Schedule ICATA 2026

Open Ceremony:
Faculty of Medicine
Str. Lucian Blaga, No. 2A, Sibiu
Senate Hall

Lectures:
Faculty of Science
Str. Dr. I. Ratiu, No. 5–7, Sibiu
Lecture rooms: A27, A14

Wednesday, March 18

08:30-9:30 Registration

09:30-09:50 Opening Ceremony

Plenary Lecture (Senate Hall)

Session Chair: Ana-Maria Acu

09:50-10:20 Stefano De Marchi, *From Radial Basis Functions to Variably Scaled Discontinuous Kernels*

10:20-10:50 Gianluca Vinti, *Beyond linearity: a unified perspective on approximation*

10:50-11:20 Ioan Raşa, *From Seventy to Seventy-Five (and Beyond)*

11:20-11:50 Coffee break

Lecture (Senate Hall)

Session Chair: Ioan Raşa

11:50-12:20 Radu Miculescu, *On the range of fractal interpolation functions*

12:20-12:40 Rosario Corso, *An overview on the estimates of the difference of positive linear operators in approximation theory*

12:40-13:00 <u>Alexandru Mihai Bica</u>, Constantin Popescu, *Convergence properties of Green's function method for two-point boundary value problems with deviating argument*

Lecture (Room A27)

Session Chair: Alexandru Mihai Bica

15:00-15:20 Abdulhamit Kucukaslan, *Two-weighted Norm Inequalities for Generalized Fractional Integrals in the Generalized Weighted Local and Global Vanishing Morrey Spaces*

15:20-15:40 Andrei Vernescu, *About the speed of convergence of certain remarkable sequences and series*

15:40-16:00 Bogdan-Cristian Anghelina, *Covers of fractal interpolation surfaces with finite families of octahedrons*

16:00-16:20 Parth Dhanwani, <u>Prashantkumar G. Patel</u>, *On Positive Linear Operators via Katugampola Fractional Integral*

16:20-16:50 Coffee break

Session Chair: Dorian Popa

16:50-17:10 Şule Yüksel Güngör, *Approximation Properties of a Moment-Based Modification of Bernstein Operators on a Symmetric Interval*

17:10-17:30 Radu Păltănea, <u>Bianca Ioana Vasian</u>, *Double Weighted Second Order Modulus*

17:30-17:50 Ștefan - Lucian Garoiu, *Exponential Bernstein-Durrmeyer operators*

19:30-22:00 Welcome Cocktail (Imparatul Romanilor Hotel)

Thursday, March 19

Lecture (Room A27)

Session Chair: Gianluca Vinti

09:00-09:20 <u>Arianna Travaglini</u>, Vita Leonessa, *Approximation properties of a sequence of integral operators associated with power Lindley distribution and applications*

09:20-09:40 <u>Michele Piconi</u>, Gianluca Vinti, *Density versus direct approach to simultaneous approximation in Sobolev-Orlicz spaces via semi-discrete sampling operators*

09:40-10:00 <u>Lorenzo Boccali</u>, Gianluca Vinti, *On the approximation properties of max-product generalized sampling operators in L^p-spaces*

10:00-10:20 <u>Lucrezia Rinelli</u>, Arianna Travaglini, Gianluca Vinti, *Sampling type operators for OCTA image enhancement*

10:20-10:40 Ana Maria Acu, <u>Miruna-Ştefana Sorea</u>, Arianna Travaglini, Gianluca Vinti, *Nonlinear multivariate sampling Durrmeyer operators*

10:40-11:10 Coffee break

Session Chair: Stefano De Marchi

11:10-11:30 <u>Voichita Adriana Radu</u>, Ana Maria Acu, Carmen Violeta Muraru Popescu, *Landmarks in Operator Approximation: The Work of professor Ioan Raşa*

11:30-11:50 <u>Dorian Popa</u>, Alexandra Măduţa, Alexandra Sîngeorzan, *On Sincov's functional equation*

11:50-12:10 <u>**Alina Ramona Baias**</u>**, Dorian Popa**, *Ulam stability of a functional equation of Fibonacci type*

12:10-12:30 <u>**Diana Otrocol**</u>**, Adela Novac, Dorian Popa**, *Best Ulam constant of some partial differential operator*

12:30-12:50 Daniela Inoan, *On some generalized Szász-Mirakyan operators*

Special Session for Early-Stage Researchers (Room A14)

Session Chair: Rosario Corso

11:10-11:30 Georgian-Cristian Chivu, *Comparative Deep Learning Models for Aortic Aneurysm Segmentation in CT Imaging*

