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ABSTRACTS

On representations by Egyptian fractions

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A fraction with numerator 1 is called an Egyptian fraction. Any rational number can be represented as a sum of Egyptian fractions, and it turns out that if we bound the number of fractions, then such representations are only finitely many. I will discuss effective forms of this statement, and some applications to the classification theory of algebraic varieties.

This is joint work with Mugurel Barcau.

Laplacian Dynamics on Graphs with Time Delays

Fatihcan ATAY
Max Planck Institute for Mathematics in the Sciences, Germany

This talk will focus on a class of closely related problems arising in diffusely coupled networks of dynamical systems, where the information flow is subject to time delays. Examples include the stability of traffic flows, synchronization of coupled oscillators, and consensus problems in networks of agents. The spatial structure naturally invites notions from graph theory into the analysis of the dynamical behavior. We discuss the effects of structure and delays on the dynamics in each case, for both directed and undirected graphs, as well as discrete and distributed delays.

The Summing Nature of Linear and Bilinear Operators Through Some Examples

Gabriela BADEA
Ovidius University of Constanta, Romania

In this talk, we will give a characterization for the summing nature of some linear and bilinear operators by means of some examples. The examples which will be refered to, are defined by using a method called Average, considered in the linear and also in the bilinear case.

This is a joint work with Dumitru Popa.

Revisiting the foundations of the Barbilian's metrization procedure

Wladimir BOSKOFF
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We prove that one of Barbilian's theorems from 1960 regarding the metrization procedure in the plane admits a natural extension depending on a bilinear form and the relative position of two Apollonian hyperspheres. This result allows us to pursue two fundamental ideas. First, that all the distances with constant curvature can be described by Barbilian's metrization principle. Secondly, that all the Riemannian metric corresponding to these distances can be obtained with the same unique procedure derived from the main theorem in the text (Theorem 2.5). We show how the hyperbolic metric of the disk, the hyperbolic metric on the exterior of the disk and the hyperbolic metric on the half- plane can be obtained in the same way). Furthermore, we obtain metrics corresponding to quadratic forms with signature that includes minus. By considering the norms provided by either Lorentz or Minkowski (pseudo-)inner product as infuence functions, two oscillant distances can be generated in some subsets of Lorentz or Minkowski plane. The geometric study concludes that these metrics are generalized Lagrange metrics. A result concerning the distance induced by a Riemannian metric as a local Barbilian distance is also proved.

Steady flow of a perfectly conducting fluid past a thin airfoil

Adrian CARABINEANU
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We consider the linearized Euler and Maxwell equations and Ohm's law. We calculate the fundamental matrix and give integral representations for the velocity, magnetic induction and pressure. The boundary (slip) condition is used to obtain an

integral equation for the jump of the pressure. We give some graphic representations of the velocity and magnetic induction for various thin airfoils.

Schwarz problem for nonlinear complex partial differential equations

Okay ÇELEBI
Yeditepe University, Turkey

We consider nonlinear elliptic differential equations of higher order with Schwarz conditions in an unbounded domain. Defining a suitable class of integral operators, we discuss the existence of the solution of the boundary value problem considered.

What do we know about Diophantine m-sets?

Mihai CIPU
Institute of Mathematics of the Romanian Academy, Romania

The talk will provide a survey on Diophantine m-sets. These are sets of positive integers a_i $(1 \leq i \leq m)$ with the property that $a_i a_j + 1$ is a perfect square for all $1 \leq i < j \leq m$.

The driving motivation for recent work is a conjecture predicting the non-existence of Diophantine quintuples. On the way towards settling this problem, several compelling results have been obtained in the last two years. The main ideas employed in the proofs will be sketched, along with pointers on future developments.

Many of the results reported in this talk have been obtained in collaboration with A. Filipin (Zagreb), Y. Fujita (Chiba), M. Mignotte (Strasbourg), T. Trudgian (Canberra).

Automatic continuity problems in spectral theory

Constantin COSTARA
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In this talk, we shall discuss some automatic continuity results from the theory of spectral linear preserver problems.

