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Faculty of Mathematics of the Alexandru Ioan Cuza University

Faculty of Mathematics and Computer Science, Ovidius University of Constanţa

Algebra, Geometry, Number Theory & Topology
– List of abstracts –

Biharmonic hypersurfaces with three distinct principal curvatures in constantly curved spaces

Ştefan Andronic

Alexandru Ioan Cuza University

Abstract: In 2015 Yu Fu proved that any biharmonic hypersurface with at most three distinct principal curvatures in space forms has constant mean curvature. In this talk, we point out that there is at least one case when the final argument in that paper is invalid and therefore the proof is not complete. We introduce a new method, involving algebraic tools and Mathematica, to solve this problem and manage to find all cases that the original proof missed. Then we show that all hypersurafaces of this type have constant mean curvature.

On the Hilbert depth of the quotient ring of the edge ideal of a star graph

Silviu Bălănescu

National University of Science and Technology Politehnica Bucharest

Abstract: We give tight bounds for the Hilbert depth of the quotient ring of the edge ideal of a star graph of order n, using certain combinatorial inequalities. In particular, we derive its asymptotic behavior.

A new approach in constructing isogenies of elliptic curves in characteristic three

Marius Băloi

University of Bucharest

Abstract: Given an elliptic curve $\mathcal{E}$ over a field K it is a challenging problem to write down explicit elements of its endomorphism ring $\mathrm{End}(E)$; the problem amounts to find all possible solutions to a functional equation in the field of rational functions $K(X)$. Instead of attempting to describe them directly, we look first for solutions in the larger field of Laurent power series $K((X))$, which we call them *formal endomorphisms*. We show that the set of separable formal endomorphisms naturally identifies with the set of $K(X)-$rational points of a cubic over $K((X))$. As a byproduct, we present a method for finding all formal separable endomorphisms in characteristic 3 and an efficient test for determining if a given formal solution is actually rational, yielding to an endomorphism of the given curve.

Moduli spaces of pointed spin curves

Bogdan Caraşcă

Humboldt Universität zu Berlin

Abstract: The moduli space of pointed spin curves parametrizes pointed curves with spin structure. I will discuss some recent work on the problem of uniruledness of these moduli spaces, and some historical background on the classical unpointed case.

A class of compact complex manifolds without complex submanifolds

Cristian Ciulică

University of Bucharest

Abstract: Endo–Pajitnov manifolds are generalizations to higher dimensions of the Inoue surfaces S^M. We study the existence of complex submanifolds in Endo–Pajitnov manifolds. We identify a class of these manifolds that do contain compact complex submanifolds and establish an algebraic condition under which an Endo–Pajitnov manifold contains no compact complex curves.

Symbolic Powers and Combinatorics

Antonino Ficarra

Basque Center for Applied Mathematics

Abstract: In the present talk we will discuss symbolic powers of monomial ideals, and their asymptotic componentwise linearity and Castelnuovo-Mumford regularity. We present a Gröbner basis criterion on the defining ideal of the symbolic Rees algebra of a monomial ideal of minimal intersection type which guarantees that all its symbolic powers have linear quotients, and hence are componentwise linear. We conjecture that each symbolic power of an edge ideal with linear resolution or a polymatroidal ideal is componentwise linear, and that for these ideals the regularity of their ordinary and symbolic powers coincide. We will present several results by the authors that support these conjectures.

p-adic integrals on curves and their explicit computations

Enis Kaya

KU Leuven

Abstract: For curves over p-adic numbers, there are two notions of p-adic integration: Berkovich-Coleman integration which can be performed locally and Vologodsky integration with desirable number-theoretic properties. They coincide in the case of good reduction but differ in general. In this talk, we will give a formula for passing between them. To do so, we use combinatorial ideas informed by tropical geometry. We will also introduce algorithms for computing these integrals on hyperelliptic curves and discuss their potential generalization to more general curves that are interesting to tropical geometers. Most of these is joint with Eric Katz.

On the rigidity of compact biconservative hypersurfaces in space forms

Aykut Kayhan

Maltepe University

Abstract: In this talk, we will briefly introduce the notion of biconservative submanifolds and some well-known properties. Next, we provide a new characterization of

biconservative hypersurfaces by introducing a divergence-free tensor. Additionally, we present an alternative proof for a known rigidity result concerning compact biconservative hypersurfaces in space forms, using a new technique involving the Cheng-Yau operator associated to the divergence-free tensor introduced above.

An Aubin-Yau theorem for Vaisman manifolds

Vlad Marchidanu

University of Bucharest

Abstract: We show how to arrive at a suitable analogue for the Aubin-Yau theorem in the Vaisman context, reducing it to a result about transversally Kähler foliations.

Non-simple polyominoes of Knig type and their canonical module

Francesco Navarra

Sabanci University

Abstract: In this talk we present the König type property for non-simple polyominoes. We show that, for closed path polyominoes, the polyomino ideals are of König type, extending the results of Herzog and Hibi for simple thin polyominoes. As an application of this result, we give a combinatorial interpretation for the canonical module of the coordinate ring of a sub-class of closed paths, namely circle closed path polyominoes. This talk is based on a joint work with Rodica Dinu.

