Workshop for Young Researchers in Mathematics
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WORKSHOP FOR YOUNG RESEARCHERS IN MATHEMATICS
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ABSTRACTS

About the minimizer of the Ginzburg-Landau energy on the exterior of a 3D ball

Ramona ANTON
Universit Pierre et Marie Curie, France

The Ginzburg-Landau energy naturally appears in the study of Bose-Einstein condensates. We prove existence, uniqueness and present some properties of the minimizer on the exterior of a 3D ball on which we impose Dirichlet boundary condition. The proof relies on Sturm-Liouville theory.

Fibrate vectoriale in geometria varietatilor proiective

Marian APRODU
IMAR, Romania

Vom discuta cateva rezultate recente din geometria complexa proiectiva care folosesc tehnici de fibrate vectoriale.(in colaborare cu Gavril Farkas si Angela Ortega)

Aplicatii si morfisme armonice

Monica APRODU
Universitatea Dunarea de Jos, Galati, Romania

Scopul expunerii este prezentarea unor rezultate din teoria aplicatiilor si morfismelor armonice pe varietati riemanniene si spatii cu singularitati.

Produse bicrossed pentru algebre Hopf. Aplicatii

Ana-Loredana AGORE
Vrije Universiteit Brussel, Belgium

Fie E un obiect al unei cateogrii $\mathcal{C}$ si $A \subset E$ un subobiect al lui E. Un subobiect H al lui E se numeste *complement* al lui A in E (sau A-*complement* al lui E) daca E poate fi scris ca un 'produs' al lui A si H astfel incat A si H au 'intersectie minimala' in E. Vom nota cu $[E : A]^f$ cardinalul claselor de izomorfism al A-complementilor lui E si il vom numi *index de factorizare* al lui A in E. Urmatoarea problema este reciproca problemei factorizarii:

Problema clasificarii complementilor (PCC): *Fie $A \subset E$ doua obiecte fixate in categoria $\mathcal{C}$. Daca un A-complement al lui E exista, descrieti si clasificati toti A-complementii lui E si calculati indexul de factorizare $[E : A]^f$.*

Vom aborda (PCC) pentru categoria algebrelor Hopf si vom prezenta aplicatii la nivel de algebre Lie si grupuri.

Classification of pseudo-Riemannian submersions with totally geodesic fibres from pseudo-hyperbolic spaces

Gabriel BĂDIŢOIU
IMAR, Romania

We classify pseudo-Riemannian submersions with connected totally geodesic fibres from a real pseudo-hyperbolic space onto a pseudo-Riemannian manifold. Also, we obtain the classification of the pseudo-Riemannian submersions with (para-)complex connected totally geodesic fibres from a (para-)complex pseudo-hyperbolic space onto a pseudo-Riemannian manifold.

Dirichlet problems with the mean curvature operator in Minkowski space

Cristian BEREANU
IMAR, Romania

In this talk we present existence and multiplicity of classical positive radial solutions for Dirichlet problems with the mean curvature operator in Minkowski space. We use a combination of degree arguments, critical point theory for lower semicontinuous functionals and the upper and lower solutions method. This is a joint work with P. Jebelean and P.J. Torres.

Periodic solutions for singular perturbations of the relativistic operator

Dana-Simona BEREANU
IMAR & Military Technical Academy of Bucharest, Romania

TBA

Rezultanti, numere prime si polinoame ireductibile

Nicolae Ciprian BONCIOCAT
IMAR, Romania

Vom prezenta o metoda de a gasi informatii despre numarul total de factori ireductibili ai unui polinom cu coeficienti intregi f, care utilizeaza informatii despre descompunerea canonica a rezultantului lui f si g, unde g este un polinom arbitrar cu coeficienti intregi. In particular vom obtine criterii de ireductibilitate pentru perechi de polinoame al caror rezultant este un numar prim. Ca o prima aplicatie vom prezenta cateva criterii de ireductibilitate pentru polinoame care au un coeficient de modul dominant si iau pentru valori intregi ale argumentului cel putin o valoare care este numar prim. In continuare vom prezenta o metoda de calcul al rezultantului a doua polinoame utilizand siruri liniare recurente, si vom arata cum pot fi utilizate numerele Lucas in studiul ireductibilitatii anumitor clase de polinoame cu coeficienti intregi. In final vom prezenta cateva conditii ca un numar sa fie prim, obtinute utilizand criterii de ireductibilitate care se bazeaza pe proprietatile rezultantului a doua polinoame.