Ulrich bundles on rational and Enriques surfaces

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Ulrich bundle on an n-dimensional projective variety X is a vector bundle which has the same cohomology type as the trivial sheaf on n-dimensional projective space. The existence problem is wildly open, even for smooth surfaces. In 2003, Eisenbud and Schreyer proved that any rank 2 Ulrich bundle E on a surface S with $c_1(E) = \omega_S(3)$ is a Lazarsfeld-Mukai bundle, and furthermore the Cayley-Chow form of S has a Pfaffian presentation. Following this manner, Aprodu, Farkas and Ortega constructed a family of Ulrich bundles on a general K3 surface using Lazarsfeld-Mukai bundles.

We will briefly discuss about this technique and its applications. We will also discuss about the existence problem on Enriques surfaces via K3 covers.

Pseudosymmetric braided categories

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A twine (respectively a strong twine) on a monoidal category is a family of natural isomorphisms on the category satisfying certain axioms. If c is a braiding on the category, the double braiding c^2 is always a twine. If c^2 is a strong twine, then c is called *pseudosymmetric*; this boils down to the fact that c satisfies a sort of modified braid relation. Every symmetric braiding is pseudosymmetric. A quasitriangular structure on a Hopf algebra is called *pseudotriangular* if it satisfies a sort of modified quantum Yang-Baxter equation; every triangular structure is pseudotriangular. We will discuss various examples of pseudosymmetric braidings and pseudotriangular structures. We define a certain group, called the *pseudosymmetric group*, denoted by PS_n, that plays for pseudosymmetric braidings the same role played by the braid group (respectively symmetric group) for braidings (respectively symmetric braidings). It turns out that PS_n is isomorphic to the quotient of the braid group B_n by the commutator subgroup $[P_n, P_n]$ of the pure braid group P_n.
(joint work with Mihai D. Staic and Fred Van Oystaeyen)

Weaker assumptions for convergence of extended block Kaczmarz and Jacobi projection algorithms

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Recent developments in the field of image reconstruction have given rise to the use of projective iterative methods, such as Kaczmarz and Jacobi, when solving inconsistent linear least squares problems. In this paper we try to generalize previous results concerning extended block versions of these two algorithms. We replace the inverse operator with the Moore-Penrose pseudoinverse and try to prove convergence under weaker assumptions. In order to accomplish this task, we show that these algorithms are special cases of a general iterative process for which convergence is already established. We also suggest an original procedure to partition the rows and columns of the system matrix into blocks, via clustering. Our numerical experiments illustrate that such a strategy results in an acceleration of the block iterative process.

Coordinatewise multiple summing operators, Littlewood's $\frac{4}{3}$-inequality and Bohnenblust and Hille $\frac{2n}{n+1}$-inequality

Dumitru POPA
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We show that the natural context in which the famous Littlewood's $\frac{4}{3}$-inequality and Bohnenblust and Hille $\frac{2n}{n+1}$-inequality sits is that of coordinatewise multiple summing operators. This talk is mainly based on the joint paper [6] with A. Defant and U. Schwarting.

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Logarithmic capacity and rational lemniscates

Stamatis POULIASIS
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First we shall present some basic facts about logarithmic capacity, analytic capacity and Green function in the complex plane. Motivated by considerations related to the semi-additivity property of analytic capacity, we will study the lemniscates of good rational functions. We will prove a reflection principle for the harmonic measure of rational lemniscates and we will give estimates for their capacity and the capacity of their components.

This is joint work with Thomas Ransford.

Quadratic numerical semigroups and the Koszul property

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Let H be a numerical semigroup. We give effective bounds for its multiplicity e(H) such that gr(K[H]) is Koszul. We conjecture that not all the values in the range are possible, and this correlates to a series of conjectures of Eisenbud, Green and Harris on a Generalized Cayley-Bacharach statement. We describe the Koszul property for several classes of numerical semigroups and we study the relationship with the Cohen-Macaulay property of the $gr(K[H])$.

Joint work in progress with Juergen Herzog.

