Universitatea ”Babeş-Bolyai”
Facultatea de Matematică şi Informatică
Departamentul de Matematică

Comunicări Ştiinţifice ale Studenţilor
- Matematică -

24 mai 2025

Secțiunea: Doctorat

Sala ‘e’

Clădirea Mathematica, str. Ploiești 23-25, Cluj-Napoca

sau

online prin Zoom

https://zoom.us/j/8105549607?pwd=a1ozZkkzdHdCRnBRS2YrT0FwQTB2dz09

Departamentul de Matematică, Facultatea de Matematică și Informatică

11:00	Cristian Rafiliu	A characterisation of subgroups of finite definition
11:20	Iulia Cătălina Plești	From number theory to group theory
11:40	Bogdan-Daniel Moldovan	Conditions for the preservation of Motzkin decomposability and the Pareto bordered property under addition
12:00	Andra-Maria Stoica	On left invertible quasi-isometric liftings
Pauză / Discuţii		
12:45	Lehel Csillag	Geometry, dynamical stability and Finsler metrizability of vectorial nonmetricity
13:05	Tőtős György	A surgery formula for the topological Poincaré series
13:25	Mihai Ilina	Aplicarea operatorilor liniari de tip rețea neuronală în procesarea imaginilor
13:45	Georgian-Cristian Chivu	Integrarea inteligenței artificiale în procesarea și segmentarea imaginilor: arhitecturi și modele
Pauză / Discuţii		
14:20	Valerian-Alin Fodor	Inverse images of relative interiors through metric projections in Hilbert spaces
14:40	Barna Schefler	Degree bounds for separating invariants of actions of finite groups
15:00	Bianca Bercea-Straton	Isomorphism theorems for polynomial rings
15:20	Anamaria Paștiu	Loewner chain associated with the generalized Graham-Kohr extension operator
15:40	Mihai Aron	An extension operator of Roper-Suffridge and Graham-Kohr type
Poză		

ABSTRACTE

11:00
11:20 **Rafiliu Cristian** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **A characterisation of subgroups of finite definition**

Îndrumător: Prof. dr. Simion Breaz

Abstract: Starting from a known result in locally finitely presented categories, namely that, for any Σ-pure-injective object M and any finitely presented object X, every finitely generated $End(M)$-submodule of $Hom(X,M)$ is a subgroup of finite definition, we prove that, in the case where M is product-complete, these two notions coincide.

11:20
11:40 **Iulia Catalina Pleșca** (Universitatea "Alexandru Ioan Cuza", Iași)

Titlu: **From number theory to group theory**

Îndrumător: Prof. dr. Marius Tarnauceanu

Abstract: In recent times, a plethora of concepts from number theory have been adapted from number theory to group theory. We add to this trend by studying groups that have integer harmonic mean of element orders, almost and quasi Leinster groups and introducing almost P numbers. This is joint work with Marius Tarnauceanu.

11:40
12:00 **Bogdan-Daniel Moldovan** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **Conditions for the preservation of Motzkin decomposability and the Pareto bordered property under addition**

Îndrumător: Prof. dr. Cornel Pintea

Abstract: "We provide some sufficient conditions on pairs of Motzkin decom- pasable sets and Pareto bordered sets in order to get the Minkowski sum of their components Motzkin decomposable and Pareto bordered respec- tively. We also prove that minimal faces of a closed convex set are also extreme faces of the set and vice-versa. This result allows us to define the generalized Minkowski sets by using the extreme faces. A Minkowski type theorem is proved with extreme faces playing the role of the extreme points in the classical Minkowski Theorem. The special class of Pareto bordered sets, which is a subclass of that of generalized Minkowski sets, is also taken into account. Indeed, as mentioned above, we show that the Minkowski sum of some Pareto bordered sets with the same lineality remains Pareto bordered. Note that the class of generalized Minkowski sets is not closed with respect to the Minkowski sum. It is however worth to mention that the class of closed convex sets which are both Motzkin decomposable and generalized Minkowski (or shortly, M dgM sets) is closed both with re- spect to Minkowski sum and Cartezian product [J. E. Mart´ınez-Legaz, C. Pintea, Closed convex sets that are both Motzkin decomposable and generalized Minkowski sets, J. Nonlinear Var. Anal. 8 (2024), No. 4, pp. 571-579]."