On the first eigenvalue of a degenerate Sturm-Liouville problem

Cristian CAZACU
IMAR, Romania

The problem of finding the optimal constant in the Hardy inequality in conical domains relies on a spectral analysis for a Sturm-Liouville equation with degeneracy at the origin. In view of that, we present some partial results which are slightly better than those already known in the literature. However, most of the questions we address are still open.

Elliptic K3 Surfaces - Some Geometry Inspired by String Theory

Adrian CLINGHER
University of Missouri - St. Louis, USA

One of the dualities in string theory, the F-theory/heterotic duality in eight dimensions, predicts an interesting correspondence between two distinct geometrical objects. On one side of the duality there are elliptically fibered K3 surfaces with section. On the other side, one finds elliptic curves endowed with certain flat principal bundles and complexified Kahler classes. The talk will discuss the geometry underlying the correspondence.

Differential inclusions depending on a real parameter

Nicusor COSTEA
IMAR, Romania

In this talk we present some recent multiplicity results for two elliptic differential inclusions which depend on a real parameter. We are interested in finding weak solutions for our problems and we work in the framework of variable exponents Lebesgue-Sobolev spaces. The main tools are a nonsmooth version of Ricceri's variational principle and critical point theory for locally Lipschitz functions. This is a joint work with C. Varga (Babes-Bolyai, Cluj) and G. Morossanu (Central European University, Budapest).

On Higher Moments of Quadratic Dirichlet L-Functions II

Adrian DIACONU
University of Minnesota, USA and IMAR, Romania

In this talk we give a cohomological description of the "p-parts" of the multiple Dirichlet series attached to moments of quadratic L-series over a number field. We expect that the Eisenstein Conjecture of Bump, Brubaker and Friedberg extends to the relevant Kac-Moody groups in our situation, and that the multiple Dirichlet series we construct occurs (perhaps, up to a normalization) in a Fourier-Whittaker coefficient of a (Kac-Moody) Eisenstein series.

Latici reziduate distributive necomutative

Liviu-Constantin HOLDON
Universitatea din Craiova, Romania

Scopul acestei lucrări este să punem în evidenţă câteva condiţii suficiente pentru distributivitate într-o latice reziduată necomutativă. Deasemenea, prezentăm o diagramă sugestivă care cuprinde clasele de latici reziduate distributive cunoscute în literatură.

Un scop secundar al acestei lucrări este să prezentăm un program de testare pentru laticile reziduate necomutative, acesta este capabil să testeze dacă o structură dată prin cele trei tabele de operaţii $\odot, \rightarrow$ şi $\rightsquigarrow$ este o latice reziduată, în caz afirmativ se va testa dacă este un caz particular de latici reziduate precum BL-algebre, MV-algebre, MTL-algebre, IMTL-algebre, algebre produs şi altele, în conformitate cu diagrama menţionată.

Deasemenea, sunt testate proprietăţi precum distributivitatea, pseudo prelinearitatea, pseudo divizibilitatea, etc. Programul permite utilizatorului să implementeze ecuaţii şi inecuaţii dorite, acesta poate fi folosit şi pentru latici reziduate comutative făcând $\rightarrow = \rightsquigarrow$.

În cazul în care o operaţie dorită nu este verificată de laticea reziduată, programul va returna o listă odordonată de elemente.

Programul reprezintă o unealtă utilă matematicenilor care doresc să obţină exemple sau contraexemple de latici reziduate fiind simplu de utilizat, nu am găsit programe similare în literatură.