11:30-11:50 Mihai Ilina, *Neural Operator Approximations for Fluid Structure Interaction in Aortic Aneurysm Modeling*

11:50-12:10 <u>**Alexandra Măduţa**</u>**, Ioan Raşa** , *Entropy of Probability Distributions*

12:10-12:30 Vlad Paşca , *Bivariate Neural Network operators based on B-spline functions*

12:30-12:50 Ana-Maria Acu, <u>**Alin Pepenar**</u>**, Ioan Raşa**, *Positive linear operators and inequalities involving convex functions*

Lecture (Room A27)

Session Chair: Voichita Adriana Radu

15:00-15:20 <u>Miruna-Daniela Roşu</u>, Nicuşor Minculete, *New aspects about inequalities related to norms for pairs of operators*

15:20-15:40 Emilia-Loredana Pop, *Properties of the intermediate point from Bonnet theorem*

15:40-16:00 José A. Adell, <u>Daniel Cárdenas-Morales</u>, *On the pointwise approximation of locally affine functions by classical positive operators*

16:00-16:20 <u>Hardikkumar B. Parmar</u>, **Prashantkumar G. Patel**, *A Study on Fractional-Type Bernstein–Kantorovich Operators Associated with q-Integers*

16:20-16:50 Coffee break

Friday, March 20

09:30-13:30 Excursion: Alba Iulia – Alba Carolina Fortress (Citadel) (Departure from Sala Thalia, Cetății str., no. 3-5)

13:30-15:00 Lunch

19:30-22:00 Official Dinner (Imparatul Romanilor Hotel)

Abstracts ICATA 2026

Bogdan-Cristian Anghelina
Title: Covers of fractal interpolation surfaces with finite families of octahedrons

Abstract. In a previous work, On the localization of Hutchinson-Barnsley fractals, Chaos Solitons Fractals, 173 (2023), 113-674, we presented a method for finding a finite family of closed balls whose union contains the attractor of a given iterated function system. Our aim, for the particular framework of fractal interpolation surfaces, is to provide an improved version of it. This approach is more efficient, from the computational point of view, as it is based on finding the maximum of certain sets, in contrast to the previous method which uses a sorting algorithm.

Alina Ramona Baias, Dorian Popa
Title: Ulam stability of a functional equation of Fibonacci type

Abstract. In this talk we present some results on Ulam stability of the functional equation of Fibonacci type, given by

$$f(x + 2) = af(x + 1) + bf(x),$$

where $f : \mathbb{R} \to X, a, b \in \mathbb{C}$ and X is a Banach space over $\mathbb{C}$. Some results concerning the best Ulam constant of this equation are also provided.

Alexandru Mihai Bica, Constantin Popescu
Title: Convergence properties of Green's function method for two-point boundary value problems with deviating argument

Abstract. The maximal order of convergence of Green's function method is obtained for two-point boundary value problems with deviating argument, by choosing suitable spline interpolation procedures and quadrature rules. The convergence is proven by providing the error estimate in the discrete and continuous approximation of the solution. The theoretical order of convergence is limited by the smoothness conditions of Green's function. The accuracy of this method and the maximal order of convergence are tested on some numerical experiments.

References

[1] A.M. Bica, *On themaximal order of convergence of Green's function method for solving two-point boundary value problems with deviating argument*, Numerical Algorithms 95 (2024) 943-978

[2] A.M. Bica, D. Curilă (Popescu), *The convergence properties of the Green's function method for third order functional differential equations*, Comput Appl Math 41 (2022) art. no. 352

[3] A.M. Bica, D. Curilă (Popescu), *Catmull-Rom spline approach and the order of convergence of Green's function method for functional differential equations*, Bull Transilv Univ Braşov Ser III 2(64) no. 2 (2022) 13–32

[4] Q.A. Dang, Q.L. Dang, *A unified approach to study the existence and numerical solution of functional differential equation*, Appl Numer Math 170 (2021) 208–218

[5] Q.A. Dang, T.H. Nguyen, V.Q. Vu, *Construction of high order numerical methods for solving fourth order nonlinear boundary value problems*, Numerical Algorithms 99 (2025) 323-354

[6] S.A. Khuri, A. Sayfy, *Numerical solution of functional differential equations: a Green's functionbased iterative approach*, Int J Computer Math 95 (2018) 1937–1949

Lorenzo Boccali, Gianluca Vinti

Title: ON THE APPROXIMATION PROPERTIES OF MAX-PRODUCT GENERALIZED SAMPLING OPERATORS IN L^p-SPACES

Abstract. In this talk, we present a recent study [2] on the approximation of (non-negative) bounded functions in $L^p([-1,1])$, for $1 \leq p < +\infty$, using max-product generalized sampling operators $(S_n^\chi)_{n\in\mathbb{N}}$. As is well-known (see [3]), these operators provide a nonlinear generalization of the celebrated sampling series (see, e.g., [1]), obtained by replacing the usual summation with the supremum-or, in the case of a finite number of terms, the maximum-over a suitable index set.

