Abstracts
& Titles

6th European
Congress of Mathematics

Kraków 2012

6ECM
Kraków 2012

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Introduction

This brochure contains information about the scientific programme of the 6. European Congress of Mathematics:

- Abstracts of plenary lectures with short vitae of speakers
- Abstracts of invited and special lectures
- Titles of presentations in panel discussions
- Titles of talks in mini-symposia
- Titles of talks in Satellite Thematic Sessions
- Titles of research posters

A list of all lectures and talks grouped according to subject classification is included for convenience.

The schedule of all 6ECM activities is provided in the brochure “Programme & Information”.

Abstracts and timetable of the lectures delivered by the prize winners are collected in a separate brochure which will be distributed right after the openning ceremony at which the prizes will be presented.

The plenary speakers and the invited speakers were nominated by the Scientific Committee of the 6ECM, formed by the Executive Committee of the European Mathematical Society. The same Committee selected the mini-symposia from proposals submitted in an open call via the 6ECM website. Note that a Mini-symposium is a special session consisting of four coordinated presentations on a selected topic. Speakers at a mini-symposium are invited by its organizers.

Two of the three special lectures: The Alan Turing Centennial Lecture and on the Mathematics of the Planet Earth (MPE) were proposed by the Executive Committee of the EMS. The lecture on MPE will be delivered at the special open London Mathematical Society meeting.

The first special lecture: the Andrzej Pelczar Memorial Lecture was established by the Polish Mathematical Society (PTM). It will be followed by award of the PTM annual scientific prizes.

The proposals for posters were submitted in an open call through the 6ECM website and the Poster Committee nominated by the Executive Organizing Committee (EOC) made the selections with the help of many referees. All proposals (abstracts of posters) were refereed.

EOC suggested the organization of some panel discussions and asked selected mathematicians to become chairs and to invite the other panelists. Some other panel discussions were proposed and organised spontaneously.

The Satellite Thematic Sessions (STS) were chosen by the EOC from proposals submitted in an open call via the 6ECM website. The STS are intended to serve as extensions of mini-symposia programme and they will be held in the afternoons during the scientific activities of the 6ECM and whole day on Sunday, July 1.

The abstracts were edited by the Editorial Committee of the 6ECM Proceedings.

1 Plenary Lectures

Some mathematical aspects of water waves

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University of Vienna (AT)

We survey recent advances on two fundamental aspects:

• While watching the sea it is often possible to trace a wave as it propagates on the water surface. Contrary to a possible first impression, what one observes traveling across the sea is not the water but a pattern (pulse of energy). A basic question in hydrodynamics concerns the particle paths beneath a traveling surface water wave. In the absence of an underlying current, one can give a qualitative description of the trajectories. The proof relies on an interplay of methods from harmonic function theory, dynamical systems and elliptic partial differential equations.

• Of all the magnificent scenes presented by water waves, breaking is surely among the most impressive. Although the mathematical description of the processes of breaking could hardly be regarded as satisfactory, some theoretical investigations offer insight. We will discuss breaking waves based on the Camassa–Holm equation which arises as an approximation to the governing equations for water waves in the shallow water regime of waves of moderate amplitude.

Both themes illustrate that an appreciation of mathematical rigor and elegance, combined with the power of meaningful abstraction, often leads to breakthroughs in physical insight, while mathematics draws considerable inspiration and stimulation from physics.

AMS MSC 2010: Primary 35Q31, 35Q35; Secondary 34C99, 31A05.

Adrian Constantin *graduated in mathematics from the University of Nice in 1992, and defended his PhD in mathematics in 1996 at the Courant Institute of Mathematical Sciences, under the supervision of Henry P. McKean and Peter D. Lax. He obtained his habilitation in 1999 from the University of Zürich.*

In 2000 Constantin was appointed Chair of Mathematics at Lund University. During 2004–2008 he held the Erasmus Smith's Chair of Mathematics (founded 1762) at the Trinity College in Dublin. He has been Professor of Mathematics at the University of Vienna (Austria) since 2008, and is the current holder of the Chair in Analysis at King's College London.

Adrian Constantin's research interests are focused on partial differential equations and their applications in physics. He was awarded several research prizes, including the Benedetto Sciarra prize of the Scuola Normale Superiore di Pisa in 1994, the Göran Gustafsson prize of the Royal Swedish Academy of Sciences in 2005, the Friedrich Bessel prize of the Humboldt foundation in 2007, and the Fluid Dynamics Research prize of the Japanese Society of Fluid Mechanics (2008).

Dissipative solutions of the Euler equations

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The incompressible Euler equations were derived more than 250 years ago by Euler to describe the motion of an inviscid incompressible fluid. It is known since the pioneering works of Scheffer and Shnirelman that there are nontrivial distributional solutions to these equations which are compactly supported in space and time. If they were to model the motion of a real fluid, we would see it suddenly start moving after staying at rest for a while, without any action by an external force. A celebrated theorem by Nash and Kuiper shows the existence of C^1 isometric embeddings of a fixed flat rectangle in arbitrarily small balls of the threedimensional space. You should therefore be able to put a fairly large piece of paper in a pocket of your jacket without folding it or crumpling it.

In a first joint work with László Székelyhidi we pointed out that these two counterintuitive facts share many similarities. This has become even more apparent in a more recent result of ours, which proves the existence of continuous solutions which dissipate the kinetic energy. Our theorem might be regarded as a first step towards a conjecture of Lars Onsager, which in his 1949 paper about the theory of turbulence asserted the existence of dissipative Hölder solutions.

AMS MSC 2010: 35Q31.

Camillo De Lellis *studied mathematics at the Scuola Normale Superiore di Pisa from 1995 to 2002, where he graduated under the supervision of Luigi Ambrosio. Since 2005 he holds a full professorship at the University of Zürich.*

De Lellis' research interests lie in geometric analysis and partial differential equations. He is particularly well known for his works in geometric measure theory and on the incompressible Euler equations. In 2009 he has received the Stampacchia medal, awarded every three years by the Italian Mathematical Union in recognition of outstanding contributions to the field of calculus of variations and related applications, and was an invited speaker at the International Congress of Mathematicians in 2010.

Persistent homology and applications

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Persistence is a recent extension of the classic concept of homology in algebraic topology. Motivated by the instability of homology to slight changes in the space, we start with a filtration and use the induced maps connecting the homology groups to trace the classes. The information is collected in a planar diagram, which is an invariant of the filtration.

Overcoming the instability of the classic theory is one reason why persistence has found many applications in the sciences and engineering, the existence of fast algorithms is another. They take only seconds to compute diagrams of complexes that reach hundreds of thousands or millions of elements, sizes that are not unusual in applications, which we find in geometry processing, data visualization, medical imaging, biological shape analysis, high-dimensional data analysis, and other areas.

AMS MSC 2010: Primary 55N99; Secondary 68W30.

HERBERT EDELSBRUNNER *received his Ph.D. in 1982 from Graz University of Technology. Currently he is a professor at the Institute of Science and Technology Austria in Klosterneuburg, a professor of Mathematics and the Arts and Sciences Professor of Computer Science at Duke University. He is also a co-founder of* Geomagic, *a company that sells software in shape sampling and processing.*

In a search for a structure

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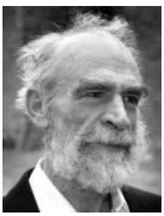
When you read a textbook on molecular or cellular biology you are enchanted by the logical beauty of biological structures, you want to share you excitement with your colleagues, but... you find out you are unable to do it. There is no language in the 21st century mathematics that can express this beauty. You feel there must be a new world of mathematical structures shadowing what we see in Life, a new language we do not know yet, something in the spirit the "language" of calculus we use when describing physical systems.

