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GENERALIZED FUNCTIONS 2018
ABSTRACTS

Invited speakers

Speaker: Nenad Antonić
Title: H-distributions and mixed-norm Lebesgue spaces
Abstract: H-measures were successfully used for computing microlocal energy density in the linear wave equation by Francfort and Murat (1992), and for linear hyperbolic systems by Antonić and Lazar (2002). However, the extension of this method to nonlinear equations presented numerous difficulties, which prompted our research in the direction of H-distributions and mixed-norm Lebesgue spaces.

While the initial goal has not yet been reached, a number of results have been obtained, of interest by itself, and they will be presented in this talk. In particular, we shall discuss a general framework for proving the continuity of linear operators on mixed-norm spaces, which will allow us to prove boundedness and compactness of some classes of pseudodifferential and integral operators on these spaces.

This is a joint research with M. Erceg, I. Ivec, M. Mišur, D. Mitrović and I. Vojnović.

Speaker: Sandro Coriasco
Title: Equivalent representations and principal symbol map of Lagrangian distributions on asymptotically Euclidean manifolds
Abstract: Starting from a class of tempered oscillatory integrals, we develop the notion of Lagrangian distribution $u \in I^{m,\mu}(X,\Lambda)$, $(m,\mu) \in \mathbb{R}^2$, on a scattering manifold X, that is, on its compactified cotangent bundle. The latter is a manifold with corners, equipped with a suitable scattering symplectic structure, which allows to define Lagrangian submanifolds Λ *at infinity*. In particular, we will illustrate the notion of principal symbol of the elements of the class of distributions $I^{m,\mu}(X,\Lambda)$, $(m,\mu) \in \mathbb{R}^2$.

The talk is based on joint works with R. Schulz and M. Doll.

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[3] S. Coriasco, M. Doll, R. Schulz, *Lagrangian distributions on asymptotically Euclidean manifolds*, Submitted (2018), arXiv:1802.08816.

Speaker: Hans Feichtinger
Title: Banach spaces of ultra-distributions over LCA groups
Abstract: It is clear that the theory of tempered distributions is in some sense limited, because it does not allow to define the Fourier transform for objects which have exponential growth. On the other hand the Schwartz-Bruhat theory, which is the analogue of L.Schwartz theory of tempered distributions for general LCA (locally compact Abelian) groups is already quite cumbersome.

Since the borderline between Banach spaces of test functions which are smaller and smaller and the trivial one (the useless space, consisting only of the zero-function) is quite thin it is interesting to take a look at the relevant condition, which is formulated in the classical Acta Mathematica paper by Yngve Domar entitled Harmonic analysis based on certain commutative Banach algebras. In this paper the so-called Beurling-Domar condition is formulated, which also appears in the book of Hans Reiter.

We will discuss various aspects of this approach and to which extent it allows to build Banach spaces of test functions (and corresponding distributions), and even finally Frechte spaces of this type, over general LCA gropus. We hope to indicate that this view-point allows certain unifications and technical simplifications compared to the technical details needed either in the Schwartz-Bruhat or in the now classical theory of ultra-distributions over the Euclidean space.

Date: Novi Sad, 27.08.–31.08.2018.

Speaker: Günther Hörmann
Title: Distributional information contained in Colombeau generalized solutions to partial differential equations
Abstract: We review and discuss a couple of results on partial differential equations that relate qualitative properties of distributional data or coefficients with solvability in Colombeau algebras of generalized functions or allow for the extraction of distribution theoretic aspects from these generalized solutions.

Speaker: Tokio Matsuyama
Title: On the Gevrey well-posedness of the Kirchhoff equation
Abstract: In this talk I inform the result on the almost global solvability of the Cauchy problem for the Kirchhoff equation in the Gevrey space γ^s_{η,L^2}. Furthermore, similar results are obtained for the initial-boundary value problems in bounded domains and in exterior domains with compact boundary.

Speaker: Marko Nedeljkov
Title: Using different forms of the delta function in papers with Michael Oberguggenberger
Abstract: I will present a few approaches dealing with problems containing the delta function that was made by Michael Oberguggenberger, some collaborators and me. The problems include ordinary differential equations, wave equations, 1D and nD radially symmetric delta shocks.

Speaker: Bojan Prangoski
Title: Quasi-analytic representation theory of $(\mathbb{R}^d, +)$ over quasi-complete locally convex spaces
Abstract: In [1], Dixmier and Malliavin addressed the following problem. Given a Banach space E, let (π, E) be a representation of a real locally compact Lie group G, i.e. $\pi : G \to GL(E)$ is a homomorphism such that the mapping $G \times E \to E$, $(p, e) \mapsto \pi(g)e$, is continuous. Such representation induces a continuous action Π of the algebra $\mathcal{D}(G)$ on E given by

$$\Pi(f)e = \int_G f(g)\pi(g)edg, \ f \in \mathcal{D}(G), \ e \in E,$$

and it restricts to a continuous action to the Banach space of smooth vectors E^∞ consisting of all elements $e \in E$ for which the orbit maps $g \mapsto \pi(g)e$, $G \to E$, are smooth (thus the smooth vectors associated to such a representation are a $\mathcal{D}(G)$-module). Dixmier and Malliavin proved that $E^\infty = \text{span}(\Pi(\mathcal{D}(G))E^\infty) = \text{span}(\Pi(\mathcal{D}(G))E)$; that is, the category of modules E^∞ over the algebra $\mathcal{D}(G)$ satisfies the weak factorisation property. Only recently the analytic variant of this problem was addressed. Namely, by denoting E^ω the space of elements of E whose orbit maps are analytic, the problem of interest here reads: does $E^\omega = \text{span}(\Pi(\mathcal{A}(G))E^\omega)(= \text{span}(\Pi(\mathcal{A}(G))E))$ hold, where $\mathcal{A}(G)$ is the space of analytic vectors of the (left) regular representation of an appropriate algebra and with it E^ω becomes an $\mathcal{A}(G)$-module? The problem was affirmatively answered by Lienau [3] when $G = (\mathbb{R}, +)$, E is a Banach space and π is a bounded representation. This result was improved by Gimperlein, Krötz, and Lienau [2] by allowing E to be a Fréchet space without the restriction on the boundedness of the representation for general locally compact real Lie group. They obtained the weak factorisation property and $\text{span}(\mathcal{A}(G) * \mathcal{A}(G)) = \mathcal{A}(G)$; in their result $\mathcal{A}(G)$ is the space of analytic vectors of the regular representation of an appropriate convolution algebra.

In this talk we generalise the above result in the following two ways when $G = (\mathbb{R}^d, +)$:

(I) We allow E to be a general quasi-complete locally convex space.