More precisely, we derive quantitative estimates for the approximation error in the L^p-norm in terms of an averaged modulus of smoothness, known as the τ-modulus (see [4]). A key step in our approach is estimating the L^p-norm of the approximation error for (non-negative) functions in the Sobolev space $W^{1,p}$. By combining this preliminary result with a constructive density theorem due to Sendov and Popov [4], we extend the quantitative estimates to the entire L^p-space. In the final part of the talk, we will show that the theory can be further extended to bounded functions of arbitrary sign by a slight modification of the definition of the max-product operators S_n^χ.

References

[1] C. Bardaro, P.L. Butzer, R.L. Stens, G. Vinti, *Prediction by samples from the past with error estimates covering discontinuous signals*, IEEE Trans. Inform. Theory, **56** (1) (2010), 614–633.

[2] L. Boccali, G. Vinti, L^p-*approximation and shape-preserving properties of the max-product generalized sampling operators*, to be submitted, (2025).

[3] L. Coroianu, D. Costarelli, S.G. Gal, G. Vinti, *The max-product generalized sampling operators: Convergence and quantitative estimates*, Appl. Math. Comput., **355** (2019), 173–183.

[4] B. Sendov, V.A. Popov, *The averaged moduli of smoothness*, Pure Appl. Math., New York, Wiley, Chichester, (1988).

José A. Adell, <u>Daniel Cárdenas-Morales</u>

Title: ON THE POINTWISE APPROXIMATION OF LOCALLY AFFINE FUNCTIONS BY CLASSICAL POSITIVE OPERATORS

Abstract. We study the approximation of $B_n f(x)$ and $S_n f(x)$ towards $f(x)$, as $n \to \infty$, where B_n and S_n are, respectively, the classical Bernstein and Szász-Mirakyan operators, and x belongs to an open interval I where the function f is assumed to be affine. The rate of convergence turns out to be exponential, this property being no longer true at the boundary of I. Our approach relies on probabilistic representations of the operators via Binomial and Poisson distributions, as well as on tools from so-called large deviation theory. Specifically, we obtain new tail estimates expressed in terms of the Kullback-Leibler divergence between the associated Bernoulli and Poisson random variables.

Georgian-Cristian Chivu

Title: COMPARATIVE DEEP LEARNING MODELS FOR AORTIC ANEURYSM SEGMENTATION IN CT IMAGING

Abstract. This work investigates deep learning architectures for the automated detection and segmentation of aortic aneurysms from computed tomography (CT) imaging, with a focus on the mathematical modeling and optimization aspects underlying modern neural network approaches. Accurate segmentation of vascular structures represents a challenging approximation problem, where the goal is to learn complex mappings between high-dimensional medical images and anatomical regions of interest.

The research begins with the implementation of a custom deep learning pipeline for medical image preprocessing, training, and evaluation. The baseline architecture used in this framework is

U-Net, a convolutional neural network that approximates segmentation functions through an encoder–decoder structure capable of capturing both local and contextual spatial information.

Building on this baseline, several architectural extensions are explored in order to analyze how different network structures influence the approximation capacity and segmentation performance. In particular, variants such as Attention U-Net and automated configuration frameworks such as nnU-Net are investigated to study the role of attention mechanisms and automated hyperparameter optimization in improving model generalization for vascular CT data.

The study further examines transformer-based architectures, including Swin-UNETR, which introduce global attention mechanisms capable of modeling long-range dependencies in volumetric images. These models can be interpreted as alternative approximation strategies that extend classical convolutional approaches by incorporating global feature representations.

To support efficient experimentation, the research also considers the integration of GPU-accelerated medical imaging frameworks such as MONAI and NVIDIA Clara Train, enabling scalable training and benchmarking of multiple architectures.

Model performance is evaluated using standard segmentation metrics including the Dice coefficient and Intersection over Union, providing a quantitative comparison of different deep learning models. The results illustrate how architectural design choices influence the approximation quality and computational efficiency of neural networks in complex medical imaging tasks.

This work aims to bridge mathematical approximation concepts with modern deep learning methodologies, highlighting how advances in neural network architectures can contribute to more robust and accurate medical image analysis systems.