I shall indicate in this talk some directions where one may look for these mathematical structures.

AMS MSC 2010: 00, 92.



Mikhail Gromov *was a student of Vladimir Rokhlin in Leningrad (now St. Petersburg) and obtained his PhD there in 1973. In 1974 he took a position at The State University of New York at Stony Brook. In 1981 he moved to France, first working at the Université Paris VI. He is now a permanent member of the Institut des Hautes Etudes Scientifiques at Paris, and a Professor of Mathematics at New York University.*

He is known for important contributions to many different areas of mathematics, especially geometry and group theory, and for being a source of vital inspiration to fellow mathematicians. He has introduced the notions of pseudoholomorphic curves in symplectic geometry, h-principle in partial differential relations, large scale invariants in Riemannian geometry, hyperbolic groups and random groups in geometric group theory. Recently he has been interested in mathematical biology.

M. Gromov received numerous awards, including the Osvald Veblen Prize of AMS (1981), the Prix Elie Cartan (1984), the Wolf Prize in Mathematics (1993), the Balzan Prize for Mathematics (1999), and the Abel Prize in 2009 "for his revolutionary contributions to geometry". He was an invited speaker at four International Congresses of Mathematicians: Nice (1970), Helsinki (1978), Warsaw (1982), Berkeley (1986). He is a honorary or foreign member of many academies of sciences and scientific societies.

Classification of algebraic varieties

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A smooth complex projective variety is a compact complex manifold defined by polynomial equations.

In (complex) dimension 1, these are the well known compact Riemann surfaces. From the topological point of view, they are classified by their genus, however from the algebraic point of view, there is a $3g - 3$ dimensional family (for each $g \geq 2$).

In dimension 2, the situation is more complicated, however a satisfactory classification was achieved by the Italian school of algebraic geometry at the beginning of the 20-th century. The Minimal Model Program is an attempt to generalize this classification to dimension ≥ 3. In dimension 3 this program was completed in the 1980's by work of Mori and others. In this talk we will discuss recent results in the Minimal Model Program that have lead to several breakthroughs in the classification of algebraic varieties such as the finite generation of the canonical ring of any smooth complex projective variety.

AMS MSC 2010: 14E30.

Christopher Hacon *studied mathematics at the Scuola Normale Superiore di Pisa, the University of Pisa (B.A. in 1992) and the University of California Los Angeles (M.S. 1995) from which he also obtained his Ph.D. in 1998. Currently he a Distinguished Professor at the University of Utah.*

Hacon is an expert in algebraic geometry. He is particularly interested in the classification of higher-dimensional complex projective varieties and has done groundbreaking work on the Minimal Model Program.

Hacon received several major awards and fellowships, among them the Clay Research Award for major breakthroughs in mathematics research (2007), the American Mathematical Society's Frank Nelson Cole Prize in Algebra (2009) and the Antonio Feltrinelli Prize in Mathematics, Mechanics and Applications (2011) considered one of Italy's highest scientific and cultural honors. He was a plenary speaker at the British Mathematical Colloquium at Edinburgh in 2010.

Representations of affine Kac–Moody groups over local and global fields

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Hebrew University of Jerusalem (IL)

Let G be a reductive algebraic group over a local field $\mathcal{K}$ or a global field F. It is well known that there exists a non-trivial and interesting representation theory of the group $G(\mathcal{K})$ as well as the theory of automorphic forms on an adelic group $G(\mathbb{A}_F)$. The purpose of this talk is to give a survey of some recent constructions and results, which show that there should exist an analog of the above theories in the case when G is replaced by the corresponding affine Kac–Moody group G_{aff} (which is essentially built from the formal loop group $G((t))$ of G). Specific topics include:

1) Hecke algebras of G_{aff} over a local non-archimedian field $\mathcal{K}$: affine Satake isomorphism, Iwahori–Hecke algebra of G_{aff}, connection with the works of Cherednik and Macdonald;

2) Affine geometric Satake correspondence (after Braverman and Finkelberg)

3) Towards automorphic forms on G_{aff}: affine Eisenstein series and Tamagawa measure.

The talk will be based on joint works with A. Braverman, M. Finkelberg, H. Garland and M. Patnaik as well as on earlier works of H. Garland, M. Kapranov and Y. Zhu.

AMS MSC 2010: Primary 20G44; Secondary 22E50, 22E55.

David Kazhdan *studied mathematics at Moscow Lomonosov University, and obtained his PhD in 1969 under the supervision of Alexander Kirillov. He was a leading member of Gelfand's school of mathematics. In 1975 he emigrated from the Soviet Union to take a position at Harvard University. Currently he is a professor at the Hebrew University of Jerusalem as well as a professor emeritus at Harvard.*

He is known for his work in representation theory, especially for introducing the notions of Kazhdan–Lusztig polynomial, Kazhdan's property (T), and for the Kazhdan–Margulis theorem.

Kazhdan held a MacArthur Fellowship from 1990 to 1995. He was appointed to the American Academy of Sciences in 1990, and was made a Fellow of the Israeli National Academy of Sciences and Humanities in 2006. He became a member of the American Academy of Arts and Sciences in 2009, and won the Rothschild Prize in Mathematics in 2010.

Threshold behaviour of random discrete structures

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Adam Mickiewicz University, Poznań (PL)

It is well known that quite often a small change of parameters which control the density of a random structure can dramatically affect its properties. In the talk we present and comment on a number of such results which emerge in different areas of mathematics, computer science and statistical physics.

AMS MSC 2010: 05A, 05C, 60C.

TOMASZ ŁUCZAK *graduated in mathematics (1984) and physics (1987) from the Adam Mickiewicz University in Poznan and received there a PhD in mathematics in 1987. Currently he is a professor of mathematics at the Adam Mickiewicz University in Poznan and at the Emory Univeristy in Atlanta, USA.*

He is an expert in applications of probabilistic and combinatorial methods in different areas of mathematics, physics, computer science, and biology.

For his work on the theory of random discrete structures Łuczak was awarded the Prize of European Mathematical Society (1992) and the annual Prize of the Foundation for Polish Science (1997). He was a speaker at the European Congress in Mathematics in 2004 and the International Congress of Mathematicians in 2006. He is a member of the Polish Academy of Sciences.

Renormalized energy, Abrikosov lattice, and log gases

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In superconductivity, one observes in certain regimes the emergence of densely packed point vortices forming perfect hexagonal lattice patterns. These are named "Abrikosov lattices" in physics. In joint work with Etienne Sandier, we showed how the distribution of these vortices is governed by a Coulomb type of interaction, which can be computed via a "Coulombian renormalized energy" which we introduced and derived rigorously from the Ginzburg–Landau model of superconductivity. Such an interaction turns out to be common in two-dimensional systems. We showed it arises in particular in the statistical mechanics of the "Coulomb gas", which contains as a specific case the Ginibre ensemble of random matrices. We also defined a one-dimensional log-interaction analogue, arising naturally in the statistical mechanics of "log gases", which contains as a specific case the so-called GUE ensemble of random matrices.