(II) We will solve the problem in the general quasi-analytic case. Namely, we will define the space of ultradifferentiable vectors of Beurling and Roumieu type. Next, we will identify the appropriate convolution algebra over which the space of ultradifferentiable vectors will become a module. Finally, we will show that this category satisfies the factorisation property (without "span").

The talk is based on collaborative works with Andreas Debrouwere and Jasson Vindas.

References

[1] J. Dixmier, P. Malliavin, *Factorisations de fonctions et de vecteurs indéfiniment différentiables*, Bull. Sci. Math. **102**(2) (1978), 307-330
[2] H. Gimperlein, B. Krötz, C. Lienau, *Analytic factorization of Lie group representations*, J. Funct. Anal. **262** (2012), 667-681
[3] C. Lienau, *Analytic representation theory of* $(\mathbb{R}; +)$, J. Funct. Anal. **257** (2009), 3293-3308

Speaker: Michael Reissig
Title: A general Levi condition for weakly hyperbolic Cauchy problems
Abstract: We consider the Cauchy problem for weakly hyperbolic m-th order partial differential equations with coefficients low-regular in time and smooth in space.

It is well-known that in general one has to impose Levi conditions to get C^∞ or Gevrey well-posedness even if the coefficients are smooth. We use moduli of continuity to describe the regularity of the coefficients with respect to time, weight sequences for the characterization of their regularity with respect to space and weight functions to define the solution spaces. Furthermore, we propose a general Levi condition that models

the influence of multiple characteristics more freely. We establish sufficient conditions for the well-posedness of the Cauchy problem, that link the Levi condition as well as the modulus of continuity and the weight sequence of the coefficients to the weight function of the solution space. Additionally, we obtain that the influences of the Levi condition and the low regularity of coefficients on the weight function of the solution space are independent of each other. This is a joint project with Massimo Cicognani (Bologna) and my PhD student Daniel Lorenz (Freiberg).

References

[1] M. Cicognani, D. Lorenz, *Strictly hyperbolic equations with coefficients low-regular in time and smooth in space*, 30 A4, accepted for publication in J. Pseudo-Differ. Oper. Appl.
[2] D. Lorenz, M. Reissig, *A generalized Levi condition for weakly hyperbolic Cauchy problems with coefficients low regular in time and smooth in space*, 40 A4, accepted for publication in J. Pseudo-Differ. Oper. Appl.

Speaker: Michael Ruzhansky
Title: Recent progress on very weak solutions
Abstract: In this talk we will review the recent progress on very weak solutions to PDEs with singularities. We will show existence and uniqueness of solutions for several classes of PDEs with distributional coefficients, as well as numerical experiments. A particular emphasis in developing this notion lies in the consistency property: if (stronger) classical, weak, distributional or ultradistributional solutions exist, they can be easily recovered from very weak solutions. The talk will be based on joint works with Claudia Garetto (Loughborough) and Niyaz Tokmagambetov (Almaty).

Speaker: Joachim Toft
Title: Periodic ultra-distributions and periodic elements in modulation spaces
Abstract: In the present talk we characterize periodic elements in Gevrey classes, Gelfand-Shilov distribution spaces and modulation spaces, in terms of estimates of involved Fourier coefficients, and by estimates of their short-time Fourier transforms. We show that such spaces can be completely characterised in terms of formal Fourier series with suitable estimates on their coefficients. For periodic Gelfand-Shilov distributions such characterisations can be found in the literature in the case when the Gevrey parameter is strictly larger than 1. Our analysis is valid for all positive Gevrey parameters.

As a consequence, inverse problems for diffusion equations and similar equations on certain bounded domains can be handeled.

The proofs are based on new types of formulae of independent interestswhen evaluating the Fourier coefficients and which involve short-time Fourier transforms.

The talk is based on a joint work with E. Nabizadeh.

References

[1] M. Reich *Superposition in Modulation Spaces with Ultradifferentiable Weights*, (preprint) arXiv:1603.08723.
[2] M. Reich, M. Reissig, W. Sickel *Non-analytic Superposition Results on Modulation Spaces with Subexponential Weights*, J. Pseudo-Differ. Oper. Appl. **7** (2016), 365–409.
[3] J. Toft *Periodicity, and the Zak transform on Gelfand-Shilov and modulation spaces*, (preprint) arXiv:1705.10619.
[4] J. Toft, E. Nabizadeh *Periodic distributions and periodic elements in modulation spaces*, Adv. Math. **323** (2018), 193–225.

Speaker: Jasson Vindas
Title: Topological properties of convolutor spaces
Abstract: The space of rapidly decreasing distributions $\mathcal{O}'_C(\mathbb{R}^d)$ was introduced by Schwartz and he showed that this is in fact the space of convolutors of $\mathcal{S}(\mathbb{R}^d)$. A detailed study of the locally convex structure of $\mathcal{O}'_C(\mathbb{R}^d)$ was carried out later by Grothendieck in the last part of his doctoral thesis. He showed that this space is ultrabornological and that its strong dual is isomorphic to the (LF)-space of very slowly increasing smooth functions $\mathcal{O}_C(\mathbb{R}^d)$. As a non-trivial consequence, this implies that $\mathcal{O}_C(\mathbb{R}^d)$ is complete and its strong dual is isomorphic to $\mathcal{O}'_C(\mathbb{R}^d)$.

In this talk we shall discuss the structural and topological properties of a general class of weighted L^1 convolutor spaces. Our general theory applies simultaneously to weighted $\mathcal{D}'_{L^1}$ spaces as well as to convolutor spaces of the Gelfand-Shilov spaces of smooth functions $\mathcal{K}\{M_p\}$. In particular, we characterize those sequences of weight functions $(M_p)_{p\in\mathbb{N}}$ for which the space of convolutors for $\mathcal{K}\{M_p\}$ is ultrabornological, thereby generalizing Grothendieck's classical result for $\mathcal{O}'_C(\mathbb{R}^d)$.

Our methods lead to the first direct proof of the completeness of $\mathcal{O}_C(\mathbb{R}^d)$, and they are based on abstract results about regularity properties of (LF)-spaces and new mapping properties of the short-time Fourier transform on various function and distribution spaces. We have also obtained similar results in the context of ultradistributions.

The talk is based on collaborative works with Andreas Debrouwere.

Speaker: Yaguang Wang
Title: On analysis of the Prandtl boundary layer
Abstract: In this talk, we shall survey our work on analysis of the Prandtl boundary layer. The stability of boundary layer is studied in the Sobolev space, when the initial tangential velocity is monotonic with respect to the normal variable. Moreover, we analyse the occurrence of back flow in two-dimensional unsteady boundary layer with monotonic initial data, when the pressure gradient of the outer flow is adverse. The back flow is an important physical event in the evolution of boundary layer, which eventually leads to the separation.