Rosario Corso
Title: AN OVERVIEW ON THE ESTIMATES OF THE DIFFERENCE OF POSITIVE LINEAR OPERATORS IN APPROXIMATION THEORY

Abstract. In many contexts within approximation theory, it is of interest to estimate the difference between two given positive linear operators. Several works addressing this topic are available in the literature. In this talk, we present an overview of some of the main results, with a particular focus on the contributions of Professor Ioan Rasa and colleagues.

Stefano De Marchi

Title: From Radial Basis Functions to Variably Scaled Discontinuous Kernels

Abstract. Radial Basis Functions (RBF) have become quite a popular tool in mathematics and applied sciences, for their flexibility, allowing us to work with multidimensional data, without requiring any special structure of the data to be approximated. Usually, RBF depends on a shape parameter that needs to be tuned or optimised. Variably Scaled Kernels (VSK) and their counterpart for discontinuous functions, Variably Scaled Discontinuous Kernels, are well-known alternatives that use a scaling function that mimics the data. In this talk, after a review of the most important properties of RBF approximations, we present VS(D) Kernels and some of their applications.

Ștefan - Lucian Garoiu

Title: Exponential Bernstein-Durrmeyer operators

Abstract. In this paper we introduce an exponential variant of the Bernstein-Durrmeyer operators. Regarding this new operators we obtain some convergence results, a Voronovskaya type theorem and some quantitative estimates using some smoothness moduli adapted to a certain Chebyshev system. Also we study their simultaneous approximation properties.

Şule Yüksel Güngör

Title: APPROXIMATION PROPERTIES OF A MOMENT-BASED MODIFICATION OF BERNSTEIN OPERATORS ON A SYMMETRIC INTERVAL

Abstract. In this talk, we introduce a moment-based modification of the classical Bernstein operators on a symmetric interval. This construction combines a domain transformation with a second-central-moment structure to yield a new sequence of positive linear operators with improved approximation properties.

We investigate the convergence properties of these operators through the use of a Korovkin-type theorem adapted to open intervals. Furthermore, we establish quantitative error estimates in terms of the first and second modulus of continuity. The rate of convergence is obtained in a Lipschitz-type space, and a Voronovskaja-type theorem is proved to describe the asymptotic behaviour of the operators. Numerical examples are included to support the theoretical results and demonstrate the effectiveness of the proposed approach.

Mihai Ilina

Title: NEURAL OPERATOR APPROXIMATIONS FOR FLUID STRUCTURE INTERACTION IN AORTIC ANEURYSM MODELING

Abstract. Aortic aneurysms pose a significant clinical risk due to the potential for rupture, a life-threatening event whose likelihood depends on the hemodynamic forces acting on the arterial wall. Quantities such as wall shear stress, intraluminal pressure, and wall displacement are critical indicators of rupture risk, yet their accurate computation requires solving coupled partial differential equation systems that model both blood flow and vessel wall mechanics.

The hemodynamics are governed by the incompressible Navier–Stokes equations, while the arterial wall is modeled as a nonlinear hyperelastic material using constitutive laws such as the Holzapfel–Gasser–Ogden model. The two-way coupling between these do-

mains fluid–structure interaction (FSI) introduces additional complexity through kinematic, dynamic, and geometric interface conditions. High-fidelity numerical simulations of this coupled system require meshes with millions of elements and thousands of time steps per cardiac cycle, resulting in computational times on the order of hours to days on high-performance computing systems.

This work investigates neural operator methods as a means to approximate the FSI solution operator directly, learning mappings between function spaces from simulation data. We present two complementary architectures: the Fourier Neural Operator, which leverages spectral convolutions for global information propagation, and graph-based neural operators, which naturally accommodate the irregular mesh topology of patient-specific vascular geometries. The presentation covers the mathematical foundations, the data generation pipeline, training and evaluation methodology, and ethical considerations for clinical deployment. Central research questions address approximation capacity, generalization to unseen geometries, preservation of physical constraints such as incompressibility, and operator stability. Preliminary analysis suggests that trained neural operators can achieve speedups of three to five orders of magnitude over classical solvers, opening pathways toward real-time cardiovascular risk assessment.

Daniela Inoan

Title: On some generalized Szász-Mirakyan operators

Abstract. We present various approximation properties for sequences of generalized Szász-Mirakyan operators based on a function ρ. Several results about convergence to the identity operator on weighted spaces, quantitative type theorems about the degree of weighted convergence, shape-preserving properties of the operators are given. Also, some estimates of the difference between two operators will be discussed.

