Ann. Acad. Rom. Sci.
Ser. Math. Appl.
ISSN 2066-6594 Vol. 17, No. 2/2025

ON THE FALL SESSION OF THE ROMANIAN ITINERANT SEMINAR ON MATHEMATICS AND ITS APPLICATIONS (RISMA), 17-19 SEPTEMBER 2025, DURĂU, ROMANIA

Savin Treanţă*

Introduction

We recall that the Romanian Itinerant Seminar on Mathematics and Its Applications (RISMA) was launched in 2024 by Prof. Gheorghe Moroşanu (with the approval of the ARS leadership, www.aosr.ro/en/romanian-itinerant seminar-on-mathematics-and-applications-sirma/, as a natural extension of the former Romanian Itinerant Seminar on Mathematical Analysis and its Applications (RISMAA: http://cs.ubbcluj.ro/rismaa), which had also been initiated in 2017 by Prof. Gheorghe Moroşanu (with annual meetings: Cluj-Napoca (2018), Constanţa (2019), Alba Iulia (2021), Braşov (2022), Craiova (2023), and again Cluj-Napoca in 2024).

Under this new format, the RISMA seminar is held twice a year, within the Spring and Autumn Scientific Conferences organized by the Academy of Romanian Scientists (ARS), being hosted in the same places.

Participants to RISMA are members of the Mathematical Sciences Section of the ARS, as well as other Romanian and foreign researchers interested in mathematics and its applications. More specifically, the idea was to extend the cooperation of our ARS colleagues to a wider community.

The papers resulting from this seminar are usually published in our journal, *Ann. Acad. Rom. Sci., Ser. Math. Appl.*, but also in other mathematics journals, depending on the authors' preference.

*savin.treanta@upb.ro, National University of Science and Technology POLITEHNICA Bucharest & Academy of Romanian Scientists, Bucharest, Romania

In the next section, we publish the abstracts submitted by the participants in the 2025 RISMA Fall Session.

Presentations

This was the second RISMA meeting, attended by many participants, including 11 presenters.

The abstracts of the presentations are attached below, listed in alphabetical order by the presenters' names. Full papers may be obtained by contacting the authors directly at the email addresses provided.

Luminiţa BARBU, *Ovidius* University, Constanţa, Romania, Associate Member of the Academy of Romanian Scientists, email: lbarbu@univ-ovidius.ro; **Gheorghe MOROŞANU**, *Babeş-Bolyai* University, Cluj-Napoca, Romania, Full Member of the Academy of Romanian Scientists, email: gheorghe.morosanu@ubbcluj.ro; and **Raluca-Gabriela TURTOI**, *Ovidius* University, Constanţa, Romania

Title: **On an abstract second-order integro-differential equation with nonlinear memory**

Abstract: We study the following delay second-order integro-differential equation in a real Banach space X:

$$u''(t) = Au(t) + \int_{-r}^{0} g(\theta, u(t+\theta), u'(t+\theta))\, d\theta,\ t \geq 0,$$

with history data $u = \phi$ and $u' = \psi$ on $[-r, 0]$. Here $r \in (0, +\infty)$ denotes a finite delay, $A : D(A) \subset X \to X$ is a densely defined, closed linear operator generating a strongly continuous cosine family on X, and $g : [-r, 0] \times X \times X \to X$ is a nonlinear mapping.

Reformulating this second-order problem as a first-order system, we focus on:

(i) global existence and uniqueness of classical and mild solutions;

(ii) continuous dependence of solutions on the initial data;

(iii) a sufficient condition for the asymptotic stability of solutions;

(iv) an application to a damped wave equation with nonlinear memory.

Vasile DRĂGAN, *Simion Stoilow* Mathematics Institute of the Roma-

nian Academy, Full Member of the Academy of Romanian Scientists, email: vasile.dragan@imar.ro

Title: **A Barbashin-Krasovski type criterion for the exponential stability of the zero solution of a linear differential equation with periodic coefficients which defines a positive evolution on an ordered Hilbert space**

Abstract: On the finite dimensional real Hilbert space $\mathcal{X}$ ordered by the order relation induced by the closed, solid, selfdual, convex cone $\mathcal{X}^+$ we consider the linear differential equation

$$\dot{x}(t) = L(t)x(t), \quad i \in \mathbf{R} \tag{1}$$

where $L(\cdot)$ is a continuous operator valued function which is periodic with period T. We say that the differential equation (1) defines a positive evolution on the ordered Hilbert space $(\mathcal{X}, \mathcal{X}^+)$, if $\mathcal{X}^+$ is an invariant set of that equation. It is known (see for example Chapter 2, from [2]) that the solution $x(t) \equiv 0$, is exponentially stable if and only if there exists a continuous vector valued function $f(\cdot)$ which is uniform positive and periodic with period T with the property that the dual non-homogeneous equation

$$\dot{y}(t) + L^*(t)y(t) + f(t) = 0, \quad t \in \mathbf{R}, \tag{2}$$

has a globally defined solution, uniform positive and periodic with period T.