Contributions

Speaker: Ahmed Abdeljawad
Title: Pseudo-differential calculus in anisotropic Gelfand-Shilov setting
Abstract: Gelfand-Shilov spaces of type $\mathcal{S}$ have been introduced in the book [5] as an alternative functional setting to the Schwartz space for Fourier analysis and for the study of partial differential equations e. g. [3, 4].

In this talk we highlight some recent results about pseudo-differential calculus, where the symbols are of infinite orders and possess suitable Gevrey regularities and which are allowed to grow sub-exponentially together with all their derivatives.

We prove mapping properties for these operators on the anisotropic Gelfand-Shilov spaces. Moreover, we show continuity for the pseudo-differential operator $\operatorname{Op}(a)$ on modulation spaces, that is, from $M(\omega_0\omega, \mathcal{B})$ to $M(\omega, \mathcal{B})$, for fixed $s, \sigma \geq 1$, $\omega, \omega_0 \in \mathcal{P}^0_{s,\sigma}$ $(\omega, \omega_0 \in \mathcal{P}_{s,\sigma})$, $a \in \Gamma^{\sigma,s}_{(\omega_0)}$ $(a \in \Gamma^{\sigma,s;0}_{(\omega_0)})$, and $\mathcal{B}$ is an invariant Banach function space.

This talk contain results from joint works with Gelfand-Shilov spaces of type $\mathcal{S}$ have been introduced in the book [5] as an alternative functional setting to the Schwartz space for Fourier analysis and for the study of partial differential equations e. g. [3, 4].

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This talk contain results from joint works with M.Cappiello and J.Toft [1] and J.Toft [2].

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Speaker: Suzana Aleksić
Title: Localized frames in shift-invariant spaces
Abstract: We investigate the concept of the localization of frames and the properties of the dual frame in shift-invariant spaces

$$V^p(\Phi) := \Big\{ f \in L^p \ \mid \ f(\cdot) = \sum_{(i,j)\in I\times\mathbb{Z}^d} c^i_j \, \phi_i(\cdot - j) \Big\}$$

where $I = \{1, 2, \dots, r\}$, $c_i = (c^i_j)_{j\in\mathbb{Z}^d} \in \ell^p(\mathbb{Z}^d)$, $i \in I$ and ϕ_i, $i \in I$, are specially chosen functions, $\Phi = (\phi_1, \dots, \phi_r)^T$. We prove that the frame operator preserves the localization and that the dual frame possesses the same localization property as the original frame.

Speaker: Teodor M. Atanacković
Title: Wave equation in Zener-type viscoelasasticity with Caputo-Fabrizio derivatives
Abstract: A new definition of fractional derivative with regular kernel, named Caputo-Fabrizio (CF) has been recently proposed in [2] and [3]. We have investigated such an approach in [1] where we studied some properties of CF derivative that are important for application in mechanics. In this paper we continue with this approach and study the existence and the uniqueness of a solution for a wave equation in visco-elastic body of generalized Zener type with CF fractional derivative. Our basic idea is to consider the constitutive equation, that in the dimensionless form reads.

References

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[2] M. Caputo, M. Fabrizio, A new Definition of Fractional derivative without Singular Kernel, Prog. Fract. Differ. Appl. 1, No. 2, 73-85 (2015).
[3] M. Caputo, M. Fabrizio, Properties of a New Fractional Derivative without Singular Kernel, Progr. Fract. Differ. Appl. 1, No. 2, 87-92 (2015)

Speaker: Sanja Atanasova
Title: Stockwell transform and characterization of wave front sets
Abstract: We define the Stockwell transform and its synthesis operator on a test function spaces $\mathcal{S}(\mathbb{R})$ and $\mathcal{S}(\mathbb{Y}), \mathbb{Y} = \mathbb{R} \times \mathbb{R}\backslash\{0\}$, and extend these definitions on the appropriate spaces of distributions via duality approach. We study the quasiasymptotic behaviour of distributions with respect to the asymptotic of their Stockwell transform. Several Abelian and Tauberian type results at the origin and at infinity are proven. Second part of the talk is dedicated to resolution of wave front sets with respect to the multidimensional Stockwell transform. Equivalence between the new definition and the definition in the sense of Hormander is proven, for the cases when the dimension is $n = 1, 2, 4, 8$. This is joint work with Katerina Saneva and Stevan Pilipović.

Speaker: Christian Bargetz
Title: On sequence-space representations of spaces of smooth functions and distributions
Abstract: By the well-known Fischer-Riesz Theorem every Hilbert space H is isometrically isomorphic to the space $\ell^2(I)$ for a suitable index set I. For separable Hilbert spaces H this provides a representation of H as a sequence space. The Theorem of Kōmura-Kōmura states that every nuclear locally convex space is isomorphic to a subspace of the product s^I for a suitable index set I. Therefore in some sense the space of rapidly decreasing sequences is the prototype of a nuclear space.

Since many spaces of smooth functions and distributions are nuclear, the question of finding sequence space representations for these spaces arises naturally. Moreover such sequence space representations allow for an isomorphic classification of these spaces.

For many spaces of test functions and distributions, Manuel Valdivia and Dietmar Vogt independently found sequence space representations. In most of these results one of the main techniques is the Pełczyński decomposition method. Therefore most of these isomorphisms are obtained in a non-constructive way.

Speaker: Marco Cappiello
Title: Schroedinger-type equations in Gelfand-Shilov spaces
Abstract: We consider for $(t, x) \in [0, T] \times \mathbb{R}^n$ the Cauchy problem

$$P(t, x, \partial_t, \partial_x)u(t, x) = f(t, x),\ u(0, x) = u_0(x) \tag{1}$$

where

$$P(t, x, \partial_t, \partial_x) = \partial_t - i\triangle_x + \sum_{j=1}^{n} a_j(t, x)\partial_{x_j} + b(t, x). \tag{2}$$

It is well-known that when the coefficients a_j, b and the Cauchy data f, u_0 are all real valued, smooth and uniformly bounded with respect to x the Cauchy problem (1) is L^2-well-posed, while if a_j are complex valued suitable decay conditions for $|x| \to \infty$ are needed on the imaginary part of the coefficients in order to obtain either L^2, H^∞ or Gevrey well posedness. It is also known that a decay at infinity of the initial data has an effect on the regularity of the solutions of (1). Here we treat the case when the initial data belong to the Gelfand-Shilov space $\mathcal{S}^\theta_s(\mathbb{R}^n)$, (resp. $\Sigma^s_\theta(\mathbb{R}^n)$) defined as the space of the smooth functions f satisfying

$$\sup_{x\in\mathbb{R}^n} \sup_{\alpha\in\mathbb{N}^n} C^{-|\alpha|}\alpha!^{-\theta} e^{c|x|^{\frac{1}{s}}} |\partial^\alpha f(x)| < \infty,$$

for some (resp. for all) $C, c > 0$, with $s > 1, \theta > 1$, and prove a result of existence and uniqueness of the solution of (1) with precise information both on the regularity and on the behavior of the solution for $|x| \to \infty$.