Abdulhamit Kucukaslan

Title: TWO-WEIGHTED NORM INEQUALITIES FOR GENERALIZED FRACTIONAL INTEGRALS IN THE GENERALIZED WEIGHTED LOCAL AND GLOBAL VANISHING MORREY SPACES

Abstract. In this paper, we prove the boundedness properties of generalized fractional integral operators I_ρ in the vanishing generalized weighted Morrey-type spaces as vanishing generalized weighted local Morrey spaces $\mathcal{VM}_{p,\varphi}^{\{x_0\}}(\mathbb{R}^n, w_1)$ and vanishing generalized weighted global Morrey spaces $\mathcal{VM}_{p,\varphi^{\frac{1}{p}}}(\mathbb{R}^n, w_2)$ by using two-weighted L_p-norm inqualities over balls. Hence, we obtain the Spanne-type boundedness of the generalized fractional integral operators I_ρ from the vanishing generalized weighted local Morrey spaces $\mathcal{VM}_{p,\varphi_1}^{\{x_0\}}(\mathbb{R}^n, w_1)$ to another one $\mathcal{VM}_{q,\varphi_2}^{\{x_0\}}(\mathbb{R}^n, w_2)$ with $(w_1, w_2) \in A_{1+\frac{q}{p'}}$ for $1 < p < q < \infty$, and from the vanishing generalized weighted local Morrey spaces $\mathcal{VM}_{1,\varphi_1}^{\{x_0\}}(\mathbb{R}^n, w_1)$ to the vanishing generalized weighted weak local Morrey spaces $\mathcal{VWM}_{q,\varphi_2}^{\{x_0\}}(\mathbb{R}^n, w_2)$ with $w_1 \in A_{1,q}$ for $p = 1, 1 < q < \infty$, where $\varphi_1, \varphi_2 \in \mathfrak{M}_{\text{loc}}$ class. We also prove the Adams-type boundedness of generalized fractional integral operators I_ρ from vanishing generalized weighted global Morrey spaces, $\mathcal{VM}_{p,\varphi^{\frac{1}{p}}}(\mathbb{R}^n, w_1)$ to $\mathcal{VM}_{q,\varphi^{\frac{1}{q}}}(\mathbb{R}^n, w_1)$ with $w_1 \in A_{p,q}$ for $1 < p < q < \infty$ and from vanishing generalized weighted global Morrey spaces $\mathcal{VM}_{1,\varphi}(\mathbb{R}^n, w_1)$ to vanishing generalized weighted weak global Morrey spaces $\mathcal{WM}_{q,\varphi^{\frac{1}{q}}}(\mathbb{R}^n, w_1)$ with $w_1 \in A_{1,q}$ for $p = 1, 1 < q < \infty$, where $\varphi \in \mathfrak{M}_{\text{glob}}$ class. The our all weight functions belong to Muckenhoupt-Weeden classes $A_{p,q}$.

Alexandra Măduţa, Ioan Raşa

Title: ENTROPY OF PROBABILITY DISTRIBUTIONS

Abstract. This talk explores the connection between probability distributions and their associated entropies, both in discrete and continuous settings. Classical and new examples of positive linear operators are discussed, along with entropy measures such as Rényi, Tsallis, and Shannon. The presentation also highlights two

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open problems related to convexity and positivity, proposed by Ioan
Raşa.

Radu Miculescu

Title: ON THE RANGE OF FRACTAL INTERPOLATION FUNCTIONS

Abstract. In this talk we show how to generate coverings (consisting of finite families of rhombi) of the graphs of fractal interpolation functions. In this way, we give an answer to the important problem concerning the spatial extent of such functions' image, which appears in geometric aided design. As a by-product we obtain estimations for the range of these functions derived solely from interpolation data and scaling parameters. We should stress upon the fact that the existing papers dealing with this subject focus on restrictions imposed on parameters of the iterated function systems generating the fractal function based on a fixed range of it. Some concrete examples and graphical representations are provided.

<u>Diana Otrocol</u>, Adela Novac, Dorian Popa

Title: BEST ULAM CONSTANT OF SOME PARTIAL DIFFERENTIAL
OPERATOR

Abstract. In this paper we give a characterization of Ulam stability for the linear partial differential operator $D \colon C^1(\mathbb{R}^2, X) \to C(\mathbb{R}^2, X)$ given by $Du = au_x + bu_y + cu$, where $a, b, c \in \mathbb{R}$ and X is a Banach space over $\mathbb{R}$. Moreover we obtain the best Ulam constant of the operator D.

References

[1] J. Brzdek, D. Popa, I. Raşa, B. Xu, *Ulam Stability of Operators*, Academic Press: Cambridge, MA, USA, 2018.