Uniform observability properties for discrete waves on non-uniform concave meshes

Aurora MARICA
University of Graz, Austria

In this talk, we emphasize the uniform boundary observability properties of the finite difference approximation of the 1-d wave equation on a particular class of non-uniform meshes obtained as a diffeomorphic transformation g of a uniform mesh of the unit interval $[0, 1]$. The observability is done at the right endpoint $x = 1$. It is well-known that the observability property fails to hold uniformly with respect to the mesh size parameter for uniform meshes (i.e. $g(x) = x$) due to the existence of high frequency spurious solutions travelling at vanishing group velocities as the mesh becomes finer. However, our approach is different by taking g within the class of strictly concave functions (i.e., $g''(x) < 0$ for all x in $[0, 1]$). In this way, the mesh is adapted to the observability region $x = 1$ because it is gradually finer close to the right endpoint. Moreover, the strictly concavity assumption avoids the possible fixed points of the associated Hamiltonian system. The method of proof consists in using a discrete multiplier technique. The presentation is based on a (future) joint work with S. Ervedoza (Maths Institute, Toulouse) and E. Zuazua (BCAM, Bilbao).

A unilateral contact model and its weak solvability by a new variational approach. A review of recent results

Andaluzia-Cristina MATEI
University of Craiova, Romania

In the present talk we review recent results obtained in paper [1]. A 3D elastostatic frictionless unilateral contact model, for nonlinearly elastic materials was considered. The mechanical model was described mathematically by a boundary value problem consisting of a system of partial differential equations associated with a displacement boundary condition, a traction boundary condition and a contact condition. The contact was modeled by Signorini's contact condition with zero gap neglecting the friction on the potential contact zone. The behavior of the material was expressed by a constitutive law which involves a nonlinear elastic operator, possibly multi-valued. We give a weak formulation using a bipotential function which depends on the constitutive map and its Fenchel conjugate. Thus, we arrive to a system of two variational inequalities whose unknown is the pair consisting of the displacement field and the Cauchy stress field. We prove the existence and the uniqueness of the weak solution based on minimization arguments for appropriate functionals associated with the variational system.

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[1] A. Matei, A variational approach via bipotentials for unilateral contact problems, Journal of Mathematical Analysis and Applications, Volume 397, Issue 1, 2013, Pages 371–380.

Algebre de tip Orlik-Solomon

Anca-Daniela MACINIC
IMAR, Romania

Studiem in context algebric si topologic o algebra de tip Orlik-Solomon asociata unui aranjament central de hiperplane peste un corp k arbitrar.

Dimension theory and dynamics for hyperbolic systems

Eugen MIHAILESCU
IMAR, Romania

There exist important connections between dimension theory, smooth ergodic theory and the dynamics of hyperbolic systems. In this talk, we will review some new results about these connections, and about their applications for hyperbolic dynamical systems and invariant probability measures on fractal sets.

Metric properties of mean wiggly continua

Nicolae MIHALACHE-CIURDEA
Universite Paris Est Creteil, France

We study lower bounds of the Hausdorff dimension for planar sets which are wiggly at scales of positive density. The main technical ingredient is a construction, for every planar continuum K, of a Borel probabilistic measure μ with the property that on every ball $B(x,r)$, $x \in K$, the measure is bounded by a universal constant multiple of $r\exp(-g(x,r))$, where $g(x,r) \geq 0$ is an explicit function. The continuum K is mean wiggly at exactly those points $x \in K$, where $g(x,r)$ has a logarithmic growth to ∞ as $r \to 0$. The theory of mean wiggly continua leads, via the product formula for dimensions, to new estimates of the Hausdorff dimension for Cantor sets.

Another application of the theory is geometric Bowen's dichotomy for Topological Collet-Eckmann maps in rational dynamics. In particular, mean wiggly continua are dynamically natural as they occur as Julia sets of quadratic polynomials for parameters from a generic set on the boundary of the Mandelbrot set.

Problema Cauchy pentru metrici Einstein riemaniene si spinori paraleli

Sergiu MOROIANU
IMAR, Romania

Impreuna cu B. Ammann si A. Moroianu, pornind de la o varietate Riemaniana (M,g) impreuna cu un spinor Killing generalizat, studiem problema existentei unei varietati spin Z in care M este o hipersuprafata si pe care spinorul se extinde la un spinor paralel. Aceasta varietate trebuie sa fie Ricci-plata. Se ajunge natural la problema extinderii unei metrici date pe M la o metrica Einstein pe Z cu forma a doua fundamentala prescrisa. Aratam ca problema cu date initiale real-analitice are solutie unica, si construim contra-exemple in cazul ne-analitic.