Speaker: Duvan Cardona
Title: L^p bounds for series Fourier operators (periodic Fourier integral operators)
Abstract: In this talk we present L^p bounds for series Fourier operators in the sense of Ruzhabnsky and Turunen. This is joint work with Rekia Messiouene.

Speaker: Soon-Yeong Chung
Title: A New Blow-up Condition for Solutions to p-Laplacian Parabolic Equations
Abstract: This lecture is concerned with a non-existence(blow-up) of the (weak) solutions to the initial and boundary value problem

$$(E)\begin{cases} u_t = \operatorname{div}\left(|\nabla u|^{p-2}\nabla u\right) + f(x, u), & in\ \ \Omega \times (0, T), \\ u(\cdot, 0) = u_0, & in\ \ \Omega, \\ u = 0, & on\ \ \partial\Omega \times (0, T), \end{cases}$$

where $p \geq 2$ and $\Omega \subset \mathbb{R}^N$ is a bounded domain with smooth boundary $\partial\Omega$.
More precisely, we prove that the solutions to (E) blow up in finite time, for sufficiently large initial data $L^\infty(\Omega) \cap H_0^p(\Omega)$, under a condition for source term $f \geq 0$ that

$$(C_p) \qquad \alpha \int_0^u f(s)\,ds \leq uf(u) + \beta u^p + \gamma,\ u > 0,$$

for some α, β, and $\gamma > 0$ with $0 < \beta \leq \frac{(\alpha-p)\lambda_0}{p}$, where λ_0 is the first eigenvalue of the p-Laplace operator $\Delta_p u := div\left(|\nabla u|^{p-2}\nabla u\right)$. Moreover, it will be shown that the condition (C_p) improves the blow-up conditions ever known so far (for example, see the conditions in [1], [2], and [3]).

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Speaker: Vladimir Danilov
Title: Averaging and mushy region generation under Rayleigh- Taylor instability
Abstract: We consider a stratified liquid with two layers separated by a fast oscillating interface in the case of Raleigh-Taylor instability. We derive the averaging equations and show that the mushy region of a certain density appears after averaging. We discuss an analog of this fact with unstable jump decay.

Speaker: Gregory Debruyne
Title: Optimality of Tauberian theorems
Abstract: The last decade has seen much activity in the field of quantified Tauberian theorems. Such results are of considerable intrinsic interest but also have striking applications, for instance in number theory and in the theory of partial differential equations. For example, the following Theorem is a version of a quantified Ingham-Karamata theorem in the context of C_0-semigroups.
Theorem *Let X be a complex Banach space and let $(T(t))_{t\geq 0}$ be a bounded C_0-semigroup on X whose generator A satisfies $\sigma(A) \cap i\mathbb{R} = \emptyset$, where σ denotes the spectrum of A. Suppose that $M\colon \mathbb{R}_+ \to (0,\infty)$ is a non-decreasing continuous function such that the resolvent satisfies $\|R(is,A)\| = O(M(|s|))$ as $|s| \to \infty$. Then*

$$\|T(t)A^{-1}\| = O\left(\frac{1}{M_{\log}^{-1}(ct)}\right), \quad t \to \infty,$$

for some $c > 0$, where the function $M_{\log}(s) = M(s)(\log(1+s) + \log(1+M(s)))$.

Similar theorems can be given for ordinary functions instead of semigroups and we will discuss optimality results of such Tauberian theorems in both cases. The talk is based on collaborative work with David Seifert.

Speaker: Pavel Dimovski
Title: Wave front sets with respect to Banach spaces of ultradistributions. Characterisation via the short-time Fourier transform
Abstract: We define ultradistributional wave front sets with respect to translation-modulation invariant Banach spaces of ultradistributions having solid Fourier image. The main result is their characterisation by the short-time Fourier transform.

Speaker: Nevena Dugandžija
Title: Generalized solutions to multidimensional cubic Schroedinger equation with delta potential
Abstract: This article addresses the Cauchy problem for homogeneous cubic Schrdinger equation in 2D and 3D and equation with a delta well potential in 3D. Solutions belong to the Colombeau algebra of generalized functions $\mathcal{G}_{2,2}$. Physically significant homogeneous problem in 2D and 3D has not yet been treated in this framework, whereas no classical results exist on equation with delta potential.

Existence and uniqueness in $\mathcal{G}_{2,2}$ is proved. In the homogeneous case, we show compatibility with the classical H^2 solution. New estimates of second order derivatives are obtained for the regularized delta potential equation.

Speaker: Alexei Filinkov
Title: On the composition of integral operators acting in tempered Colombeau algebras
Abstract: We show that generalised compositions of generalised integral operators are well dened on the space G, Colombeau algebra of tempered generalised functions. While the extension of the classes of dierential and integral equations that can be rigorously set and solved is seminal to current mathematics, it is also vital to the application of mathematics to other elds of study such as physics and engineering. Consistent with this latter driver a key motivation for the analysis that is presented here arises from a requirement in physics to be able to compose generalised integral operators, and the fact that it is not possible to realise these operator compositions within the space of Schwartz distributions. It has previously been shown that integral operator compositions exist in the Colombeau algebras of compactly supported generalized functions. We demonstrate via an extension of the Schwartz kernel theorem to the space of bounded linear operators L(G,G) on tempered Colombeau algebras that compositions of generalised integral operators are well dened on the space G. More than this we use Hermite function expansions of ultradistributions to demonstrate that a countably innite number of such compositions is well dened, hence we are able to show that compositions of exponentiated forms of these operators exist in the space of Colombeau tempered ultra-distributions.

Speaker: Antonio R. G. Garcia
Title: Differential Calculus over Colombeau's Full Generalized Numbers
Abstract: Starting from the Colombeaus full generalized functions, the sharp topologies and the notion of generalized points, we introduce a new kind differential calculus (for functions between totally disconnected spaces). We study generalized pointvalues, Colombeaus differential algebra, holomorphic and analytic functions. We show that the Embedding Theorem and the Open Mapping Theorem hold in this framework. Moreover, we study some applications in differential equations.

Speaker: Snežana Gordić
Title: Stationary Colombeau stochastic processes
Abstract: Colombeau-type stochastic processes defined as Colombeau functions with values in the space of random variables with finite second moments are considered. The properties of stationary Colombeau stochastic processes, distinguishing between strict stationarity and weak stationarity, are studied. It is proved that the generaliyed expectation of a stationary Colombeau stochastic process is a genralized constant. A special form of generaliyed correlation function of stationary Colombeau stochastic processes is given. The solutions to a class of SPDEs in the framework of stationary Gaussian Colombeau stochastic processes are investigated.

