system's operators. As

an application, we consider important special cases. For systems of normal operators, we obtain an explicit formula for the solution and reformulate our results based on the eigenvalues of the operators P_j. This particular case recovers known results for left-invariant vector fields on compact Lie groups. Moreover, under the assumption of commutativity, $[P_j, P_k] = 0$, our general conditions simplify significantly, recovering classical theorems on the torus. This is a joint work with Alexandre Kirilov (UFPR) and Pedro Meyer Tokoro (UFPR).

Ricardo Paleari da Silva

On diagonal systems and Vekua-type operators

Abstract: We investigate the global hypoellipticity and global solvability of systems of left-invariant differential operators on compact Lie groups. Focusing on diagonal systems, we establish necessary and sufficient conditions for these global properties. As an application, we provide a complete characterization of these properties for systems of vector fields defined on products of tori and spheres. We extend our analysis to some triangular systems on compact Lie groups. Finally, we present some results about Vekua-type operators in this context, providing a good guess in a case with variable coefficients. This last part is a work in progress.

Luis Fernando Ragognette

Real involutive systems on compact Lie groups

Abstract: Consider G a connected compact Lie group and $\mathcal{V}$ an essentially real, left-invariant involutive structure. We proved that each class in the q-cohomology group associated with $\mathcal{V}$ has a representative that is a q-form with constant coefficients, in particular, all these groups are finite-dimensional.

For a tube structure defined on the product of a compact Lie group with a torus, we also prove that there is an isomorphism between the cohomology associated with the tube structure and a tensor product of the de Rham cohomology and a space of smooth functions defined in a certain torus.

This is a joint work with Gabriel Araújo (ICMC-USP), Igor A. Ferra (UFSCar) and Max R. Janhke.

Luís Márcio Salge

Spectrum of elliptic differential operators with constant coefficients on $L^p_{s,loc}(\Omega)$

Abstract: In this work, we extended the study of spectrum started in (Costa-Salge, *Annals of Functional Analysis*, 2022) and (Salge-Picon, *Matemática Contemporânea*, 2024)

for elliptic homogeneous differential operators with constant coefficients to the n dimensional case in the real scales of localized Sobolev Spaces $L^p_{s,loc}(\Omega)$, where $1 \leq p < \infty$ and $s \in \mathbb{R}$ and

$$L^p_{s,loc} = \{u \in \mathcal{D}'(\Omega); \mathcal{F}^{-1}[(1+|\xi|^2\mathcal{F}(\phi u)] \in L^p(\mathbb{R}^n), \forall \phi \in C^\infty_c(\Omega)\}.$$

This is quite different from what we find in the literature, where all the relevant results are concerned with spectrum on Banach spaces. Our aim is to understand the behavior of the spectrum using the closure of the operator. In particular we show that there is no complex number in the resolvent set of such operators, which suggests a new way to define spectrum if we want to reproduce the classical theorems of the Spectral Theory in Fréchet spaces. Joint work with Tiago H. Picon (University of São Paulo).

Antonio Victor da Silva Junior

Denjoy-Carleman Microlocal Regularity on Smooth Real Submanifolds of Complex Spaces

Abstract: This is a joint work with N. Braun Rodrigues (Unicamp). We construct approximate solutions (in the regular Denjoy-Carleman sense) for certain systems of smooth pairwise commuting complex vector fields. Employing such construction, a well-defined notion of Denjoy-Carleman wave front set of distributions on $\mathcal{C}^\infty$-smooth maximally real submanifolds in complex space is given and we show that it can be characterized in terms of the decay of a Fourier-Bros-Iagolnitzer transform. We also apply the approximate solutions construction to analyze the Denjoy-Carleman microlocal regularity of solutions of certain systems of first-order nonlinear partial differential equations and present current developments of the theory.

Isadora Vieira Coelho da Silva

Global hypoellipticity for a special class of sums of squares on $\mathbb{T}^1 \times \mathbb{S}^3$

Abstract: This work concerns the study of the regularity of a class of operators defined as sums of squares of real vector fields on $\mathbb{T}^1 \times \mathbb{S}^3$, where $\mathbb{S}^3$ denotes the three dimensional sphere and $\mathbb{T}^1 = /(2\pi)$ the torus. More precisely, we investigate the global hypoellipticity of the operator

$$P = -\frac{\partial^2}{\partial t^2} - a\partial_0^2, \quad a > 0,$$

on $\mathbb{T}^1 \times \mathbb{S}^3$, in the context of Komatsu classes, where ∂_0 is a left-invariant vector field on $\mathbb{S}^3$, known as the neutral operator.

Giuliano Zugliani

Systems of hypocomplex vector fields on the torus

Abstract: We consider here a system defined by a class of hypocomplex vector fields on the torus $\mathbb{T}^n$. We use an operator similar to the Cauchy one to study the global solvability of the complex associated with a locally integrable structure defined by such vector fields. This is a joint work with Camilo Campana (UFSC).