A genetic algorithm for optimization of container stacking in a bay

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One indicator for efficient management in a port is the time spent by a ship in the port quays. The time allowed for loading-unloading into a specialized quay is mentioned in the management contract. Because the cost of the overtime is very high, it is very important to have a special plan to unload the containership in a short time. The unloading task is the set of operations performed by cranes and vehicles to unload a container from the vessel and discharge it into a storage cell from a bay in the container terminal (the containers are stored in bays on top of each other). Given the number of containers to be unloaded from a vessel and the initial state (in regards of number of available storage cells) of a bay, the genetic algorithm that we propose in this paper finds the plan of container stacking in the bay, whilst the objective function is to minimize summation of travel times of vehicles in unloading tasks of the cranes. The performance of the proposed method is evaluated through several sets of tests on control parameters of the algorithm.

Period integrals of algebraic variety and generalised hypergeometric functions

Susumu TANABÉ
Galatasaray University, Turkey

We will discuss analytic aspects of monodromy presentation of homology and cohomology of an (affine) algebraic variety. Besides well known Gel'fand-Kapranov-Zelevinsky A-hypergeometric functions (HGF) there is another way to present the

period integral as a generalized hypergeometric function, using so called Horn HGF. The analytic continuation of the Horn HGF will give us essential informations on the global monodromy of periods. We will discuss its application to the homological mirror symmetry conjecture.

Semi-theoretical solution of outer Neumann problem coupled with inner Dirichlet problem for MHD circular pipe flow

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A mathematical model is given as an outer Neumann problem coupled through boundary conditions with an inner Dirichlet problem in a 2D circular region for MHD pipe flow. Exterior Neumann problem is defined with Laplace equation and interior Dirichlet problem is formulated with coupled advection-diffusion equations. Unique solution of advection-diffusion problem is obtained inside the region, reducing it to integral equations defined on the circle, by using fundamental solutions and Divergence theorem. Exterior solution is given with Poisson' s integral formula with an additive constant which is also an integral equation on the common circular boundary. All these three integral equations are also coupled with the boundary conditions. Additive constant is found from the solvability condition of Neumann problem and the continuation of magnetic fields on the circle. The theoretical part of the solution results in solving a system of coupled integral equations on the boundary. The collocation method is made use of to obtain a linear system of equations for numerical values of the solution on the boundary. Then, the solution is extended to the interior and exterior regions using boundary numerical values of the solutions. The velocity in the pipe, and exterior and interior induced magnetic field behaviors are simulated in terms of graphics for several values of problem parameters.

Hypergeometric Galois actions

Muhammed ULUDAĞ
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We outline a project to study the Galois action on a class of modular graphs (special type of dessins) which arise as the dual graphs of the sphere triangulations of non-negative curvature, classified by Thurston. Because of their connections to hypergeometric functions, there is a hope that these graphs will render them- selves to explicit calculation for a study of Galois action on them, unlike the case of a general dessin.

Evaluating the ruin probability in a nonhomogeneous risk process

Raluca VERNIC
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Recently, nonhomogeneous claim sizes have been considered in the actuarial literature starting from the fact that the claims are seasonally influenced by the economic environment. In this context, in this work we present some recursive formulas for the ruin probability of a surplus process at or before claim instants under the assumptions that the claim sizes are independent, nonhomogeneous distributed, and independent of the inter-claim revenues (i.e., the premium difference between two consecutive claims), which are assumed to be independent, identically distributed, following an arbitrary distribution on nonnegative values.

Class Number Problems and Lang Conjectures

Ayberk ZEYTIN
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In this talk, we will discuss some conjectures of Lang relating the degree of a hypersurface to its arithmetic. We will then introduce a tool called cark, a particular infinite bipartite ribbon graph with a unique loop, which represents narrow ideal classes in quadratic number fields. Finally we will give examples of hypersurfaces whose integral points corresponds to carks, and hence to ideal classes. These hyper surfaces are Kobayashi hyperbolic and they provide examples to Lang conjectures.
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