Speaker: Maximilian Hasler
Title: The Picard-Lindelöf method in Colombeau type algebras
Abstract: We extend earlier preliminary results concerning a convenient Picard–Lindelöf–Cauchy–Lipschitz theorem in the setting of algebras of Colombeau type generalized functions. The main tool is a fixed point theorem which goes beyond the known results of contractions in ultrametric spaces, which are not "fine" enough for our purpose Using this fixed point theorem and an algebra with asymptotics defined by the differential problem, we are able to establish the announced theorem on existence and uniqueness of solutions to the ODE with irregular data In view of going beyond this, we report on our progress in tackling the problem of the transport equation, a partial differential equation, with irregular coefficients We also try to compare our results to those of other authors and approaches, in particular those in the framework of generalized smooth functions (GSF).

The talk is based on joint work with Jean-André Marti.

Speaker: Egzona Iseni
Title: For some boundary value problems in distributions
Abstract: n this paper we give a result concerning convergent sequences of functions that give convergent sequence of distributions in and find the analytic representation of the distribution obtained by their boundary values. Also, we present two examples.

The talk is based on joint work with Vesna Manova Erakovikj, Bedrije Bedzeti, and Vasko Reckovski.

Speaker: Ivan Ivec
Title: Transport properties for parabolic H-measures
Abstract: Microlocal defect functionals (H-measures, semiclassical measures etc.) are objects which determine, in some sense, the lack of strong compactness for weakly convergent L^2 sequences. More precisely, they describe the oscillation and concentration effects for quadratic quantities of weakly converging sequences. H-measures are suitable to treat problems where all partial derivatives are of the same order [3]. More recently, parabolic H-measures were introduced in order to treat 1:2 ratio between orders of partial derivatives [1].

We extend the results obtained in [2] to parabolic H-measures. The main result is propagation principle expressed in terms of the theory of pseudodifferential operators. It is then applied to the Schrödinger equation and the vibrating plate equation, with comparison to the results obtained in [1].

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Speaker: Smiljana Jaksic
Title: Weyl calculus of pseudo-differential operators on space of tempered distributions on positive orthant
Abstract: We begin this talk by brief introduction to quantum mechanics. Then we present the characterization of the space of tempered distributions on positive orthant in terms of Laguerre coefficients. Finally, by applying the obtained characterization to prove boundedness of Weyl pseudo-differential operators with radial symbols on the space of tempered distributions.

Speaker: Marko Janev
Title: Complex fractional Zener model of wave propagation
Abstract: This work introduces complex order fractional operators in order to capture more features of the wave propagation phenomena occurring in viscoelastic materials. We analyze the equation describing the wave propagation phenomena in viscoelastic media, and is obtained using the complex fractional Zener model. Following the procedure proposed by Bagley and Torvik, we derive the so-called thermodynamical restrictions on all parameters of the equation, in order to preserve the Second law of Thermodynamics. Existence and the uniqueness of the solution are analyzed and will prove solvability and explicitly calculate the solution.

Speaker: Andrzej Kaminski
Title: On the product of ultradistributions of Beurling and Roumieu type
Abstract: We present some results concerning the existence of sequential product in various spaces of Beurling and Roumieu ultradistributions.

Speaker: Dmitrii Karp
Title: Fractional Hankel transform on spaces of entire functions and their duals
Abstract: The fractional Hankel transforms are usually defined on $L^2(0,\infty)$ as a real powers of the (properly normalized) classical Hankel transform. Defined in this ways they form a unitary group isomorphic to the operator of multiplication of the Fourier-Laguerre coefficients by $e^{i\alpha}$, $\alpha \in \mathbb{R}$. One can also define a C_0 semigroup ("the Laguerre semigroup") as multiplication operator by $e^{i\alpha}$ acting on the Fourier-Laguerre coefficients with $\alpha = it$, $t > 0i$. We give a characterization of the image of $L^2(0,\infty)$ under the action of this semigroup as a certain weighted space of entire functions. We proceed by constructing the dual space of analytic functionals and build the test function space as projective limit of the spaces of entire functions and the space of generalized functions as inductive limit of such dual spaces. We further present the infinitesimal generator of the Laguerre semigroup. Next, we discuss conditions for the members of the generalized function space to be regular, i.e. representable by integrable functions and conditions under which the fractional Hankel transform possesses an integral representation. Finally, we develop the operational calculus for the fractional Hankel transform as defined on the generalized function space.

Speaker: Mohammed Taha Khalladi
Title: On the existence of almost periodic generalized solutions of linear differential equations with generalized constant coefficients
Abstract: The aim of this talk is to study the existence of generalized solutions of linear systems of ordinary differential equations with generalized constant coefficients in the algebra of almost periodic generalized functions. This is the continaution of our works.

Joint work with Pr. Chikh BOUZAR.

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Speaker: Irina Kmit
Title: Bounded Solutions to Quasilinear First-Order Hyperbolic Systems in a Strip
Abstract: We consider boundary value problems for quasilinear first-order one-dimensional hyperbolic systems in a strip. The boundary conditions are supposed to be of a smoothing type. This means that the L^2-solutions to the linear version of the problem becomes eventually C^2-smooth for any initial L^2-data. We establish conditions for the existence and uniqueness of bounded, in particular, almost periodic classical solutions. To this end we examine robustness of the exponential dichotomy for the evolution family generated by the linearized problem, and show that the dichotomy survives under small (unbounded) perturbations.

Speaker: Marko Kostić
Title: Weyl-Almost Periodic Solutions and Asymptotically Weyl-Almost Periodic Solutions of Abstract Volterra Integro-Differential Equations
Abstract: The main purpose of this paper is to investigate Weyl-almost periodic solutions and asymptotically Weyl-almost periodic solutions of abstract Volterra integro-differential equations and inclusions. The class of asymptotically Weyl-almost periodic functions, introduced in the paper, seems to be not considered elsewhere even in the scalar-valued case. We analyze the Weyl-almost periodic and asymptotically Weyl-almost periodic properties of convolution products and various types of degenerate solution operator families subgenerated by multivalued linear operators.

Speaker: Petar Kunštek
Title: Numerical methods for classical optimal designs with classical solutions
Abstract: A multiple state optimal design problem for stationary diffusion equations with two isotropic phases is considered. Commonly, optimal design problems do not have solutions (such solutions are usually called classical). By analysing the optimality conditions we are able to show that in the case of annulus, the solution is unique, classical and radial. The presence of classical solutions give opportunity to test different numerical methods i.e. compare rates of convergence, stability or check for possible errors. For demonstration, a shape gradient method was implemented in Freefem++.

