The First Balkan Mathematics Conference

July 1st, 2023, Piteşti, Romania

Program

09:00 – 09:30 **Opening Ceremony**

BMC Opening Lecture, Chairperson: Betül Tanbay

09:30 – 10:20	**Dan-Virgil Voiculescu**	From perturbations of operators to noncommutative condensers

Chairperson: Volker Mehrmann

11:00 – 11:50	**Monica Vişan**	Recent progress in completely integrable PDE

Chairperson: Jan Philip Solovej

12:00 – 12:50	**Aleksey Kostenko**	Spectral theory of strings and the Camassa-Holm equation

Chairperson: Dorin Popescu

16:30 – 17:20	**Laura Ciobanu**	Equations in groups: between decidability and undecidability

Chairperson: Frédéric Hélein

17:30 – 18:20	**Iakovos Androulidakis**	Hypoellipticity and the Helffer-Nourrigat conjecture

Chairperson: Radu Gologan

18:30 – 19:20	**Klavdija Kutnar**	Hamiltonicity in Vertex-transitive Graphs

Abstracts

Hypoellipticity and the Helffer-Nourrigat conjecture
Iakovos Androulidakis

Hypoelliptic differential operators play a central role in various fields, from stochastic analysis to contact and sub-riemannian geometry. A computable criterion of hypoellipticity was proposed by Helffer and Nourrigat in 1979. In this lecture we will give an overview of hypoellipticity and present the proof of the Helffer-Nourrigat conjecture. This is joint work with Omar Mohsen and Robert Yuncken.

Equations in groups: between decidability and undecidability
Laura Ciobanu

For a group or semigroup or ring G, solving equations where the coefficients are elements in G and the solutions take values in G can be seen as akin to solving systems of linear equations in linear algebra, Diophantine equations in number theory, or more generally, polynomial systems in algebraic geometry.

In this talk I will give a survey about solving equations in infinite non-abelian groups, with emphasis on free groups, and show how imposing certain constraints on the solutions can tilt the balance between decidability and undecidability.

Spectral theory of strings and the Camassa-Holm equation
Aleksey Kostenko

Generalized indefinite stings, the object introduced by J. Eckhardt and the speaker almost 10 years ago, serve as yet another canonical model of a self-adjoint operator with simple spectrum. One of our main goals in this talk is to overview developments in spectral theory of strings. In particular, we plan to present a characterization of spectral measures/Weyl-Titchmarsh functions of (relative) HilbertSchmidt perturbations of some model strings. Our second goal is to demonstrate the application of this result to the Camassa-Holm equation, a remarkable nonlinear wave equation, for which generalized indefinite strings serve as Lax (isospectral) operators. Based on joint work with J. Eckhardt (Loughborough).

Hamiltonicity in Vertex-transitive Graphs
Klavdija Kutnar

A path (cycle) containing every vertex in a graph is called a Hamilton path (Hamilton cycle, respectively). A graph is called vertex-transitive if for any pair of vertices u and v there exists an automorphism mapping u to v. In 1969, Lovasz asked whether every finite connected vertex-transitive graph has a Hamilton path.

With the exception of the complete graph on two vertices, only four connected vertex-transitive graphs that do not have a Hamilton cycle are known to exist. These four graphs are the Petersen graph, the Coxeter graph and the two graphs obtained from them by replacing each vertex by a triangle. The fact that none of these four graphs is a Cayley graph has led to a folklore conjecture that every Cayley graph has a Hamilton cycle. (A Cayley graph is a graph whose automorphism group admits a regular subgroup.) Both of these two problems are still open. However, a considerable amount of partial results are known.

I will survey some results about the topic. Special emphasis will be given to a solution to one of the problems posted recently by Gregor, Merino and Mütze, together with a connection to another long standing problem regarding vertex-transitive graphs - the problem about the existence of semiregular automorphisms in vertex-transitive graphs.

Recent progress in completely integrable PDE
Monica Vişan

I will survey recent work on low regularity conservation laws, equicontinuity, and optimal well-posedness for several completely integrable systems. I will describe the method of commuting flows and the increasingly sophisticated techniques that have been required in order to achieve sharp results across a spectrum of integrable models.

This is based on joint work with B. Harrop-Griffiths, R. Killip, T. Laurens, and M. Ntekoume.

From perturbations of operators to noncommutative condensers
Dan-Virgil Voiculescu

The quasicentral modulus plays a key role in normed ideal perturbations of Hilbert space operators, in the multivariable analogues of the Weyl - von Neumann - Kuroda and Kato - Rosenblum theorems. I will explain a non-commutative analogy with condenser capacity in nonlinear potential theory.