In this talk I will present the renormalized energy, examine the question of its minimization and its link with the Abrikosov lattice and weighted Fekete points. I will describe its relation with the statistical mechanics models mentioned above and show how it leads to expecting crystallisation in the low temperature limit.

AMS MSC 2010: 35Q56, 82B05, 82D10, 82D99, 15B52.

Sylvia Serfaty *studied mathematics at the Ecole Normale Superieure in Paris from 1994 till 1998, and obtained her PhD in Mathematics in 1999 from the University of Paris-Sud in Orsay under the supervision of Fabrice Bethuel. Currently she is a professor at the Université Pierre et Marie Curie (Paris VI) and a Global Distinguished Professor at the Courant Institute of Mathematical Sciences.*

She is an expert in mathematical physics and partial differential equations. A substantial part of her research has been devoted to the Ginzburg-Landau model of superconductivity.

Sylvia Serfaty received several major awards and fellowships, among them the Sloan Foundation Research Fellowship (2003), the NSF Career Award (2003), the European Mathematical Society Prize (2004), and the European Young Investigator award (2007). She was a speaker at the International Congress of Mathematicians in 2006 and plenary speaker at the International Congress of Mathematical Physics in 2009.

Classifying classes of structures in model theory

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By the thesis of Classification Theory, reasonable families of classes of mathematical structures should have natural dividing lines, where a dividing line means a partition into low, analysable, tame classes on the one hand, and high, complicated, wild classes on the other. These partitions will generate a tameness hierarchy. For each such partition, if the class is on the tame side one should have useful structural analyses applying to all structures in the class, while if the class is on the wild side one has strong evidence of chaotic behavior (set theoretic complexity). These results should be complementary, proving that the dividing lines are not merely sufficient conditions for being low complexity, or sufficient conditions for being high complexity. This has been successfully done for the partition to stable/unstable and further subdivisions on the tame side for the family of Elementary Classes (i.e., classes with conventional axiomatizations, ranging from Abelian groups and algebraically closed fields through random graphs to Peano Arithmetic, Set Theory, and the like). Critical dividing lines for the taxonomy (stable/unstable, superstable/unsuperstable) involve the behavior of the Boolean algebras of parametrically definable sets and relations.

We shall consider dividing lines among unstable elementary classes, typified by the theories of dense linear orders and random graphs. Much attention has been given on the one hand to so-called *simple theories* which include the random graphs and "pseudo-finite fields", and on the other hand to *dependent theories*, which include the theories of the real closed field, the p-adics, and many fields of power series. Without assuming specialized knowledge, we shall try to describe some advances, particularly recent ones, and discuss our prospects.

AMS MSC 2010: 03C45.

Saharon Shelah *obtained his Ph.D. in 1969 from the Hebrew University of Jerusalem. Currently he holds the A. Robinson Chair for Mathematical Logic at the Hebrew University (since 1978) and is also a Distinguished Visiting Professor at Rutgers University (USA).*

Shelah is an expert in model theory and set theory whose work has greatly influenced both subjects. He is the author of about 1000 research papers and seven important monographs.

Shelah's major achievements include the development of classification theory in model theory, of iterated forcing methods in consistency proofs (the invention of proper forcing) and of the theory of possible cofinalities in cardinal arithmetic which led to unexpected ZFC results about cardinal exponentiation. Among Shelah's contributions to famous problems from other parts of mathematics are a construction of an uncountable group without uncountable proper subgroups, a proof that Whitehead's problem is independent of ZFC and giving a primitive recursive upper *bound to van der Waerden's numbers $V(C, N)$.*

Shelah was awarded the Anna and Lajos Erdös Prize in Mathematics (1977), the Israel Prize for Mathematics (1998), the Bolyai Prize (2000), the Wolf Prize in Mathematics "...for his many fundamental contributions to mathematical logic and set theory and their applications within other parts of mathematics" (2001) and the EMET prize (2011). He was a plenary speaker at the 1986 International Congress of Mathematicians in Berkeley and at the British Mathematical Colloquium at Exeter in 1988.

Geometry of stochastic processes

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CNRS (FR)

Given a stochastic process, that is a (finite) collection $(X_t)_{t \in T}$ of random variables, it is a fundamental problem to find upper and lower bounds for the "size of this process", as measured e.g. by the quantity $\mathsf{E} \sup_{s,t \in T} |X_s - X_t|$. Recent progress in this area has allowed the final solution of two old problems (concerning convergence of random Fourier series and of orthogonal series). We consider in particular the fundamental case of "random series of functions", where the random variables X_t are of the type $X_t = \sum_{i \le N} t_i \xi_i$, where $(\xi_i)_{i \le N}$ are independent random variables and where $t = (t_i)_{i \le N}$ are coefficients. The central question here is to relate the size of process with the "geometry of the index set". The most important situation is where the variables ξ_i are centered standard Gaussian random variables. It has been understood since 1985 that in this case the best possible upper bounds are given by a suitable version of Kolmogorov's chaining. Based on these considerations, we propose a long term research program in the form of a daring series of conjectures which would cover other cases of fundamental importance, and first of all the case of coin-flipping random variables, i.e. $\mathsf{P}(\xi_i = \pm 1) = 1/2$. These conjectures are precise formulations of the optimistic idea that there should be no methods to bound such families of random variables from above other than the "trivial methods" (such as the use of chaining, of linearity, of the triangle inequality) and mixtures of these.

AMS MSC 2010: 60G99.

Michel Talagrand *received his PhD in 1977 from the Pierre and Marie Curie University (Paris VI) under the supervision of Gustave Choquet. He is a professor at CNRS and a member of the Institut de Mathématiques in Paris.*

He is known for important contributions to probability theory, functional analysis and their applications. He has obtained a complete characterization of boundedness and continuity of Gaussian processes, developed a concentration of measure theory in product spaces, solved numerous problems in probability on Banach spaces. Recently he became interested in mean field models of spin glasses, gave mathematical foundation to many works of physicists, and proved the validity of the celebrated prediction of Parisi.

He received numerous awards, including the Loève Prize (1995) and the Fermat Prize "for fundamental contributions in various domains of probability" (1997). He was an Invited Speaker in 1990 and a Plenary Speaker in 1998 at the International Congresses of Mathematicians. He is a full member of the French Academy of Sciences and a Chevalier of the Legion of Honor.

2 Invited Lectures

Bernoulli numbers, Drinfeld associators and the Kashiwara–Vergne problem

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In 1978, Kashiwara and Vergne put forward a conjecture on the properties of the Campbell–Hausdorff series. This conjecture provides, among other things, a natural (independent of structure theory) proof of the Duflo isomorphism between the center of the universal enveloping algebra and the ring of invariant polynomials. The conjecture is given by two linear equations for a pair of Lie series, $a(x, y)$ and $b(x, y)$. The first equation is of the form

$$\ln\left(e^x e^y\right) = x + y + [x, a(x, y)] + [y, b(x, y)],$$

and the second equation is expressed in terms of the generating function of Bernoulli numbers $x/(e^x - 1) = \sum_{k=0}^{\infty} B_k x^k/k!$.

There is another object in Lie theory which makes use of Bernoulli numbers. This is a Drinfeld associator satisfying the pentagon equation. In the talk, we explain how one can prove the Kashiwara–Vergne conjecture using Drinfeld associators. We also state several conjectures arising from comparison of topological, number theoretic and Lie theoretic approaches to associators.

The talk is based on joint work with B. Enriquez, E. Meinrenken and C. Torossian.