[2] N. Lungu, D. Popa, *Hyers-Ulam stability of a first order partial differential equation*, J. Math. Anal. Appl., 2012, 385, 86–91.

[3] A. Novac, D. Otrocol, D. Popa, *On Ulam stability of a partial differential operator in Banach spaces*, Mathematics, 2023, 11, 2488.

Hardikkumar B. Parmar, Prashantkumar G. Patel

Title: A Study on Fractional-Type Bernstein–Kantorovich Operators Associated with q-Integers

Abstract. In this paper, we present and examine a novel category of Bernstein–Kantorovich operators that incorporate fractional integrals and q-integers. Initially, we determine the moments of the operators, which are subsequently utilized to obtain global approximation results regarding the first- and second-order moduli of continuity and Peetre's K-functional. Moreover, Voronovskaya-type and Grüss–Voronovskaya-type asymptotic formulas are derived, that define the exact rate of convergence. We demonstrate a Chebyshev–Grüss-type inequality utilizing the least concave majorant of the modulus of continuity. Finally, we look into the limit form of the proposed operators and show that they converge to a limit operator, along with estimates of the error in q-numbers.

Vlad Paşca

Title: Bivariate Neural Network operators based on B-spline functions

Abstract. We introduce and study a class of neural network operators whose activation mechanism is built from cardinal B-splines. The compact support and smoothness of B-splines lead to localized approximation processes that fit naturally into the theory of positive operators. We prove convergence results and investigate qualitative features such as shape preservation, showing that several geometric properties of the target function are inherited by the approximants. A central part of the analysis is the derivation of Voronovskaja-type asymptotic formulas, which provide a refined

description of the local rate of convergence and highlight the role of the underlying spline moments. The construction is further extended to a bivariate tensor-product setting, where analogous convergence and asymptotic results are obtained together with axial shape preserving properties. Finally, we illustrate the method by numerical experiments in image processing, and we report standard similarity measures (SSIM and PSNR) to assess the quality of the reconstructed images.

Parth Dhanwani, <u>Prashantkumar G. Patel</u>

Title: ON POSITIVE LINEAR OPERATORS VIA KATUGAMPOLA FRACTIONAL INTEGRAL

Abstract. In this paper, we introduce a new class of positive linear operators constructed by means of the Katugampola fractional integral, which generalizes the classical Riemann–Liouville fractional integral operator. The proposed operators extend several well-known approximation processes through the incorporation of fractional parameters, providing enhanced flexibility in controlling smoothness and convergence behavior.

We first investigate the fundamental structural properties of the operators and compute their moments, which are essential in analyzing their approximation performance. By employing techniques based on the modulus of continuity, we establish direct approximation results. Furthermore, we prove several preserving properties of the proposed operators, highlighting their suitability within the framework of positive linear approximation theory.

The results obtained demonstrate that the introduction of fractional parameters offers a meaningful generalization of classical operators and contributes to the development of fractional approximation methods.

Ana-Maria Acu, Alin Pepenar, Ioan Raşa

Title: POSITIVE LINEAR OPERATORS AND INEQUALITIES INVOLVING CONVEX FUNCTIONS

Abstract. We study inequalities involving convex functions and positive linear operators and interpret them within the framework of convex stochastic order $\leq_{cx}$. Our approach is operatorial in nature and provides a unified view of such inequalities involving several classical approximation processes. By considering a broad class of positive linear operators, we obtain new inequalities that describe dominance between the corresponding induced measures.

In addition to the direct problem, showing that the convexity of a function f implies inequalities of the type $L_n f \geq M_n f$, we also consider the inverse problem: given f and a suitable family of measures $\mu \leq_{cx} \nu$ satisfying

$$\int f \, d\mu \leq \int f \, d\nu,$$

does it follow that f must be convex? This inverse problem is particularly challenging. As an illustrative example, we ask whether, for $f \in C[0, \infty)$, the condition $S_t f \leq V_t f$ for all $t > 0$, where S_t and V_t denote the Szász–Mirakjan and classical Baskakov operators respectively, necessarily implies the convexity of f.

Michele Piconi, Gianluca Vinti

Title: DENSITY VERSUS DIRECT APPROACH TO SIMULTANEOUS APPROXIMATION IN SOBOLEV-ORLICZ SPACES VIA SEMI-DISCRETE SAMPLING OPERATORS

Abstract. In this talk, we present recent results on semi-discrete Durrmeyer-type sampling operators in Sobolev-Orlicz spaces [2, 1, 3]. These operators extend well-known families in the literature, such as generalized and Kantorovich sampling operators, as they combine both a discrete and a continuous kernel.