Our aim is to show that under the assumption of exact detectability of a suitable auxiliary system associated to the equation (1), the exponential stability of its zero solution is guarantee even if the dual equation (2), with free term taking values in $\mathcal{X}^+$ but not necessarily uniform positive, has a T periodic and positive solution which is not necessarily uniform positive.

The main mathematical tool involved in the proofs is a spectral criterion of type Popov-Belevich-Hautus which allow us to decide if a system with periodic coefficients is exact detectable or not.

[1] E.M. Barbashin, N.N. Krasovskii, Stability of motion in the large, Doklady A.N. SSSR, vol. 86, 1952, 453-456.

[2] V. Dragan, T. Morozan, A.M. Stoica, Mathematical Methods in Robust Control of Linear Stochastic Systems, 2nd ed. New York, NY, USA: Springer, 2013.

Teodor HAVÂRNEANU and **Cătălin POPA**, *Octav Mayer* Mathematics Institute of the Romanian Academy, Iași, Romania, emails: havi@uaic.ro, cpopa@uaic.ro

Title: **Boundary controllability for the three-dimensional magnetohydrodynamics equations**

Abstract: We consider the following controlled (MHD) system

$$\begin{aligned}
&\frac{\partial y}{\partial t} - \Delta y + (y\nabla)y - (B\cdot\nabla)B + \nabla p = f && \text{in } Q = \Omega\times(0,T),\\
&\frac{\partial B}{\partial t} + \operatorname{curl}(\operatorname{curl} B) + (y\cdot\nabla)B - (B\cdot\nabla)y = 0 && \text{in } Q,\\
&\operatorname{div} y = 0,\ \operatorname{div} B = 0 && \text{in } Q,\\
&y = u,\ B = v && \text{on } \Sigma = \partial\Omega\times(0,T),\\
&y(\cdot,0) = y_0, B(\cdot,0) = B_0 && \text{in } \Omega.
\end{aligned} \tag{1}$$

Here y is the velocity of the fluid, B is the intensity of the magnetic field, p is the scalar pressure, u, v are the boundary controls, $\Omega\subset\mathbb{R}^3$ is a domain with the boundary $\partial\Omega$ of class C^2 and f is the density of the external forces.

Let $(\tilde{y},\tilde{B},\tilde{p})$ be a fixed solution of the stationary system of (1). We established the following controllability result: in certain hypotheses there exist $u, v\in L^2\left(0,T;\left(H^{1/2}(\partial\Omega)\right)^3\right.$ such that the solution (y,B) of the system (1) satisfies $y(x,T)=\tilde{y}(x), B(x,T)=\tilde{B}(x)$ a.e. in Ω. For the proof we reduce this boundary controllability problem to an exact internal controllability for (MHD) system and then we apply a previous result we have obtained.

Mircea LUPU, *Transilvania* University, Braşov, Romania, Corresponding Member of the Academy of Romanian Scientists, emails: emlupu2006@yahoo.com, valtecsrl@yahoo.com

Title: **Compressible free surfaces fluid flow in the presence of bodies with axial simmetries**

Abstract: In this paper, some direct and inverse methods are presented regarding the compressible fluid flow with free surfaces in the presence of bodies with axial symmetries. Dirichlet and Riemann-Hilbert boundary problems are formulated, and singular integral equations for analytical functions appear. The complex potențial of the flow and the complex velocity

are obtained using as canonic domain the upper half-plane. Analytical solutions are found for some particular cases, namely, for movement in the presence of conical surfaces or in the presence of the circular disk. Comparisons and discussions about the correspondence with the incompressible case and other results known from the literature are also made.

Mircea MERCA, National University of Science and Technology POLITEHNICA Bucharest, Corresponding Member of the Academy of Romanian Scientists, email: mircea.merca@profinfo.edu.ro

Title: **Coefficients and binary partitions**

Abstract: Building on Nathan J. Fine's work, we know that binomial coefficients can be expressed as sums of products of binomial coefficients, with each product corresponding to an integer partition. Expanding this perspective, we unveil a refined and elegant decomposition of binomial coefficients through binary partitions. We built upon these concepts by exploring their q-analogues using Gaussian poly nomials.