Speaker: Michael Kunzinger
Title: A category of non-linear generalized functions
Abstract: In this talk I report on recent joint work with Paolo Giordano on the theory of Generalized Smooth Functions (GSF), which is based on non-Archimedean analysis on the Robinson-Colombeau ring of generalized numbers. This approach is methodically very close to classical analysis, and many results can be recovered with only minimal modifications of standard proofs. In particular, it is possible to obtain very general sheaf properties of GSF as set-theoretical functions on generalized points, a concept pioneered by Michael Oberguggenberger.

Speaker: Jean-André Marti
Title: The hurricane eye's wall
Abstract: (Some major hurricanes as Maria of category 5 have completely destroyed in 2017 many Caribbean islands as Domenica, Barbuda, the french part of Saint Martin, and seriously damaged Porto Rico, Haiti, Cuba Virgin Islands and a large part of Miami in Florida. The total number of dead people is at least 547. The maximum wind velocity was 350km/h.

This catastrophic event gives a good motivation to study more closely the problem and we propose a new approach of it. The hurricanes tracks are now well forecasted but we cannot change them. But we can study the destructive machinery of the hurricane's eye, not well known.)

The talk is devoted to the study of the structure of the hurricane's eye, and its border, the eye's wall, following previous results from Le Roux and Marti. A jumping solution acrosss the eye's wall to the Mercator projection of the Euler equations leads to a new result stated by Le Roux in a recent but unpublished manuscript: in a given hurricane model the wind speed (at the sea level) has a dicontinuous jump tangent to the 2D curve of the eye's wall. Here we develop a generalized functional framework which permits a mathematical proof of the result. The 2D study, with a symmetry of revolution hypothesis, can be interpretated as the basis of the 3D one, the model will be reduced to a system hyperbolic nonlinear of two equations in which the altitude z can be interpretated as a real evolution variable. The purpose of this model is to contribute to a better understanding of the cyclonic phenomenon.

Speaker: Irina Melnikova
Title: Generalized and regularized solutions to infinite dimensional stochastic problems
Abstract: In recent decades there has been growing realization that elements of chance play an essential role in many processes around us, including processes in physics, biology, and finance. Mathematical models that give an accurate description of these processes lead to stochastic equations. This survey is devoted to different approaches to investigation of stochastic differential equations for random processes with values in Hilbert spaces and spaces of abstract distributions.

Speaker: Choi Min-Jun
Title: Eigenvalue Problems for Discrete Laplacian under the Mixed Boundary Conditions and their Applications
Abstract: In this talk, we discuss the existence of positive eigenvalues and their positive eigenfunctions for the discrete eigenvalue problem under the mixed boundary conditions:

$$\begin{cases} -\Delta_\omega u(x) = \lambda u(x), & x \in S, \\ \mu(z)\frac{\partial u}{\partial n}(z) + \sigma(z)u(z) = 0, & x \in \partial S \end{cases}$$

on a discrete network S. Here, μ, $\sigma : \partial S \to [0, +\infty)$ are continuous functions with $\mu^2(z) + \sigma^2(z) > 0$, $z \in \partial S$.

We also provide the existence of positive solutions for the discrete Poisson's equation under the mixed boundary conditions. Moreover, by using the fact that eigenvalue and their eigenfunction is positive, we also provide behaviors of solutions to the discrete semilinear heat equation.

Speaker: Svetlana Mincheva-Kaminska
Title: Existence theorems for convolution of Roumieu ultradistributions
Abstract: We prove various existence theorems concerning the convolution in the space of Roumieu ultradistributions and in the space of Roumieu tempered ultradistributions. The conditions for the existence of the convolution are given, in particular, in terms of the supports of ultradistributions.

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Speaker: Lenny Neyt
Title: The Structure of Ultradistributional Quasiasymptotics
Abstract: As the application of generalized functions became more prevalent in a wide array of different mathematical models, so too became the need for an asymptotic theory. This ushered in several different approaches, among which the S-asymptotic and, the primary interest of this talk, the quasiasymptotic, first introduced by Zavyalov. An (ultra-)distribution f is said to admit quasiasymptotic g at infinity (resp. at the origin) with respect to the gauge function ρ if the limit

$$f(\lambda x) = \rho(\lambda)g(x) + o(\rho(\lambda)),$$

holds (ultra-)distributionally as $\lambda \to +\infty$ (resp. as $\lambda \to 0+$). In particular, it may be seen as an asymptotic separation of variables.

Speaker: Eduard A. Nigsch
Title: Distributional curvature of conical metrics in full Colombeau algebras
Abstract: The conical metric, which appears e.g. in the description of cosmic strings, is flat everywhere except at the tip of the cone. Intuitively, its curvature should be proportional to the delta distribution there, but as the curvature tensor is a nonlinear function of the metric one cannot calculate it for this singular metric by classical means. I will present an extension of Colombeau's theory of nonlinear generalized functions where this curvature can be calculated and shown to be associated to a delta distribution. By diffeomorphism invariance of the theory, this result does not depend on any choice of coordinates.

Speaker: Michael Oberguggenberger
Title: Colombeau random variables
Abstract: This talk addresses random variables taking values in the Colombeau ring of generalized numbers. With the help of various examples and counterexamples, we explore conditions that do or do not allow one to define probabilities of events, cumulative distribution functions, characteristic functions and the like. While

Colombeau random variables and random functions have been in extensive use, such basic probabilistic question seemingly have found little attention so far.

Speaker: Ljubica Oparnica
Title: Distributed order fractional differential equation modeling viscoelastic waves
Abstract: In this work, the classical wave equation is generalized for the case of viscoelastic materials by the use of distributed order fractional model, and describe wave propagation in infinite viscoelastic media. We consider, analyze and solve the distributed order wave equation given as system of three equations. The first equation is the equation of motion and it is a consequence of the Second Newton Law. The second equation is the constitutive equation of distributed order fractional type, and the third equation is the strain measure for small local deformations. We study existence and uniqueness of fundamental solutions for the generalized Cauchy problem corresponding to distributed order wave equation. As consequence, we establish existence, uniqueness, and obtain explicit form of the solution to a class of wave equations, corresponding to the linear fractional order constitutive models, and we also study a genuine distributed order wave equation. The wave speed is found to be connected with the material properties at initial time instant, more precisely with the glass modulus.

Speaker: Fethia Ouikene
Title: Almost periodic generalized ultradistributions
Abstract: The aim of this work is to introduce and to study an algebra of generalized ul- tradisributions containning almost periodic ultradistributions. Proprieties of this algebra are studies.