We study the problem of simultaneous approximation in the Sobolev–Orlicz setting through a density approach. We first prove

a convergence result in the uniform norm, showing that the ordinary derivatives of the operators converge uniformly to the derivatives of the functions. Next, we establish a convergence theorem in the Luxemburg norm on the space of test functions, which is then extended to the full Sobolev–Orlicz space via a modular density result. A key tool in this analysis is the Hardy–Littlewood maximal operator in Orlicz spaces [4].

We also present a complementary direct approach to study the rate of convergence by means of quantitative estimates. This allows us to extend the convergence analysis to a more general framework, relaxing some growth conditions on the φ-function.

We conclude by discussing current and future research directions, including Voronovskaja-type formulae in Sobolev-Orlicz spaces, proved both with respect to the modular and the Luxemburg norm.

References

[1] D. Costarelli, M. Piconi, M., G. Vinti, *On the regularization by Durrmeyer-sampling type operators in L^p-spaces via a distributional approach*, Journal of Fourier Analysis and Applications, 31 (2025), Article 11.

[2] T.K. Donaldson, N.S. Trudinger, *Orlicz–Sobolev spaces and imbedding theorems*, Journal of Functional Analysis, 8(1971), 52–75.

[3] M. Piconi, G. Vinti, *Semi-discrete sampling in Sobolev-Orlicz spaces*, (2025), Submitted.

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Emilia-Loredana Pop

Title: PROPERTIES OF THE INTERMEDIATE POINT FROM BONNET THEOREM

Abstract. Starting from the Bonnet theorem, if we consider two continuous functions f and $g : [a, b] \to \mathbb{R}$, where f is monotone, then there exists a function $c : [a, b] \to [a, b]$ continuous in a, for which an integral equality holds. We present properties of the function c that is derivable at the point a and calculate its derivative $c\prime$ in this point, under specific conditions.

Dorian Popa, Alexandra Măduţa, Alexandra Sîngeorzan

Title: ON SINCOV'S FUNCTIONAL EQUATION

Abstract. Let S be a nonempty set and $(G, +)$ an abelian group. In this paper, we give some results on the inhomogeneous Sincov's equation

$$f(x, z) - f(x, y) - f(y, z) = I(x, y, z),$$

where $I : S^3 \to G$ is a given function. We obtain necessary and sufficient conditions on I for the existence of a solution of Sincov's inhomogeneous equation and we give a result on Ulam Stability of it. A Pexiderized version of Sincov's equation is also studied. In this way we give an answer to a problem formulated by L. Reich at the 61st edition of ISFE.

Voichita Adriana Radu, Ana Maria Acu, Carmen Violeta Muraru Popescu

Title: LANDMARKS IN OPERATOR APPROXIMATION: THE WORK OF PROFESSOR IOAN RAŞA

Abstract. This paper is a survey of the main results obtained by Ioan Rașa in the area of approximation by linear operators. We present some of his most influential ideas on positive operators, rates of convergence, and the use of moments and smoothness

tools in approximation theory. These results became natural reference points for many later works and opened new ways of thinking about operator-based approximation. The survey also shows how these ideas entered and shaped the author's own research, as an example of the living influence of Raşa's mathematical style and vision.

Ioan Raşa

Title: FROM SEVENTY TO SEVENTY-FIVE (AND BEYOND)

Abstract. In a previous edition of this conference, I reviewed results obtained up to the age of seventy. Today I will present some articles, written together with collaborators and friends, published in the five years that have passed since then. I have chosen articles in which there are open problems and conjectures.

Lucrezia Rinelli, Arianna Travaglini, Gianluca Vinti

Title: SAMPLING TYPE OPERATORS FOR OCTA IMAGE ENHANCEMENT

Abstract. In this presentation, we describe our research [2] on the reconstruction properties of sampling Kantorovich (SK) operators (see e.g. [1]) and their application to the enhancement of Optical Coherence Tomography Angiography (OCTA) images for the analysis of retinal diseases. From a theoretical standpoint, SK operators are particularly effective in approximating discontinuous signals, owing to their integral-based definition and strong convergence properties. This aspect is especially relevant in digital image processing, since digital images can naturally be modeled as discontinuous signals. Building on these well-established analytical results, we exploit the strong reconstruction capabilities of sampling Kantorovich operators to enhance OCTA images. Their ability to accurately recover structural details while reducing noise

enables the reconstruction of OCTA images that closely resemble Fluorescein Angiography, the invasive and costly gold standard in retinal diagnostics. We conducted a quantitative analysis of OCTA images from healthy and diabetic patients, comparing original data with SK-processed images. The mathematically driven reconstruction allowed for a more reliable evaluation of retinal vascular connectivity (see also [3]) and a precise characterization of the foveal avascular zone (FAZ). Morphometric analysis of the FAZ revealed significant structural differences between the two groups, highlighting the impact of diabetes on retinal microvasculature. Overall, our findings underscore the central mathematical role of sampling Kantorovich operators as a powerful tool for reconstructing discontinuous signals, demonstrating how rigorous approximation theory can effectively support ophthalmological diagnosis.