AMS MSC 2010: 17B01, 17B35, 53D55.

Holomorphic deformations, quasiconformal mappings and vector valued calculus of variations

Kari Astala astala@mappi.helsinki.fi
University of Helsinki (FI)

In this talk, based on joint work with T. Iwaniec, I. Prause and E. Saksman, we describe a new approach to vector valued calculus of variations, via holomorphic deformations and ideas from quasiconformal mappings.

A fundamental question in the calculus of variations is to characterize quasiconvex functionals $F : \mathbb{R}^{n\times m} \to \mathbb{R}$ or, equivalently, functionals for which the energy integral $\int F(Du)\,dx$ is lower semicontinuous. Somewhat surprisingly, the vector valued case $m, n \geq 2$ is still widely open. According to Morrey, the convexity of F in the direction of rank-one matrices is a necessary condition, but as Šverák shows, it is not sufficient in dimensions $m \geq 3$. On the other hand, there is an abundace of evidence for sufficiency in planar domains, $n = m = 2$.

The talk will focus on an important functional originated in the work of Burkholder on optimal martingale inequalities. The conjectural quasiconvexity of the Burkholder functional motivates several deep results e.g. in singular integrals and PDE's.

AMS MSC 2010: 30C62, 30C70, 49K10, 49K30.

Coagulation with limited aggregations

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Smoluchowski coagulation equations describe the evolution of the concentrations of particles which merge pairwise as time passes. In the original equation, particles are only characterized by their masses; here we suppose they have also arms (or stubs) which are used to perform aggregations. In other words, each particle receives initially a certain number of potential links which are consumed when the particle takes part to a coagulation event. Therefore the total number of aggregations involving a given particle is limited by its initial number of arms.

The purpose of the talk is to survey some recent contributions to this topic, including explicit resolution, phenomenon of gelation and of self-organized criticality, and limiting concentrations. This hints at connexions with certain branching processes which then are enlighten by the study of the microscopic model. The latter is a close relative to the so-called configuration model, a random graph model in which the degree sequence is pre-described.

AMS MSC 2010: 82C23, 60J80.

The Cremona group

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The Cremona group is the group of all birational transformations of the plane; using affine coordinates (x, y), each element f of this group can be expressed in the form $f(x, y) = (p(x, y), q(x, y))$ where p and q are rational fractions in x and y. This group is infinite dimensional, and contains elements with rich dynamical behaviors. In this respect, it looks like groups of diffeomorphisms of compact manifolds. On the other hand, it shares interesting properties with smaller groups, like linear groups or Lie groups. I shall describe the basic features of the Cremona group, and explain how algebraic geometry, dynamical systems, and geometric group theory can be combined simultaneously to describe the structure of this group of transformations.

AMS MSC 2010: 14E07, 20E32, 32M05, 37F99.

Exemplar-based image inpainting and applications

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Image inpainting consists in recovering the missing or corrupted parts of an image so that the reconstructed image looks natural. The purpose of this talk will be to give an overview of recent techniques in non-local exemplar-based image inpainting and its applications in video and cinema post-production.

Non-local methods for image denoising and inpainting have gained considerable attention in recent years. This is due to their superior performance in textured images, a known weakness of purely local methods. Local methods on the other hand have shown to be very appropriate for the recovering of geometric structure such as image edges. The synthesis of both types of methods is a trend in current research. Variational analysis in particular is an appropriate tool for a unified treatment of local and non-local methods. We present a general variational framework for the problem of non-local image inpainting, from which some previous inpainting schemes can be derived, in addition to leading to novel ones. We give an statistical mechanics interpretation of the proposed framework.

We also study the properties of the variational formulation of the Efros-Leung copying scheme.

Finally, we show applications of image inpainting to different problems: interpolation of sparsely sampled images, the replacement of objects in video sequences, and to the post-production of depth-enhanced imagery.

AMS MSC 2010: 68U10, 35A15, 65D05, 65C50.

KAM theory: a journey from conservative to dissipative systems

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The announcement of Kolmogorov's theorem in 1954 and the publication of the first proofs by Moser (1962) and Arnold (1963) represented a breakthrough in the theory of stability of nearly–integrable systems, and marked the beginning of the so–called KAM theory. Under very general assumptions, KAM theory provides the persistence under a small perturbation of invariant tori filled by quasi–periodic motions.

The aim of this talk is to present some developments of KAM theory in the context of conservative and dissipative (i.e., conformally symplectic) systems (either maps and flows). A sketch of the proofs, based on a suitable parameterization of the solution and on the implementation of a quadratic iterative scheme, will be included.

I will also pay attention to the applications of KAM theory to several models, ranging from paradigmatic problems like the standard map to more concrete models of interest in physical applications, including, e.g., the spin–orbit coupling and the three–body problem in Celestial Mechanics. In these contexts I will illustrate how a computer–assisted KAM proof may be devised in order to prove the existence of invariant tori for realistic values of the parameters.

AMS MSC 2010: 70K43.

The p-adic Langlands program

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The group $G_{\mathbb{Q}}$ of automorphisms of the field $\overline{\mathbb{Q}}$ of algebraic numbers is still a very mysterious object despite continuous efforts of number theorists for more than 150 years. One way to understand this group is to consider its representations. In 1967 Langlands proposed a program which seeks to describe the representations of $G_{\mathbb{Q}}$ coming from geometry in terms of harmonic analysis on the various completions of $\mathbb{Q}$ (i.e., $\mathbb{R}$ and the fields of p-adic numbers $\mathbb{Q}_p$ for prime numbers p). The last decade has seen the apparition of a p-adic avatar of Langlands' program following Wiles' proof of Fermat's last theorem and the ensuing proof of the Taniyama-Weil conjecture (a special but crucial case of Langlands' correspondence) by Breuil-Conrad-Diamond-Taylor. This p-adic program is still in infancy, but the case of representations of dimension 2 is rather well understood by now. Compared with the classical case, the p-adic picture has some very nice features that I will emphasise in my talk.

AMS MSC 2010: 11-XX.

Mirror symmetry and Fano manifolds

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Given a Laurent polynomial f, I explain how to construct the Picard–Fuchs differential operator L_f and its natural solution, the principal period π_f. By definition, f is extremal if L_f has smallest possible ramification. I introduce two classes of Laurent polynomials in 3 variables that are conjectured to be extremal: Minkowski polynomials and polynomials with boundary motive of Hodge–Tate type. I briefly summarize certain facts about the quantum cohomology of a Fano manifold X, introducing the regularized quantum differential operator $\widehat{Q}_X$ and power series solution $\widehat{J}_X$. Conjecturally, $\widehat{Q}_X$ is of small (often minimal) ramification. A Fano manifold X is mirror-dual to a Laurent polynomial f if $\widehat{Q}_X = L_f$. I demonstrate how to derive the classification of Fano 3-folds (Iskovskikh, Mori–Mukai) from the classification of 3-variable Minkowski polynomials. In conclusion, I give a status report on a program aimed at a classification of Fano 4-folds using these ideas.

Coauthors: Tom Coates, Sergey Galkin, Vasily Golyshev, Alexander Kasprzyk.

AMS MSC 2010: Primary 14J33; Secondary 14D07, 14J45.

Irregular motion and global instability in Hamiltonian systems

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AMS MSC 2010: 37J40, 70F15.

