

**ON THE SPRING SESSION OF THE
ROMANIAN ITINERANT SEMINAR ON
MATHEMATICS AND ITS APPLICATIONS
(RISMA), 29 May 2026, Bucharest, ROMANIA**

Gheorghe MOROȘANU* Savin TREANȚĂ†

*In memory of Mihail MEGAN (1947-2025), who was an excellent
educator and talented mathematician*

Introduction

We recall that the Romanian Itinerant Seminar on Mathematics and Its Applications (RISMA) was launched in 2024 by Prof. Gheorghe Moroșanu (with the approval of the ARS leadership, see 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>).

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, during the same time slot.

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

*gheorghe.morosanu@ubbcluj.ro, Department of Mathematics, Babeș-Bolyai University, Cluj-Napoca, Romania & Academy of Romanian Scientists, Bucharest

†savin.treanta@upb.ro, National University of Science and Technology *PO-LITEHNICA* Bucharest & Academy of Romanian Scientists, Bucharest

papers resulting from this seminar are usually published in our journal, *Ann. Acad. Rom. Sci. Ser. Math. Appl.*

This was the third meeting of the RISMA, which was attended by several participants, including 9 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.

• **Vasile BERINDE**, Technical University of Cluj-Napoca, North University Center of Baia Mare, Romania, Full Member of the Academy of Romanian Scientists; email address: vasile.berinde@mi.utcluj.ro

Title: **Fixed Point Algorithms in Data Science**

Abstract: In this paper we present some aspects related to the construction of fixed point algorithms for solving Data Science problems.

• **Aurelian CERNEA**, University of Bucharest, Romania, Corresponding Member of the Academy of Romanian Scientists, email address: ac-ernea@fmi.unibuc.ro

Title: **Some Classes of Differential Inclusions of Fractional Order**

Abstract: Two classes of differential inclusions of fractional order defined by different fractional derivatives (Hilfer-Hadamard, and generalized Caputo) and with several boundary conditions are studied. All the problems take into account the situation when the set-valued maps are not convex valued. The existence of solutions is established by means of different techniques.

• **Vasile DRĂGAN**, *Simion Stoilow* Mathematics Institute of the Romanian Academy, Full Member of the Academy of Romanian Scientists, and **Samir ABERKANE**, Université de Lorraine, CRAN, UMR Vandoeuvre-Nancy Cedex, France, and CNRS, CRAN, UMR 7039, France; email addresses: vasile.dragan@imar.ro, samir.aberkane@univ-lorraine.fr

Title: **Exponential Stability in Mean Square of the McKean-Vlasov Linear Stochastic Differential Equations**

Abstract: Our aim is to analyse the problem of the exponential stability in mean square of a class of McKean-Vlasov type stochastic linear differential equations. We refer to stochastic differential equations which contain besides the unknown function its mean value and/or its conditional expectation. This class of differential equations is known in the literature as **mean-field stochastic differential equations**. We assume that the initial states can be either random vectors independent of the Brownian motion or adapted to the filtration generated by the Brownian motion which affects the dynamical system under consideration, or deterministic vectors. We show that without loss of generality we can characterize the exponential stability in mean square property of the zero solution of a McKean-Vlasov linear differential equation based only on the behavior of its trajectories which are starting from deterministic states. To a McKean-Vlasov type linear differential equation is associated, in a natural way, a standard Itô type stochastic linear differential equation. In many already published works, it was asserted that the exponential stability in mean square of the zero solution of a McKean-Vlasov type stochastic linear differential equation is equivalent to the exponential stability in mean square of the zero solution of the associated Itô type stochastic linear differential equation. We show that equivalence is not true and hence, the known criteria for the exponential stability in mean square for Itô stochastic linear differential equations can be used only as sufficient conditions for exponential stability in mean square of the zero solution of the McKean-Vlasov stochastic linear differential equations. Also we show that based on the structure of the matrix coefficients of the associated Itô type differential equation, we may derive Lyapunov criteria of lower dimension for exponential stability in mean square in comparison to those which could be obtained by applying directly the known criteria from the literature.

• **Teodor HAVÂRNEANU** and **Cătălin POPA**, *Octav Mayer* Mathematics Institute in Iaşi of the Romanian Academy, Iaşi Branch; email addresses: havi@uaic.ro, cpopa@uaic.ro

Title: **Boundary Controllability for the Two-Dimensional Navier-Stokes Equations with Navier Slip Boundary Conditions**

Abstract: We consider the following Navier-Stokes controlled system, denoted (1),

$$\frac{\partial y}{\partial t} - \Delta y + (y \cdot \nabla) + \nabla p = f, \quad \text{in } Q = \Omega \times (0, T)$$

$$\begin{aligned}
& \operatorname{div}(y) = 0, \quad \text{in } Q \\
& y \cdot N = 0, \quad \operatorname{curl}(y) = 0, \quad \text{on } \Sigma = \partial\Omega \times (0, T) \\
& y = u, \quad \text{on } \Sigma \\
& y(\cdot, 0) = y_0(\cdot), \quad \text{in } \Omega,
\end{aligned}$$

where $\Omega \subset \mathbb{R}^2$ is a bounded domain with the boundary $\partial\Omega$ of class C^2 , $y = (y_1, y_2) : Q \rightarrow \mathbb{R}^2$ is the velocity of the fluid, p is the scalar pressure, $u : \Sigma \rightarrow \mathbb{R}^2$ is the boundary control, $f : Q \rightarrow \mathbb{R}^2$ is the density of the external forces and y_0 is the initial velocity. Let $(\tilde{y}, \tilde{p})$ be a fixed solution of the stationary system of (1). We established the following controllability result: in certain hypotheses, there exists $u \in L^2(0, T; (H^{\frac{1}{2}}(\partial\Omega))^2)$ such that the solution of the system (1) satisfies $y(x, T) = \tilde{y}$, a.e. in Ω . For the proof, we reduce this boundary controllability problem to a local exact internal controllability problem for the Navier-Stokes system with Navier boundary conditions and then we apply a previous result we have obtained.