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Speaker: Sanja Pantić
Title: An Enery Study of Solitary Wave Solutions for the Extended Regularized Long-Wave equation
Abstract: Traveling waves that are smooth and symmetric about their maximum, that decay rapidly to zero on their outskirts and that travel alone are named solitary waves. They appear when there is a balance between nonlinearity and dispersion. Such waves are of importance to applications and therefore are studied as solutions for numerous equations. The generalized Korteweg-de Vries equation and its regularized alternative known as the GeneralizedRegularized Long-Wave equation (GRLW) $u_t+u_x+\alpha(u^p)_x-\beta^2u_{xxt}=0$, feature such solutions. Solitary-wave solutions of the GRLW equation are stable for speeds that are greater than its critical speed, which is known explicitly, and depends on coefficients α, β and power p. When another nonlinearity is introduced into the GRLW equation, extending it to

$$u_t + \alpha u_x + \beta^p(u^p)_x + \beta_q(u^q)_x - \gamma u_{xxt} = 0,$$

the stability of solitary waves may gain another stable region for specific combination of its coefficients α, β_p β_q , γ and powers p and q. We are interested in the minimal perturbation that would contribute to a slow-moving solitary wave being transformed into a fast-moving solitary wave and vice versa.

Speaker: Stevan Pilipović
Title: Regularity through mollification
Abstract: We introduce and study new algebras and modules of generalized functions which are useful in the analysis of non-linear problems. It is shown that various Schwartz distribution spaces are naturally embedded into our new spaces of generalized functions. We then investigate the role of regularity in this context; in particular, we present several criteria for detecting various type of regularity properties through the use of mollifiers.

Speaker: Asghar Ranjbari
Title: Uniformly closure of sets and some continuity results in locally convex cones
Abstract: Locally convex cones are generalizations of locally convex spaces. In this paper, we introduce uniformly closure of a set in locally convex cones and verify the polar of this set. Also we prove some continuity results of adjoint of a linear operator between two locally convex cones.

Speaker: Dimitrios Scarpalezos
Title: Connectivity versus topology for generalized functions and points
Abstract: Colombeau generalized functions have a disconnected topology however they have a connectivity structure heritated from the usual smooth functions and is basic for many situations for example for intermediate value theorems.

Speaker: Benedict Schinnerl
Title: Geodesic completeness for impulsive gravitational waves in a cosmological background
Abstract: We consider non-expanding impulsive gravitational waves propagating in an (anti-) de Sitter background. The geometry is modelled by a distributional metric in 4-dimensional conformally flat coordinates. This has not been considered before, due to the 'strongly' singular form of the geodesic equations in these coordinates. We succeed to prove existence and uniqueness of geodesics in a regularisation scenario, by extending a fixed point argument to the case at hand.

Speaker: Martin Schwarz
Title: Stochastic Transport in the Goupillaud medium, a Colombeau version
Abstract: Stochastic Transport with spatially varying coefficients can be modelled by the Goupillaud medium. In the classic Goupillaud medium it is assumed that the transport speed is piecewise constant, such that the transport time through one layer is always constant. As the layer thickness goes to zero, the characteristic curve becomes highly irregular. If the transport speed is chosen random and in particular independently identically distributed, it will be a Levy process.

At GF2016 in Dubrovnik we elaborated the details of the classical Goupillaud medium. In this talk we will present a Colombeau version of the Goupillaud transport. We will deal with existence and uniqueness of the solution as well as with the associated solution.

Speaker: Meryem Slimani
Title: Asymptotic almost automorphy of generalized functions
Abstract: The aim of the talk is asymptotic almost automorphy of generalized functions in the framework of Colombeau algebra, it is the continuity of the work on almost automorphic distributions [1] and the developpement of the work [2].

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Speaker: Christian Spreitzer
Title: Distributional limits of generalized solutions to the Cauchy problem for first-order systems
Abstract: We investigate distributional limits of Colombeau generalized solutions to first-order systems and second-order wave equations of low regularity. As applications in physics, we consider the Dirac equation and the Klein-Gordon equation with singular potentials. In special cases, we obtain distributional limits of generalized solutions even for coefficients whose regularity is too low for a weak interpretation of the differential equation outside the framework of Colombeau algebras.

Speaker: Roland Steinbauer
Title: Impulsive gravitational waves and their mathematics
Abstract: Impulsive gravitational waves are general relativistic spacetimes modelling short but intense bursts of gravitational radiation. Mathematically they are described by metrics of low regularity (Lipschitz continuous or even distributional), which makes them especially interesting examples in the study of non-regular spacetime geometries. After providing a brief overview of the topic we present recent results focusing on geodesic completeness and on the mathematically rigorous description of the so called 'discontinuous coordinate transformation' relating the Lipschitz continuous form of the metric to the distributional one.

Speaker: Diana T. Stoeva
Title: Fréchet frames for spaces of generalized functions and localization
Abstract: Fréchet frames, introduced in the last decade, naturally generalize frames for Banach spaces to frames for projective and inductive limits of Banach spaces, in particular for spaces of generalized functions. We will start the talk with brief introduction to Fréchet frames and their usage for obtaining series expansions.

Further, we will focus on certain classes of localized frames and their relation to Fréchet frames and series expansions of spaces of distributions. As an illustration of some results, we will consider relation to samlping and Gabor frames. Finally, we will discuss characterizations of spaces of tempered distributions and ultradistributions via orthonormal bases and present extensions of these characterizations to the frame setting.

The talk is based on a joint work with Stevan Pilipović.

Speaker: Djurdjica Takači
Title: On the Solutions of the Fuzzy Fractional Differential Equation
Abstract: We consider the fuzzy fractional differential equation with fuzzy boundary and initial conditions. The solution of this problem is obtained by using Zadeh's extension principle. First the exact and the approximate solutions of the corresponding crisp problems are constructed, in the frame of Mikusinski operators, and they are extended to the exact and the approximate solutions given fuzzy problem.

This talk is based on the joint work with Aleksandar and Arpad Takači.

Speaker: Nenad Teofanov
Title: The Grossmann-Royer transform on Gelfand-Shilov type spaces with an application to localization operators
Abstract: We recall relevant facts related to the Gelfand-Shilov type spaces and their dual spaces of ultradistributions. Then we consider different time-frequency representations, and focus on the Grossmann-Royer transform, also in the context of Gelfand-Shilov spaces.

As an applicaiton we consider the continuity and compactness properties of localization operators on modulation spaces. We define localization operators in terms of the Grossmann-Royer transform, and show that such definition coincides with the usual definition based on the short-time Fourier transform.

Speaker: Todor Todorov
Title: Linear Discontinuous Functionals as Generalized Functions
Abstract: We prove the existence of solutions for a class of linear partial differential equations with smooth coefficients in the space of the algebraic dual ${}^*\mathcal{D}(\Omega)$ of $\mathcal{D}(\Omega)$.