On flat bundles in characteristic 0 and $p > 0$

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On a smooth quasi-projective complex variety X, the category of complex linear representations of the topological fundamental group, which is an abstract group of finite type, is tensor equivalent to the category of $\mathcal{O}_X$-coherent $\mathcal{D}_X$-modules with regular singularities (Deligne's Riemann-Hilbert correspondence). In characteristic $p > 0$, the latter, which is tensor equivalent to the category of infinitely Frobenius divisible vector bundles, is no longer controlled by a group of finite type. Yet some striking properties on the complex side are true on the characteristic $p > 0$ side. Most particularly, this category is controlled by Grothendieck's étale fundamental group.

AMS MSC 2010: 14G17, 14D99.

Combinatorial realisation of cycles and small covers

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The following problem on realisation of cycles was posed by Steenrod in 1940s. Given a homology class $x \in H_n(X, \mathbb{Z})$ of a topological space X, does there exist an oriented closed smooth manifold M^n and a continuous mapping

$f : M^n \to X$ such that $f_*[M^n] = x$? If the answer is "yes", x is said to be realisable. In 1954, Thom found a non-realisable 7-dimensional class and proved that for every n, there is a positive integer $k(n)$ such that the class $k(n)x$ is always realisable. The proof was by methods of algebraic topology and gave no information on the topology of M^n. We give a purely combinatorial construction of a manifold that realises a multiple of a given homology class. For every n, this allows us to find a manifold M^n that has the following universality property:

(∗) For any X and any $x \in H_n(X, \mathbb{Z})$, some multiple of x can be realised by an image of some non-ramified finite-sheeted covering of M^n.

This manifold M^n is a so-called small cover of the permutahedron, i.e., a manifold glued in a special way out of 2^n permutahedra. (The permutahedron is a special convex polytope with $n!$ vertices.) Further, among small covers over other simple polytopes, we find a broad class of examples of manifolds that have property (∗). In particular, in dimension 4, we find a hyperbolic manifold with property (∗), thus proving a conjecture of Kotschick and Löh claiming that a multiple of any homology class can be realised by an image of a hyperbolic manifold.

AMS MSC 2010: Primary 57N65, 53C23; Secondary 52B70, 32Q45.

Remarks on global regularity for solutions to the incompressible Navier–Stokes equations

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We review some recent results concerning the Cauchy problem for the three dimensional, homogeneous, incompressible Navier–Stokes equations. We show in particular that the set of initial data generating a global smooth solution is open and connected, and we discuss in what sense it is open for weak topology.

AMS MSC 2010: 35Q30.

Why the empirical sciences need statistics so desperately?

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Science can be described as a systematic attempt to extract reliable information about the world. The cognitive capacities of *homo sapiens* come with various biases, such as our tendencies (a) to detect patterns in what is actually just noise, and (b) to be overly confident in our conclusions. Thus, the scientific method needs to involve safeguards against drawing incorrect conclusions due to such biases. A crucial part of the necessary toolbox is the theory of statistical inference.

There exists a large and well-developed (but of course incomplete) body of such theory, which, however, researchers across practically all of the empirical sciences do not have sufficient access to. The lack of statistical knowledge therefore forms a serious bottleneck in the quest for reliable scientific advances. As has been observed by several authors in recent years, statistical malpractice is widespread across a broad spectrum of disciplines, including (but not limited to) medicine, cognitive sciences, Earth sciences and social sciences.

In this talk I will first try to describe the overall situation and provide some concrete examples. I will then move on to discuss the more difficult issue of what can and needs to be done.

AMS MSC 2010: 62A01.

Solving the KPZ equation

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Warwick University (UK)

The Kardar–Parisi–Zhang, or KPZ, equation was originally introduced in the eighties as a model of surface growth, but it was soon realised that its solution is a "universal" object describing the crossover between the Gaussian universality class and the KPZ universality class. The mathematical proof of its universality however is still an open problem, in particular because of the lack of a good approximation theory for the equation. Indeed, the only known way so far to mathematically interpret solutions to the KPZ equation is to reduce it to a linear stochastic PDE via a non-linear transformation called the Cole–Hopf transform. Unfortunately, the resulting linear equation does itself lack a sufficiently flexible approximation theory and many microscopic models do not behave well under the Cole–Hopf transform.

We will present a new notion of solution to the KPZ equation that bypasses the use of the Cole–Hopf transform. It allows to factorise the solution map into a "universal" (independent of initial condition) measurable map, composed with a solution map with good continuity properties. This lays the foundations for a robust approximation theory to the KPZ equation, which is needed to prove its universality. As a byproduct of the construction, we obtain very detailed regularity estimates on the solutions, as well as new homogenisation results.

AMS MSC 2010: 60H15.

The matrix logarithm: from theory to computation

Nicholas J. Higham higham@ma.man.ac.uk
University of Manchester (UK)

We describe the theory of the matrix logarithm and present some new algorithms for computing it and its condition number. The matrix logarithm arises in a number of applications (e.g., Markov models, optics, inverse problems) and we begin by outlining some of them. We describe some key properties of the set of matrix logarithms, giving particular attention to non-primary logarithms, whose existence is what makes the embeddability problem for Markov chains so hard. We present a new inverse scaling and squaring algorithm for computing the matrix logarithm, which employs a matrix analogue of the method Briggs used in the 17th century to produce his tables of logarithms. Numerical evaluation of the Fréchet derivative and estimation of the condition number, important for optimization and measuring sensitivity of the logarithm, will also be discussed.

AMS MSC 2010: 15A60, 65F30.

Computing the Schrödinger equation with no fear of commutators

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The discretization of a linear Schrödinger equation is difficult due to the presence of a small parameter which induces high oscillations. A standard approach consists of a spectral semidiscretization, followed by an exponential splitting. This, however, is sub-optimal, because the exceedingly high precision in space discretization is marred by low order of the time solver. It turns out, however, that once we employ spectral collocation in place of a conventional spectral method, the size of nested commutators becomes small, and this allows to boost significantly the order of space discretization.

In this talk we consider formally objects in the free Lie algebra spanned by the Laplacian and by a multiplication by the potential. We demonstrate that only a very small proportion of commutators survives once the exponential is split by using a symmetric version of the Zassenhaus splitting. Since the size of these commutators remains small once derivatives are appropriately replaced with spectral collocation derivative matrices, this approach, in tandem with Krylov subspace techniques for rapid computation of a matrix exponential, results in an affordable and precise discretization of the linear Schrödinger equation.

Coauthors: Philipp Bader, Karolina Kropielnicka.

AMS MSC 2010: Primary 65M22; Secondary 17B01, 65M70.

Dynamics of non-archimedean Polish groups

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A Polish group is *non-archimedean* if it admits a local basis at the identity consisting of open subgroups. Alternatively these groups can be viewed as automorphism groups of countable structures. The study of the dynamics of non-archimedean groups unveils interesting interactions between mathematical logic, finite combinatorics (especially Ramsey theory), topological dynamics, ergodic theory and group representations. In this talk I will give an introduction to this area of research.

AMS MSC 2010: 03E75.

Cluster algebras and cluster monomials

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Cluster algebras were invented by Sergey Fomin and Andrei Zelevinsky at the beginning of the year 2000. Their motivations came from Lie theory and more precisely from the study of the so-called canonical bases in quantum groups and that of total positivity in algebraic groups. Since then, cluster algebras have been linked to many other subjects ranging from higher Teichmüller theory through discrete dynamical systems to combinatorics, algebraic geometry and representation theory. According to Fomin–Zelevinsky's philosophy, each cluster algebra should admit a 'canonical' basis, which should contain the cluster monomials. This led them to formulate, about ten years ago, the conjecture on the linear independence of the cluster monomials. In this talk, we will give a concise introduction to cluster algebras and sketch the ingredients of a proof of the conjecture. The proof is valid for all cluster algebras associated with quivers and was obtained in recent joint work with G. Cerulli Irelli, D. Labardini-Fragoso and P.-G. Plamondon.