12:00
12:20 **Andra-Maria Stoica** (Universitatea "Lucian Blaga", Sibiu)

Titlu: **On left invertible quasi-isometric liftings**

Îndrumător: Prof. dr. Larian Suciu

Abstract: This presentation investigates left-invertible quasi-isometric liftings for operators similar to contractions on Hilbert spaces. A bounded linear operator S is said to be a quasi-isometry if it acts as an isometry on its range. We will focus on those liftings that resemble the classical Sz. Nagy-Foiaș isometric liftings for contractions. Additionally, the case of operators that are contractive on their range will be detailed, as it represents a good example where the obtained theory is closely related to the classical one.

12:45
13:05 **Lehel Csillag** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **Geometry, dynamical stability and Finsler metrizability of vectorial nonmetricity**

Îndrumător: Prof. dr. Ladislau Nagy

Abstract: We introduce a novel type of (integrable) vectorial nonmetricity, extending the previous literature by the inclusion of a cubic, completely symmetric term, reminiscent of statistical manifolds. This connection is completely described by three coefficients, which fully describe its geometric properties. We find conditions on these coefficients, which guarantee preservation of lengths, volumes and angles under (auto)parallel transport. We improve previous analyses on cosmological dynamics based on such a connection, and generalize Barrow's integrable Weyl theory. Finally, we comment on the Finsler metrizability of such a connection, realizing its autoparallels as geodesics of a well-chosen (α, β) Finsler metric.

13:05
13:25 **Tőtős György** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **A surgery formula for the topological Poincaré series**

Îndrumător: Prof. dr. András Némethi

Abstract: We consider the topological Poincaré series associated with a resolution (or plumbing) graph Γ of a normal surface singularity with integral homology sphere link. Following the splice construction we "split" Γ into certain induced graphs and consider their Poincaré series as well. We prove that, after a suitable change of variables, these series can be connected by a surgery formula. In particular, this induces a surgery formula for the polynomial part of the Poincaré series and a new surgery formula for the Seiberg-Witten invariant of the link as well. The idea can be extended to the rational homology sphere link case which is a work in progress.

13:25
13:45 **Mihai Ilina** (Universitatea "Lucian Blaga", Sibiu)

Titlu: **Aplicarea operatorilor liniari de tip rețea neuronală în procesarea imaginilor**
Îndrumător: Prof. dr. Ana Maria Acu
Abstract: Operatorii rețelelor neuronale au atras o atenție semnificativă în ultimii ani datorită legăturilor strânse cu teoria aproximării și a gamei largi de aplicații. În această lucrare, investigăm potențialul formulării lor multidimensionale, implementând un algoritm pentru reconstrucția digitală a imaginilor. Mai exact, comparăm performanțele operatorilor NN cu cele ale binecunoscuților operatori de eșantionare Kantorovich, a căror implementare reprezintă un algoritm relativ recent utilizat în procesarea imaginilor, servind atât ca filtru de netezire, cât și ca instrument de îmbunătățire a rezoluției. Comparația este realizată printr-o evaluare cantitativă folosind doi indici de similaritate: indicele de similaritate structurală (SSIM) și raportul semnal-zgomot de vârf (PSNR).

13:45
14:05 **Georgian-Cristian Chivu** (Universitatea "Lucian Blaga", Sibiu)

Titlu: **Integrarea inteligenței artificiale în procesarea și segmentarea imaginilor: arhitecturi și modele**
Îndrumător: Prof. dr. Ana Maria Acu
Abstract: Lucrarea explorează aplicarea inteligenței artificiale în procesarea și segmentarea imaginilor, concentrându-se pe fundamentele matematice ale arhitecturilor utilizate, precum și pe modelele care stau la baza funcționării acestora. Se analizează rețele neuronale convoluționale (CNN), arhitecturi encoder-decoder, precum U-Net, precum și modele avansate bazate pe atenție (lucrarea attenion is all you need), cum ar fi Vision Transformers (ViT). Se prezintă conceptele matematice esențiale — convoluția, funcțiile de activare, optimizarea funcțiilor de pierdere și backpropagation — care contribuie la antrenarea și perfecționarea acestor rețele. Lucrarea include și exemple practice de segmentare semantică și segmentare de obiecte, cu scopul de a evidenția aplicabilitatea metodelor într-un context real. Analiza subliniază modul în care formalismul matematic stă la baza deciziilor automate în prelucrarea imaginilor.