The Buchberger Resolution

Anda OLTEANU
Universitatea Politehnica Bucuresti, Romania

n this talk we define the Buchberger resolution which is a graded free resolution of a monomial ideal in a polynomial ring. In general, this resolution is not minimal. We give a complete characterization of the cases when the Buchberger resolution is minimal. This is a joint work, in progress, with Volkmar Welker.

Higher moments for quadratic Dirichlet L-functions

Vicentiu PASOL
IMAR, Romania

We construct the "improved" Multiple Dirichlet Series for quadratic Dirichlet L- functions for all moments over any number field. This is joint work with Adrian Diaconu (U. Minnesota)

Linear sofic groups and algebras

Liviu PAUNESCU
IMAR, Romania

In a joint work with Goulnara Arzhantseva, we introduce linear sofic groups and linear sofic algebras. A group is linear sofic if and only if its group algebra is linear sofic. Linear soficity for groups is a priori weaker than soficity but stronger than weak soficity. We shall discuss problems in proving that linear sofic groups are sofic or that they satisfy Kaplansky's direct finiteness conjecture.

A simple proof of the Eichler-Selberg trace formula for congruence subgroups

Alexandru POPA
IMAR, Romania

We present new formulas for the trace of Hecke and Atkin-Lehner operators on spaces of modular forms for congruence subgroups of the modular group. The proof is based on three properties of a universal Hecke operator acting on period polynomials of modular forms, two of which were introduced by Don Zagier twenty years ago. This is joint work with Don Zagier.

O prezentare simpla a grupului corpului cu manere in gen 2

Radu-Clement POPESCU
IMAR, Romania

Grupul corpului cu manere este un subgrup al grupului claselor de homeomorfisme al unei suprafete. Folosind un complex particular de curbe, Wajnryb, a gasit o prezentare a grupului corpului cu manere de gen g, care actioneaza pe acest complex. Aceasta prezentare, care este complicata, poate fi simplificata pentru gen $g = 2$.

Numerical analysis in fluid-structure interaction problems

Loredana SMARANDA
University of Pitesti, Romania

We focus on a numerical method for the discretization of an initial and boundary value problem that models the selfpropelled motion of one deformable solid in a bidimen- sional viscous incompressible fluid. In the model, we suppose that the solid is subjected to a known deformation

eld representing the action of the aquatic organism muscles. The governing equations consist of the Navier-Stokes equations for the uid, coupled to Newton's laws for the solid. The numerical method we propose is based on a global weak formulation, where the nonlinear term in the NavierStokes model is discretized using the characteristic function. In this talk, we concentrate our attention in the semi- discretization in time and we prove the stability and the convergence of the numerical scheme.

Asupra proprietatii IC a conului tangent al unui inel toric

Dumitru STAMATE
Universitatea Bucuresti, Romania

Studiem proprietatea intersectie completa (IC) pentru conul tangent $grK[S]$ al unui inel toric $K[S]$ asociat unui semigrup S. Fie S semigrupul generat de numerele naturale $n_1 < n_2 < \cdots < n_r$, iar S_i sa fie semigrupul generat de $n_1 + i, n_2 + i, \ldots, n_r + i$. Demonstram ca pentru i suficient de mare, algebrele $K[S_i]$ si $grK[S_i]$, ori au ambele proprietatea IC, ori niciuna dintre ele. Ca o consecinta, urmare a unor rezultate recente ale lui A.V. Jayanthan si H. Srinivasan, in familia shiftata de semigrupuri S_i proprietatea IC pentru $grK[S_i]$ apare ori doar pentru un numar finit de i, sau eventual periodic.

PDEs involving an anisotropic variable exponent operator

Denisa STANCU-DUMITRU
IMAR, Romania

In this talk, we will present some nonlinear elliptic problems involving an anisotropic variable exponent operator of type

$$\sum_i \partial_{x_i}(|\partial_{x_i} \cdot|^{p_i(x)-2}\, \partial_{x_i} \cdot).$$

This operator allows a distinct behavior of partial derivatives in various directions. In the particular case when functions $p_i(\cdot)$ are all equal for each i, this operator has similar properties with the $p(\cdot)$-Laplacian. For these problems, we investigate the existence and multiplicity of solutions. The proofs of our results combine the critical point theory and different variational methods.