AMS MSC 2010: Primary 13F60; Secondary 17B20.

Weak solutions to the complex Monge–Ampère equation

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Canonical Kähler metrics, such as Ricci-flat or Kähler–Einstein, are obtained via solving the complex Monge-Ampère equation. The famous Calabi–Yau theorem asserts the existence and regularity of solutions to this equation on compact Kähler manifolds for smooth data. In this talk we shall present methods, based on pluripotential theory, which yield the results on the existence and stability of the weak solutions of the Monge–Ampère equation for possibly degenerate, non-smooth right hand side. Those weak solutions have also interesting applications in geometry. They lead to canonical metrics with singularities, which may occur as the limits of the Kähler–Ricci flow or the limits of families of Calabi–Yau metrics when the Kähler class hits the boundary of the Kähler cone.

AMS MSC 2010: Primary 32W20; Secondary 32U15, 32Q15.

Phase transitions in self-interacting random walks

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The talk will explore the topic of self-interacting walks where varying some natural parameter leads to drastic changes in the behaviour of the process. Examples include a linearly- and once-reinforced random walk and a self-avoiding walk. Two results will be discussed in detail:

• On any graph with bounded degrees, a linearly-reinforced random walk has a recurrent phase. Here the parameter is the initial weights. Joint work with Omer Angel and Nicholas Crawford.
• On $\mathbb{Z}^d$, $d \geq 2$, a self-avoiding walk in a domain weighted by β^{len} has a space-filling phase. Joint work with Hugo Duminil-Copin and Ariel Yadin.

All the terms without exception will be defined in the talk.

AMS MSC 2010: 60K99.

On blow-up curves for semilinear wave equations

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IHES Bures-sur-Yvette (FR)

We consider the semilinear wave equation with focusing power nonlinearity in one space dimension. Blow-up solutions are known to exist, and the solution can be defined on some domain of definition under the blow-up curve.

Considering an arbitrary blow-up solution, our goal is to describe its behavior near the blow-up curve, and the geometry of the blow-up curve itself. Such properties are linked to the notion of non-characteristic points on the curve.

First, we find criteria on initial data to ensure the existence or the non-existence of characteristic points. Then, we prove the regularity of the blow-up curve away from characteristic points, and show a surprising isolatedness property for characteristic points, together with the classification of the behavior of the solution near them.

In order to do this, we introduce for this problem a notion of critical space. Furthermore, we link the geometrical properties of the blow-up curve with the problem of decomposing a general solution into a sum of solitons.

AMS MSC 2010: 35B40, 35B44.

Commuting higher rank ordinary differential operators

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Sobolev Institute of Mathematics, Novosibirsk (RU)

We survey the theory of commuting ordinary differential operators. Some advances in the case of higher rank operators are discussed. Sufficient conditions are found when rank two operators are formally self-adjoint.

We also point out examples of formally self-adjoint operators with polynomial coefficients, corresponding to a spectral curve of arbitrary genus. These operators define a commutative subalgebra of the Weyl algebra A_1.

AMS MSC 2010: 37K10.

Stochastic calculus with respect to the fractional Brownian motion

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The University of Kansas (USA)

The fractional Brownian motion (fBm) is a centered Gaussian stochastic process $\{B_t^H, t \geq 0\}$ which is self-similar and it has stationary increments and variance $E((B_t^H)^2) = t^{2H}$, where $H \in (0, 1)$ is called the Hurst parameter. The purpose of this talk is to describe some properties of the fBm, and to discuss some recent advances on the stochastic calculus with respect to this process.

The fBm and its multiparameter extension called the fractional Brownian sheet, are suitable input noises in ordinary and partial differential equations. We will present a version of the Feynman–Kac formula for the heat equation on $\mathbb{R}^d$ driven by a multiplicative fractional Brownian sheet. This formula holds if the Hurst parameters of the noise in time H_0 and space $(H_1, \ldots, H_d)$ satisfy $2H_0 + \sum_{i=1}^{d} H_i > d + 1$, and involves stochastic integrals of distributions with respect to the fractional Brownian sheet.

AMS MSC 2010: 60H05, 60H15.

Sampling, interpolation, translates

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Tel Aviv University (IL)

I am going to discuss the following topics: universal sampling of signals with bounded disconnected spectrum; approximation of discrete functions and size of the spectrum; high-dimensional interpolation/sampling problems.

The presentation is based on joint work with A. Ulanovskii.

I will also speak about Wiener's conjecture on cyclic vectors for translations in $L^p(\mathbf{R})$. Our recent result, joint with N. Lev, gives a counterexample to this conjecture.

AMS MSC 2010: Primary 42-XX; Secondary 94A20.

Multidimensional periodic and almost-periodic spectral problems: Bethe–Sommerfeld Conjecture and integrated density of states

Leonid Parnovski Leonid@math.ucl.ac.uk
University College, London (UK)

I will talk about recent progress in the study of the spectral properties of periodic and almost-periodic differential and pseudo-differential operators acting in $\mathbb{R}^d$, $d \geq 2$. There will be two major types of results I will discuss.

1. The Bethe–Sommerfeld Conjecture. This conjecture was originally formulated for 3-dimensional Schrödinger operators with periodic potentials and stated that the spectrum of such operators cannot have infinitely many gaps. While proved in this generality in 1985 by M. Skriganov, the conjecture was still open for other types of operators. I will describe recent results where the conjecture was established for a wide (and almost optimal) class of periodic pseudo-differential operators, including magnetic Schrödinger operators in all dimensions. These are joint results with A. Sobolev.

2. The asymptotic behaviour of the integrated density of states. I will discuss my joint result with R. Shterenberg where we have obtained a complete asymptotic expansion of the integrated density of states of Schrödinger operators for large energies. This expansion holds when the potential is either smooth periodic, or generic quasi-periodic, or belongs to a wide class of almost-periodic functions.

AMS MSC 2010: 35P20, 47G30, 47A55.

About covering spaces and numbers

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In his "Esquisse d'un Programme" Grothendieck presented a grand vision about a new approach to some of the most fundamental question in algebraic/arithmetic geometry and in number theory. This generated an intensive — almost frantic — research in several directions, from trying to understand the poly-logs and the multi-zeta values to developing approaches for an effective proof of the Mordell conjecture (Falting's Theorem) to decoding anabelian schemes from their Galois theory to describing the (absolute) Galois groups as automorphism groups of variants of fundamental group functors. In my talk I will touch upon aspects of the last question mentioned above. This question ties in with ideas of Bogomolov for a birational anabelian program which goes beyond Grothendieck's birational anabelian conjectures, and reshapes our understanding about the nature of (birational) anabelian phenomena.

AMS MSC 2010: 11G, 12E, 12F, 13B, 14F.

Evolution problem in General Relativity

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The talk will focus on mathematical aspects of the evolution problem in General Relativity and review its progress, main challenges and open problems. A prominent interaction of Geometry and PDE methods in the subject will be illustrated on examples ranging from incompleteness theorems and formation of trapped surfaces to geometric properties of black holes and their stability.