• **Aurelian ISAR**, Institute of Physics and Nuclear Engineering, Bucharest-Magurele, Full Member of the Academy of Romanian Scientists; email address: isar@theory.nipne.ro

Title: **Quantum Entanglement in Curved Spacetime**

Abstract: The influence of Hawking radiation on quantum entanglement for bimodal Gaussian states near a Schwarzschild black hole is investigated. It is shown that for a thermal squeezed state of a bimodal bosonic system the Hawking radiation reduces and even can destroy the entanglement between the mode of a Kruskal observer and the mode of an accelerated observer hovering outside the event horizon of black hole. We investigate also the influence of the thermal environment on the behavior in time of the entanglement between the modes of the two considered observers and show that the entanglement is destroyed in a finite time for non-zero values of the temperature of the thermal environment, i.e., the so-called phenomenon of entanglement sudden death takes place.

• **Gheorghe MOROȘANU**, Babeș-Bolyai University, Cluj-Napoca, Romania, Full Member of the Academy of Romanian Scientists, and **Lihe WANG**, University of Iowa, Iowa City, IA, USA

Title: Bounded Solutions on the Positive Semiaxis for an Incomplete Cauchy Problem

Abstract: Consider in a real Hilbert space H the following incomplete Cauchy problem

$$(ICP) \quad u''(t) = \nabla\phi(u(t)), \quad t \geq 0; \quad u(0) = u_0,$$

where $u_0 \in H$ is a given vector, and $\phi : H \rightarrow \mathbb{R}$ is a C^1 function, whose gradient $\nabla\phi$ is a locally Lipschitz operator.

We call (ICP) an incomplete Cauchy problem because the usual additional Cauchy condition $u'(0) = v_0$ is missing.

The differential equation above is important because it expresses the law of conservation of energy (this becomes obvious after scalar multiplication of the equation by $u'(t)$ and integration of the resulting equation on the interval $[0, t]$).

It is well known that if ϕ is a convex function, possessing at least one minimum point, then problem (ICP) has a unique solution bounded on the positive semiaxis for each $u_0 \in H$.

Here we are concerned with the case when ϕ is not convex, and in particular we pay attention to the special case when ϕ is quasi-convex (i.e., its level sets are convex).

• **Adrian PETRUŞEL**, Babeş-Bolyai University, Cluj-Napoca and Academy of Romanian Scientists

Title: Fibre Contraction Principle: Theory and Applications

Abstract: We will focus on the so-called Fibre Contraction Principle, both for single-valued and multi-valued operators. We will start with the single-valued case and some applications of this principle. Then, based on the main metric fixed point theorem for multi valued contractions, we will present a Multivalued Fibre Contraction Principle for multi-valued operators with applications (based on some joint works with I.A. Rus and M.A. Şerban).

• **Dan TIBA**, Institute of Mathematics Simion Stoilow of the Romanian Academy, Full Member of the Academy of Romanian Scientists

Title: Two Superposed Optimal Design Problems with Pointwise Boundary Observation

Abstract: This paper is devoted to some geometric optimization problems related to the advantageous placement of certain utilities. The considered performance indices include naturally pointwise boundary observation terms. Our approach is based on the use of Hamiltonian systems and the considered optimization problems examine the questions from two points of view: the optimal distribution of the sensors in a given geometric setting, respectively the optimal design of a geometric structure such that the associated optimized pointwise boundary sensors ensure efficient observation characteristics. The subject enters the optimal design theory and the used methodology is grounded on optimal control approaches. Several numerical examples are also included.

• **Savin TREANȚĂ**, National University of Science and Technology *POLITEHNICA* Bucharest & Associate Member of the Academy of Romanian Scientists, Bucharest

Title: Optimality and Duality Criteria in Constrained Variational Control Models Governed by Caputo and Riemann-Liouville Fractional Derivatives

Abstract: In this paper, under various generalized convexity assumptions, we investigate optimality and duality criteria associated with a class of constrained variational control models governed by Caputo and Riemann-Liouville fractional derivatives. Concretely, first, we define the concepts of controlled invex (pseudo-invex, quasi-invex) functionals by using the Caputo fractional derivative of order $0 < \alpha \leq 1$. Thereafter, we introduce the problem under study by considering continuously differentiable interval-valued functions. In order to analyze its solution set, we establish an integration-by-parts formula generating the Karush-Kuhn-Tucker necessary optimality conditions. The main results formulate sufficient optimality criteria for the considered problem under invexity (pseudo-invexity, quasi-invexity) hypotheses of the involved functionals. Also, we continue the study with various duality results.