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<u>Miruna-Daniela Roşu</u>, Nicuşor Minculete

Title: NEW ASPECTS ABOUT INEQUALITIES RELATED TO NORMS FOR PAIRS OF OPERATORS

Abstract. In this paper, our goal is to establish novel inequalities for ω_e, the Euclidean operator radius, for ω_1, the Rhombic numerical radius, and for ω_∞ for a pair of bounded linear operators defined

on a complex Hilbert space. Additionally, we use a generalization of Bessel's inequality to derive further inequalities relevant to both single and pairs of Hilbert space operators. Some further extensions are also given.

Ana Maria Acu, Miruna-Ştefana Sorea, Arianna Travaglini, Gianluca Vinti

Title: NONLINEAR MULTIVARIATE SAMPLING DURRMEYER OPERATORS

Abstract. Our main goal is to define and investigate convergence properties and applications of a class of nonlinear multivariate Durrmeyer sampling operators, generalizing to a multidimensional setting the univariate nonlinear operators previously studied in [A. Travaglini, G. Vinti, *Nonlinear sampling Durrmeyer operators: approximation results in function spaces*, submitted (2025)]. Moreover, our results are presented in the most general framework, namely in Orlicz spaces, which are useful for handling signals that may not be continuous.

Arianna Travaglini, Vita Leonessa

Title: APPROXIMATION PROPERTIES OF A SEQUENCE OF INTEGRAL OPERATORS ASSOCIATED WITH POWER LINDLEY DISTRIBUTION AND APPLICATIONS

Abstract. In this contribution, we introduce and investigate a new sequence of positive linear integral operators of probabilistic type, constructed by means of the *power Lindley distribution* and its generalizations. The proposed operators, denoted by $(L_{n,\nu})_{n \geq 1}$, are obtained by setting in the three-parameter density function

$$f_{\alpha,\beta,\nu}(t) = \frac{\alpha \beta^{\nu+1}}{(\beta+1)\Gamma(\nu)\nu}(\nu+t^\alpha)t^{\alpha\nu-1}e^{-\beta t^\alpha}, \qquad (t > 0, \ \alpha, \beta, \nu > 0),$$

the parameters $\alpha = n$, $\beta = x^{-n}$, $x > 0$, and $\nu \geq 1$.

We study the approximation properties of operators $(L_{n,\nu})_{n\geq 1}$ in spaces of weighted continuous functions, obtaining estimates for the rate of convergence in terms of moduli of smoothness, as well as an asymptotic formula. This allows us to compare the approximation errors of $L_{n,\nu}$ for different values of ν, and to relate them to previously introduced operators $G_{n,\nu}$ based on the generalized Gamma distribution (see [5]).

Moreover, motivated by the probabilistic representation of approximation processes (see [3, Section 5.2], [4]), we consider a broader family of exponential-type distributions as in [1], from which the density underlying $(L_{n,\nu})_{n\geq 1}$ can be recovered as a particular case. For this generalized setting, we compute important statistical quantities such as the expected value, variance, and information potential, and we establish bounds for the latter by means of the proposed operators, following ideas in [2].

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Radu Păltănea, <u>Bianca Ioana Vasian</u>

Title: Double Weighted Second Order Modulus

Abstract. A second order modulus with two weight functions is defined in order to obtain estimates of the degree of approximation of functions with fast growth to infinity by general positive linear operators which preserve polynomials of degree one. Exemplifications are given for Szász-Mirakjan operators.

Andrei Vernescu

Title: About the speed of convergence of certain remarkable sequences and series

Abstract. We present certain classical and new results concerning the speed of convergence of some remarkable sequences and series.

Gianluca Vinti

Title: Beyond linearity: a unified perspective on approximation

Abstract. I will discuss some approximation results for a general family of nonlinear operators, proposing a unifying approach. I will consider both pointwise and uniform convergence, and modular convergence in Orlicz spaces. Finally, a brief description concerning further developments dealing with qualitative and quantitative estimates is presented. The theory allows to simultaneously treat families of discrete and semi-discrete operators (such as sampling or Durrmeyer-type sampling operators) and integral operators. The first ones (of sampling type) have also been studied in relation to concrete applications in the real world.

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