AMS MSC 2010: 35Q75, 83C57.

Quantum chaos and number theory

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Quantum chaos is an emerging branch of mathematical physics, studying the fine structure of the energy spectrum and of the wave functions of quantum systems in the semi-classical limit. It offers many tantalizing challenges for the mathematician. Some of the more accessible models are closely connected to cutting-edge issues in number theory. The lecture, aimed at a general audience, will describe some of these problems, what has been accomplished to date and the many outstanding issues remaining.

AMS MSC 2010: Primary 81Q50; Secondary 11-XX.

Effective equations for quantum dynamics

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Systems of interests in natural sciences are typically characterized by a huge number of degrees of freedom. For such systems the fundamental equations of physics are impossible to solve. one of the main goals of statistical mechanics is therefore the derivation of simpler effective theories, which allow to make predictions about the behavior of large systems, and, at the same time, approximate the solutions of the fundamental equations in the interesting limiting regimes. In this talk I am going to present some models for which effective evolution equations can be derived from first principles quantum dynamics in mathematically rigorous terms.

AMS MSC 2010: 82C10.

Combinatorics of asymptotic representation theory

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The representation theory of the symmetric groups S_n since its very beginning has been intimately related to combinatorics: combinatorial objects such as Young tableaux and combinatorial algorithms such as Littlewood–Richardson rule. Unfortunately, in the limit as n tends to infinity, the structure of these combinatorial objects and algorithms becomes very complicated and cumbersome and it is hard to extract from them some meaningful answers to asymptotic questions. In order to overcome these difficulties, since 1990s a kind of dual combinatorics of the representation theory of the symmetric groups was investigated. This dual combinatorics turned out to be highly successfull for solving asymptotic problems: one of its applications is a connection (discovered by Biane) between representations of the symmetric groups, random matrices and Voiculescu's free probability theory. During the lecture I will concentrate on one of the highlights of this new combinatorics: Kerov polynomials which express characters in terms of free cumulants (quantities which originate from free probability and random matrix theory). It is known, for example, that the coefficients of Kerov polynomials are equal to a generalization of Hurwitz numbers, but several mysteries concerning their structure remain.

AMS MSC 2010: Primary 20C30; Secondary 05E10,46L54.

Probing probability measures in high dimensions

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A significant challenge arising in many application areas is to obtain information from probability measures in high dimensions. A large and interesting class of problems of this type arise from the approximation of measures in Hilbert space which have a density with respect to a Gaussian measure. I will describe a range of new Monte Carlo–Markov chain algorithms for probing such probability measures, and describe the techniques that have been developed in order to analyze them. These techniques exploit recent developments in the ergodic theory of stochastic PDEs and stochastic processes in Hilbert space.

AMS MSC 2010: 65-XX, 60-XX.

On scale-invariant solutions of the Navier–Stokes equations

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University of Minnesota (USA)

In this talk we will consider various classes of the Navier–Stokes solutions which are invariant under the natural scaling symmetry of the equations.

These include the forward self-similar solutions and the Landau solutions. We will outline the proof of a recent result with Hao Jia that, under natural assumptions, any scale-invariant data give rise to a global, scale-invariant solutions. Connections with the problem of uniqueness of the Leray–Hopf weak solutions will also be discussed.

AMS MSC 2010: 76-XX.

Ramsey-theoretic analysis of the conditional structure of weakly-null sequences

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Institut de Mathématiques de Jussieu (FR)
University of Toronto (CA)

Understanding the conditional structure that could be present inside a weakly-null sequence in a normed space lies at the heart of several classical problems of this area of mathematics. We will expose the set-theoretic and Ramsey-theoretic methods relevant to both the lack and the existence of this conditional structure. We will concentrate on more recent results and will point out problems for further study.

AMS MSC 2010: 03E05, 05D10, 46B20.

3 Special Lectures

Andrzej Pelczar Memorial Lecture: Tilings and Markov Partitions

Maciej P. Wojtkowski wojtkowski@matman.uwm.edu.pl
University of Warmia and Mazury, Olsztyn (PL)

We will explore the connection between symmetry of 1-dimesional tilings and Markov partitions. The symmetries are furnished by Pisot substitutions and the corresponding toral automorphisms have Markov partitions with the number of elements equal to the number of different tiles. The talk will be a fair mixture of algebra, geometry and dynamics.

AMS MSC 2010: 60-XX.

Mechanising the Mind: Turing and the Computable – a Centenary Lecture

Philip Welch p.welch@bristol.ac.uk
University of Bristol (UK)

On the occasion of this Turing centenary year we revisit his fundamental 1936 paper *"On Computable numbers"* (written when he was only 24), thus solving Hilbert's *Entscheidungsproblem*, and somewhat incidentally laying the foundations of a theory of computer science.

We take a similar snapshot of his later PhD thesis and the resulting paper on *Systems of Logic based on Ordinals*, which tried to overcome the limitations of Gödel's Second Incompleteness Theorem in formal theories, and, although ingenious, see why this analysis in the longer term did not prove so successful.

Together with some recounting of the biographical details of Turing's life, this lecture should be accessible to all.

AMS MSC 2010: Primary 01A60; Secondary 03D10.

Mathematics for the Planet Earth
A Challenge and an Opportunity to Mathematicians

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The "Mathematics of Planet Earth" initiative (MPE2013) aims to be an important occasion for showing the essential relevance of mathematical sciences in planetary issues at research level for solving some of the greatest challenges of our century. As in the World Mathematical Year 2000, it should also be an opportunity for the non less important Raising Public Awareness of mathematics at the educational and societal levels.

The Planet Earth System is composed of several sub-systems, such as, the atmosphere, the liquid oceans and the icecaps and the biosphere, and in all of them mathematics, enhanced by the supercomputers, has currently a key role in the "universal method" for their study, which, following J.-L. Lions, consists of the mathematical modeling, the analysis with simulation and the control. Much before the advent of computers, the representation of the Earth, the navigation and the cartography have contributed in a decisive form to the mathematical knowledge, as well as the International Geosphere-Biosphere Program, sponsored by the International Council of Scientific Unions, is contributing to stimulate several mathematical research topics.

In this lecture, we present a brief historical introduction to the essential mathematics for understanding the Planet Earth and some of the challenges raised by the current global change, with a special focus on the international competition for modules for a virtual global exhibition promoted by MPE2013, which launching has the UNESCO patronage, and the research initiatives announced for 2013, in particular, in Europe by the ERCOM centers.

AMS MSC 2010: 00-XX.