Speaker: Filip Tomic
Title: New challenges in extended Gevrey regularity
Abstract: By introducing two-parameter dependent sequences $M_p^{\tau,\sigma} = p^{\tau p^\sigma}$, $p \in \mathbf{N}$, $\tau > 0$, $\sigma > 1$, we define and study classes of smooth functions which contain Gevrey functions. In particular, we present the results concerning superposition and inverse-closedness property of our classes. Moreover, we extend the notion of the associated function to the $M_p^{\tau,\sigma}$ and prove the Paley-Wiener type result. We also define wave-front sets related to our classes and discuss their basic properties.

Speaker: Srdjan Trifunović
Title: Existence of a weak solution to incompressible viscous fluid and nonlinear plate fluid-structure interaction problem in 3D
Abstract: In this talk, we shall study a nonlinear, moving boundary fluid-structure interaction problem between an incompressible viscous fluid modeled by the 3D Navier-Stokes equations, and an elastic structure modeled by nonlinear plate equations for a large class of nonlinearities that includes Kirchoff, von Karman and Berger plates. The existence of the weak solution is obtained by designing a hybrid approximation scheme that deals with the nonlinearities both in the fluid and the structure. We combine time-discretization and operator splitting to create two sub-problems, one piece-wise stationary for the fluid and one in a Galerkin basis for the plate. We give a sufficient condition for number of time discretization sub-intervals in every step in a form of dependence with number of Galerkin basis functions and nonlinearity order in the nonlinear plate, that guarantees the convergence of a subsequence of approximate solutions to the weak solution. This is a joint work with professor Ya-Guang Wang from Shanghai Jiao Tong University.

Speaker: Ville Turunen
Title: Time-frequency analysis on compact groups
Abstract: Phase-space analysis or time-frequency analysis is a subfield of Fourier analysis. It is traditionally exercised in Euclidean spaces, presenting signals simultaneously both in time and in frequency. We introduce a natural family of time-frequency transforms for signals on any compact group. We also study the properties of the related pseudo-differential operators for signal processing.

Speaker: Daniel Velinov
Title: Disjoint hypercyclic properties of abstract differential equations of first order
Abstract: This talk is a devoted on the theory of disjoint hypercyclic and disjoint topologically transitive abstract non-degenerate differential equations of first order as well as disjoint chaoticity for strongly continuous semigroups and C-distribution semigroups in Banach and Fréchet function spaces. We give results on disjoint topologically mixing property for C-distribution semigroups and prove a disjoint analogue of the Desch-Schappacher-Webb criterion in this context. Some new results on disjoint transitivity and disjoint chaoticity of strongly continuous families of composition operators and strongly continuous semigroups induced by semiflows will be given, as well. Additionally, some remarks on frequent hypercyclicity of strongly continuous and generalized semigroups will be given.

Speaker: James Vickers
Title: Some recent (and not so recent) results on generalised solutions to hyperbolic equations
Abstract: This talk will look at some recent results on generalised solutions to hyperbolic PDEs and relate these to previous work in this area. Issues considered will be:
(1) Approximation and regularisation of the equation,
(2) Embedding in an algebra of generalised functions,
(3) Changes of coordinates and diffeomorphism invariance,

(4) Controlling the characteristics, bi-characteristics and causal structure,
(5) Regularity theory,
(6) Relationship to weak solutions,
(7) Physical interpretation of the solution.

Speaker: Vesa Vuojamo
Title: Time-Frequency Analysis on SU(2)
Abstract: The concept of a Fourier series in non-commutative compact groups is given by the Peter-Weyl theorem. This enables also the study of time-frequency transforms and pseudodifferential operators. However, for a general compact group G the set $\widehat{G}$ of equivalence classes of irreducible unitary representations is not a group. Thus, the notion of a modulation is more difficult.

We present the basic tools for time-frequency analysis in the case of SU(2), consider transforms of the Cohen's class and contrast these to the simple Abelian case of the unit circle S^1.

Speaker: Yunyun Yang
Title: Asymptotic expansions of thick distributions
Abstract: In this talk, I will briefly review the theory of thick distributions. Then I will talk about asymptotic expansions of thick distributions and its connection to usual distributions. I will give a few examples of such expansions.

Speaker: Nurgissa Yessirkegenov
Title: Very weak solutions to wave equations on graded groups
Abstract: In this talk we discuss the well-posedness of the Cauchy problem for the Rockland wave equations on graded groups (which include the cases of Rn, Heisenberg, and general stratified Lie groups) when the time-dependent propagation speed a(t) is Holder and distributional. In the case a(t) is a distribution, we introduce the notion of "very weak solutions" to the Cauchy problem, and prove its existence and uniqueness in an appropriate sense.

Speaker: Gholamreza Zamani
Title: On the zero point problem of monotone operators in CAT(0) spaces
Abstract: In this paper, a common fixed point of an infinitely countable family of quasi-nonexpansive mappings and a common zero of a finite family of monotone operators are approximated in reflexive CAT(0) spaces. In addition, we define a norm on span X* and give an application of this norm.

List of participants

- Ahmed Abdeljawad, *University of Torino*
- Aleksandar Aksentijević, *University of Kragujevac*
- Jelena Aleksić, *University of Novi Sad*
- Suzana Aleksić, *University of Kragujevac*
- Nenad Antonić, *University of Zagreb*
- Teodor Atanacković, *University of Novi Sad*
- Sanja Atanasova *Ss. Cyril and Methodius University, Skopje*
- Christian Bargetz, *University of Innsbruck*
- Bedrije Bedzeti, *State University of Tetova*
- Eva Buriankova, *Charles University*
- Marco Cappiello, *University of Torino*
- Duvan Cardona, *Pontificia Universidad Javeriana*
- Sandro Coriasco, *University of Torino*
- Soon-Yeong Chung, *National Institute for Mathematical Sciences*
- Vladimir Danilov, *National Research University HSE*
- Gregory Debruyne, *Ghent University*
- Pavel Dimovski, *Ss. Cyril and Methodius University, Skopje*
- Nevena Dugandžija, *University of Novi Sad*
- Hans Feichtinger, *University of Vienna*
- Alexei Filinkov, *University of Adelaide*
- Antonio R.G. Garcia, *UFERSA*
- Sneana Gordić, *Faculty of Education in Sombor*
- Michael Grosser, *University of Vienna*
- Katerina HadziVelkova Saneva, *Ss. Cyril and Methodius University, Skopje*
- Maximilian Hasler, *Université des Antilles*
- Günther Hörmann, *University of Vienna*
- Egzona Iseni, *Mother Teresa University*
- Ivan Ivec, *University of Zagreb*
- Smiljana Jakšić, *University of Belgrade*
- Marko Janev, *University of Novi Sad*
- Maja Jolić, *University of Novi Sad*
- Andrzej Kamiński, *University of Rzeszow*
- Dmitrii Karp, *Far Eastern Federal University*
- Mohammed Taha Khalladi, *University of Adrar*
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