Tatiana MIHĂESCU, Department of Theoretical Physics, National Institute of Physics and Nuclear Engineering, Bucharest-Magurele, email: mihaescu.tatiana@theory.nipne.ro; and **Aurelian ISAR**, Department of Theoretical Physics, National Institute of Physics and Nuclear Engineering, Bucharest-Magurele, Full Member of the Academy of Romanian Scientists, email: isar@theory.nipne.ro

Title: **Dynamics of two strongly coupled harmonic oscillators in Gaussian open systems**

Abstract: We investigate the Markovian evolution of Gaussian entanglement and steering in a system consisting of two strongly coupled harmonic oscillators immersed in a structured environment. Specifically, we analyze the contribution of the interaction between modes when the magnitude of the intermode coupling strength is comparable to the local frequencies of the modes, and the rotating wave approximation does not apply. This investigation is applied for a generalized Gaussian channel, when the environment is modeled by a collection of squeezed bosonic modes. We provide also a comparison of the evolutions of entanglement and steering in weak and strong coupling regimes.

Gheorghe MOROŞANU, *Babeș-Bolyai* University, Cluj-Napoca, Romania, Full Member of the Academy of Romanian Scientists, email address: gheorghe.morosanu@ubbcluj.ro

Title: **On certain orthographic rules for the Romanian language**

Abstract: In this article we discuss some controversial orthographic rules for the Romanian language regarding the letters **î** and **â**, both of which represent a single sound, similar to the one corresponding to the letter **i** in the English word **pencil**, but with a slightly different pronunciation nuance. The rules, established by the orthographic reforms of the Romanian Academy in 1904 and 1993, refer to the positions of the twin letters î and â in Romanian words that imply the corresponding sound.

We show that these rules are illogical and sometimes lead to writing difficulties for Romanian speakers.

Therefore, we strongly propose the use of the letter **î** everywhere, except for the words **român, România** and their derivatives, which recall the Latin origin of the Romanian language.

Let us note that in 1953 the same Academy had proposed the use of the letter **î** everywhere, including in the words **romîn**, **Romînia** and their derivatives, so our proposal is not completely new. But our logical analysis of the orthographic rules of 1904 and 1993 legitimizes our proposal, which guarantees clarity and simplicity.

Cristinel MORTICI, *Valahia* University, Târgovişte, Romania, National University of Sciences and Technology POLITEHNICA, Bucharest, Full Member of the Academy of Romanian Scientists, email: cristinel.mortici @hotmail.com; and **Dan-Ştefan MARINESCU**, *Iancu de Hunedoara* National College, Hunedoara, Romania, email: marinescuds@gmail.com

Title: **An approach to Gâteaux and Fréchet differiability based on delta-convex functions**

Abstract: The aim of this paper is to present an approach to Gâteaux and Fréchet differentiability based on delta-convex functions. We extend some results by Ivan and Raşa and by Marumo and Takeda.

Adrian PETRUŞEL, *Babeș-Bolyai* University, Cluj-Napoca, Romania, Full Member of the Academy of Romanian Scientists, email address:

adrian.petrusel@ubbcluj.ro; and **Gabriela PETRUŞEL**, *Babeș-Bolyai* University, Cluj-Napoca, Romania

Title: **Banach-Caccioppoli contraction principle - from theory to applications**

Abstract: In this paper, some variants of the Banach-Caccioppoli contraction principle and some of the most relevant applications of it are presented.

Dan TIBA, *Simion Stoilow* Mathematics Institute of the Romanian Academy, Full Member of the Academy of Romanian Scientists, email: dan.tiba@imar.ro

Title: **Shape and topology optimization for variational inequalities with pointwise boundary observation**

Abstract: We study optimal design problems involving variational inequalities with unilateral conditions in the domain and pointwise boundary observation. We use regularizing and penalization techniques in the setting of the Hamiltonian approach to shape/topology optimization problems. Numerical examples are also included.

Savin TREANŢĂ, National University of Science and Technology POLITEHNICA Bucharest, Associate Member of the Academy of Romanian Scientists, email: savin.treanta@upb.ro

Title: **On Euler-Lagrange equation and related conservation laws**

Abstract: Variational calculus with gradient-type variations has often been neglected, although it proves to be suitable for certain concrete problems governed by several evolution variables. These kinds of variations lead to Euler-Lagrange partial differential equations controlled by the right-hand member. In this context, we also introduce anti-trace Euler-Lagrange partial differential equations that are suitable for some innovative ideas.