Projectivity of moduli of PT-pairs on threefolds

Mihai Pavel

Simion Stoilow Institute of Mathematics of the Romanian Academy

Abstract: Stable pairs were introduced by Pandharipande and Thomas as a means to define new curve-counting invariants on Calabi-Yau threefolds. These objects can be interpreted through a generalized stability condition for complexes in the derived category of coherent sheaves – now known as Pandharipande-Thomas (PT) stability. This perspective

naturally leads to the study of moduli spaces of PT-stable objects on projective threefolds. While it is known that these moduli spaces possess the structure of an algebraic space, the question of whether they are projective remains open. In this talk, we present recent progress in this direction, based on joint work with Tuomas Tajakka.

Moduli of secondary Kodaira surfaces

David Petcu

University of Bucharest & IMAR

Abstract: This talk is based on a work in progress. We use the ideas found in Borcea's paper about the moduli space of primary Kodaira surfaces in order to describe the moduli space of secondary Kodaira surfaces. These are finite quotients of the primary Kodaira surfaces with the property that the canonical bundle is not trivial.

From Number Theory to Group Theory

Iulia Pleşca

Alexandru Ioan Cuza University

Abstract: In this talk, we explore analogues of number-theoretic concepts in the field of group theory. We introduce and investigate the following:
- Almost and quasi-Leinster groups: analogues of almost and quasi-perfect numbers. We provide a full characterization of these groups in the nilpotent case and examine some non-nilpotent examples.
- An analogue of harmonic numbers: groups whose element orders have an integer harmonic mean.
- Almost P numbers: given a group property P (such as cyclicity or abelianity), a positive integer n is an almost P number if all groups of order n, except one, satisfy property P.
This is joint work with M. Tarnăuceanu.

Intrinsic Characterizations of Biconservative Surfaces in the Four-Dimensional Hyperbolic Space

Mihaela Rusu

Alexandru Ioan Cuza University

Abstract: In this talk, we present an extension of the investigation of biconservative surfaces with parallel normalized mean curvature vector fields (PNMC) in the four-dimensional space forms, focusing on the hyperbolic space $\mathbb{H}^4$, the last remaining case to explore. We establish that an abstract surface admits a PNMC biconservative immersion in $\mathbb{H}^4$ if and only if it satisfies a certain intrinsic condition; if such an immersion exists, it is unique. We further analyze these abstract surfaces, showing that they form a two-parameter family. In addition, we provide three characterizations of the intrinsic condition to explore the geometric properties of these surfaces.

Polyharmonic maps and polyharmonic submanifolds

Antonio Sanna

University of Cagliari

Abstract: In this presentation we introduce the notion of harmonic and biharmonic (2-harmonic) maps between Riemannian manifolds. In particular, when the maps are isometric immersions, their harmonicity or biharmonicity represent nothing but minimal or biharmonic submanifolds, respectively. Next, we generalize the definition of biharmonic maps and introduce the notion of r-harmonic maps. The r-harmonic maps are characterized by an elliptic semi-linear system of PDE whose leading term has order $2r$. A very particular case, with nice geometric properties, is represented by curves parameterized by arc length. In the last part, we present the characterization formula of r-harmonic curves describing some results and examples.

Closed Forms of Integer Sequences

Lorenzo Sauras Altuzarra

Kurt Gödel Society

Abstract: Building on Matiyasevich's methods, Mazzanti (2002) and Marchenkov (2007) proved that every "usual" sequence of non-negative integers (specifically, every Kalmár elementary function) admits a closed-form representation. Their notion of closed form, called arithmetic term, is defined inductively from non-negative integers and variables by using addition, truncated subtraction, multiplication, integer division, and exponentiation. In this talk, we will explore several examples of arithmetic terms and outline the techniques employed in their construction. This talk is based on a joint work with Mihai Prunescu and Joseph M. Shunia.

Linear sections of Grassmannians and resonance of vector bundles

Călin Spiridon

University of Bucharest & IMAR

Abstract: The varieties swept out by the projective lines corresponding to the points of linear sections of Grassmannians $\mathrm{Gr}(2, n)$ are called resonance varieties. Any vector bundle gives rise to a resonance in a natural way. The aim of this talk is to highlight some of the distinctive features of resonance loci associated with vector bundles, which set them apart from general resonance loci. We study the resonance of restricted universal quotient bundles and also explore the role of transversality. Throughout the talk, we include simple yet illuminating examples. This talk is based on a joint work with Marian Aprodu.

Unirationality of bielliptic loci

Andrei Stoenică

University of Bucharest & IMAR

Abstract: Bielliptic curves are double covers of genus 1 curves. Since they admit automorphisms, their isomorphism classes represent points in the singular locus of M_g, the moduli space of genus g curves. The bielliptic locus of M_g has been investigated before by Bardelli, Casnati and Del Centina and they have shown that it is rational for $g \leq 5$ and unirational for $g \geq 6$. In this talk, we present a stronger result in the case when $g \geq 11$, namely that the bielliptic locus of the Hilbert scheme of canonical curves in $\mathbb{P}^{g-1}$ is unirational. Then the unirationality of the bielliptic locus of M_g comes as an immediate consequence. This result is based on the description of canonical bielliptic curves as intersections between cones over elliptic normal curves and quadric hypersurfaces and the construction of a parameter space for them which reflects this structure.