14:20
14:40 **Valerian-Alin Fodor** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **Inverse images of relative interiors through metric projections in Hilbert spaces**
Îndrumător: Prof. dr. Cornel Pintea
Abstract: In this paper, we study the inverse image and its closure, under the metric projector operator, onto a closed convex set of that convex set and an arbitrary face of it. In an arbitrary real Hilbert space, assuming that the relative interior is nonempty, we characterize the inverse image of the relative interior of the closed convex set, while for a convex subset, we describe its intersection with the given convex set. However, in the finite-dimensional setting, we provide a characterization of the inverse image of a convex subset. Also, for a polyhedral set, we study the inverse images and their closures of the relative interiors of its faces. This characterization is provided for facets (1-codimensional faces) as well as for 2 and 3-codimensional faces, and in fact, our results extend to finite-codimensional faces as well.

14:40
15:00 **Barna Schefler** (Eötvös Loránd University, Budapest)

Titlu: **Degree bounds for separating invariants of actions of finite groups**
Îndrumător: Prof. dr. Mátyás Domokos
Abstract: The *separating Noether number* of a finite group is the minimal positive integer d such that for any finite dimensional linear representation of the group, any two different orbits are separated by an invariant polynomial that has degree at most d.
In the special case, when G is *abelian*, (under some conditions on the base field) all irreducible representations are one-dimensional. This fact has an important consequence, namely that questions formulated in the language of invariant theory can be interpreted as problems of theory of zero-sum sequences.

15:00
15:20 **Bianca Bercea-Straton** (Universitatea "Ovidius" & Academia Navală "Mircea cel Bătrân", Constanța)

Titlu: **Isomorphism theorems for polynomial rings**
Îndrumător: Prof. dr. Cristina Flaut
Abstract: Formulated by Emmy Noether (1927), the isomorphism theorems describe universal features of quotient rings, homomorphism, and subrings. We first briefly present the steps for constructing the modulo n of the residue class, $\mathbb{Z}_n$. Then we will give the general construction of the factor ring of a ring A with respect to an ideal I of it. Factor rings intervene in several other important constructions in mathematics: $\mathbb{R}$ and $\mathbb{C}$ fields, finite fields. The isomorphism theorem is usually used in the following way: suppose that $B \leq_R A$ and demonstrate that A/B is isomorphic with C. Looking for the definition of a surjective morphism $\varphi : A \to C$, with $\operatorname{Ker}\phi = B$. Then the isomorphism theorem ensures the existence of the required isomorphism.

15:20
15:40 **Anamaria Paștiu** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **Loewner chain associated with the generalized Graham-Kohr extension operator**
Îndrumător: Prof. dr. Mirela Kohr
Abstract: Let f be a locally univalent function on the unit disc and let $\gamma \in [0,1], \omega \in \left[0, \frac{1}{2}\right]$. We consider the family of operators extending f to a holomorphic map from the unit ball $\mathbb{B}$ in $\mathbb{C}^n$ to $\mathbb{C}^n$ given by

$$\Theta_{n,\gamma,\omega}(f)(z) = \left(f(z_1), z' \left(\frac{f(z_1)}{z_1} \right)^{\gamma} (f'(z_1))^{\omega} \right),$$

where $z' = (z_2, \ldots, z_n)$. When $\omega = \frac{1}{2}$ and $\gamma = 0$ we obtain the Roper-Suffridge extension operator. We show that if $f \in \hat{S}_\beta$ with $|\beta| < \frac{\pi}{2}$ then $\Theta_{n,\gamma,\omega}(f)$ is a spirallike map of type β. We show that if f is a normalized univalent Bloch function on $\mathbb{U}$ then $\Theta_{n,\gamma,\omega}(f)$ is a Bloch mapping on $\mathbb{B}$.

15:40
16:00 **Mihai Aron** (Universitatea "Babeș-Bolyai", Cluj-Napoca)

Titlu: **An extension operator of Roper-Suffridge and Graham-Kohr type**

Îndrumător: Prof. dr. Mirela Kohr

Abstract: In this work, we generalize the Roper-Suffridge-Graham-Kohr extension operator, $f \mapsto \Psi_{n,\alpha,\beta}$, where f is normalized locally univalent function on the unit disc of the complex plane and

$$\Psi_{n,\alpha,\beta}(f)(z) = \left(f(z_1), \left[\frac{f(z_1)}{z_1} \right]^{\alpha} [f'(z_1)]^{\beta} \tilde{z}, \right),$$

where $z = (z_1, \tilde{z})$ belongs to the unit ball of $\mathbb{C}^n$.
We address to the problem of preserving starlikeness and convexity through the new operator. The newly introduced operator provides a new method for constructing starlike functions on the unit ball of $\mathbb{C}^n$. Also, we improve the result regarding preservation of starlikness in case of extension operator $\Psi_{n,\alpha,\beta}$. Finally, we propose an open problem and present a brief introductory study on it.