4 Panel Discussions

EuDML: Accessing Europe's mathematical treasures

MODERATOR: Jiří Rákosník *(Academy of Sciences of the Czech Republic, Praha, CZ) – Member of the EMS Electronic Publishing Committee*

PANELISTS:

Laurent Guillopé *(Université de Nantes, FR)*, **About mathematical archives for the future**

Marek Niezgódka *(University of Warsaw, PL)*, **Towards Open Mathematics: the role of communication platforms, positioning of EuDML**

Olaf Teschke *(Zentralblatt MATH & Fachinformationszentrum Karlsruhe, DE)*, **Crosslinking, scope, classification – How EuDML and Zentralblatt work together and improve each other**

Financing of mathematical research

MODERATOR: Pavel Exner *(Czech Academy of Sciences, CZ) – Vice President European Research Council*, **The role of ERC in supporting mathematical research**

PANELISTS:

Mats Gyllenberg – *European Science Foundation*

Michał Karoński *(Adam Mickiewicz University, Poznań, PL) – National Science Center (NCN), PL*, **The role of NCN in supporting Polish mathematics**

Sastry G. Pantula – *National Science Foundation, USA*, **Opportunities in mathematical and statistical sciences at NSF**

Lex Zandee – *The Netherlands Organisation for Scientific Research (NWO)*, **How to improve the relation between mathematics research funding from ERC and from the national research councils**

Redressing the gender imbalance in mathematics: strategies and outcomes

(Joint EMS/EWM Panel Discussion)

MODERATOR: Caroline Series *(University of Warwick, UK) – Chair of the EMS Committee on Women in Mathematics*

PANELISTS:

Penelope Bidgood *(Kingston University, UK) – Chair, Committee on Women in Statistics*, **Women in Statistics**

Kari Hag *(NTNU, Trondheim, NO)*, **Scandanavian initiatives for Women Mathematicians**

Marja Makarow *(University of Helsinki, FI) – Chief Executive of the ESF 2008-11*, **Does a research career in mathematics attract women?**
`http://www.genderinscience.org/`

Christie Marr *(The Isaac Newton Institute, Cambridge, UK) – Deputy Director*, **The Newton Institute Gender Balance Initiative**

Marie-Francoise Roy *(Université de Rennes, FR) – Convenor of EWM*, **Women in Mathematician France and Germany in the last 25 years**

The role of mathematics in the emerging economies

MODERATORS: Andreas Griewank *(Humboldt University, Berlin, DE)*
Tsou Sheung Tsun *(University of Oxford, UK)*

PANELISTS:

Neela Nataraj *(Indian Institute of Technology, Bombay, IN)*

Alexander Shananin *(Moscow Institute of Physics and Technology, Dolgoprudny, RU)*

YuanJin Yun *(Federal University of Parana, BR)*

Gareth Witten *(University of Cape Town, ZA)*

"Solid findings" in Mathematics Education; proposals and discussion

Guenter Toerner *(University of Deusseldorf, DE) – Chair of the EMS Comittee of Education*

Tommy Dreyfus *(University of Tel Aviv, IL)*

Despina Potari *(University of Athens, GR)*

What is expected from European learned societies?

MODERATOR: Marta Sanz-Solé *(Universitat de Barcelona, ES) – President of the European Mathematical Society*

PANELISTS:

Ehrhard Behrends *(Freie Universität, Berlin, DE) – Chair of the EMS Committee Raising Public Awareness of Mathematics*, **Popularization of mathematics: why and how?**

Wolfgang Eppenschwandter – *Initiative for Science in Europe, Executive Coordinator*, **Joining forces for science-driven science policy in Europe**

Maria J. Esteban *(CNRS & University Paris-Dauphine, FR) – President of Société de Mathématiques Appliquées et Industrielles*, **Building bridges between Academia, Industry and the Society**

Gert-Martin Greuel – *Editor-in-Chief of Zentralblatt MATH; Director of the Mathematisches Forschungsinstitut Oberwolfach, DE*

Ari Laptev *(Imperial College, London, UK) – Director of the Institute Mittag-Leffler, Djursholm, SE*

5 Mini-symposia

25 Years of Quantum Groups: From Definition to Classification

ORGANIZER: Alexander Stolin (*University of Gothenburg, SE)*

TALKS:

Yuri I. Manin (*Max-Planck Institute, Bonn, DE)*, **Symmetries and deformations in noncommutative geometries based upon operads**

Michael Semenov-Tian-Shansky (*University of Bourgogne, Dijon, FR)*, **Duality for Poisson Lie groups and for quantum groups: from quantum R-matrices to quantum virasoro**

Stanisław Lech Woronowicz (*University of Warsaw, PL)*, **Drinfeld double in the C^*-algebra setting**

Efim Zelmanov (*University of California, San Diego, USA)*, **Towards classification of quantum groups**

Absolute Arithmetic and $\mathbb{F}_1$-geometry

ORGANIZER: Koen Thas (*Ghent University, BE)*

TALKS:

Koen Thas (*Ghent University, BE)*, **Foundations of absolute arithmetic (Introductory talk)**

Yuri I. Manin (*Max Planck Institute, Bonn, DE & Northwestern University, Evanston, USA)*, **$\mathbb{F}_1$-analytic functions and Borger's descent**

Oliver Lorscheid (*IMPA, Rio de Janeiro, BR)*, **$\mathbb{F}_1$-geometry and its applications**

Lieven Le Bruyn (*University of Antwerp, BE)*, **Noncommutative geometry and $\mathbb{F}_1$**

Applied and Computational Algebraic Topology

ORGANIZER: Martin Raussen (*Aalborg Universitet, DK)*

TALKS:

Patrizio Frosini (*Università di Bologna, IT)*, **Metric shape comparison via multidimensional persistent homology**

Lucile Vandembroucq (*University of Minho, PT)*, **Topological complexity of motion planning**

Dmitry Feichtner-Kozlov (*Universität Bremen, DE)*, **Topological methods in distributed computing**

Martin Raussen (*Aalborg Universitet, DK)*, **Concurrency and directed algebraic topology**

Arithmetic Geometry

ORGANIZERS: Wojciech Gajda (*Adam Mickiewicz University, PL)*
Samir Siksek (*University of Warwick, UK)*

TALKS:

Sander Dahmen (*Utrecht, NL)*, **Klein forms and the generalized superelliptic equation**

Tim Dokchitser (*Bristol, UK)*, **Parity conjecture for elliptic curves**

Michael Stoll (*Bayreuth, DE)*, **Rational points on curves**

Szabolcs Tengely (*Debrecen, HU)*, **Composite rational functions**

Bachelier Finance Society: Mathematical Finance

ORGANIZER: Peter K. Friz (*TU and WIAS Berlin, DE)*

TALKS:

Jan Obloj (*Oxford University, UK)*, **Robust hedging with beliefs**

Stefan Gerhold (*TU Vienna, AT)*, **Extrapolation analytics for Dupire's local volatility**

Mike Tehranchi (*Cambridge University, UK)*, **Put-call symmetry and self-duality**

Peter K. Friz (*TU and WIAS Berlin, DE)*, **Generalized sub-Riemannian cut loci and volatility smiles**

Braids and Configuration Spaces

ORGANIZER: Mario Salvetti (*University of Pisa, IT)*

TALKS:

Fred Cohen (*Universiy of Rochester, USA)*, **Braid groups at the interface of low dimensional topology and homotopy theory**

Filippo Callegaro (*Scuola Normale Superiore, IT)*, **The Cohomology of the braid group B_3 and of $SL_2(\mathbb{Z})$ with coefficients in geometric representations**

Toshitake Kohno (*University of Tokyo, JP)*, **Homological representations of braid groups and KZ connections**

Mario Salvetti (*University of Pisa, IT)*, **Topological problems on braid groups and generalizations**

Computational Dynamics and Computer Assisted Proofs

ORGANIZERS: Warwick Tucker (*Uppsala University, SE)*
Piotr Zgliczyński (*Jagiellonian University)*

TALKS:

Alain Albouy (*CNRS, Observatoire de Paris, FR)*, **Rigorous upper bounds for the number of equilibrium configurations of** n **point particles**

Angel Jorba (*Universidad de Barcelona, ES)*, **Approximating invariant tori on a parallel computer**

Michael Plum (*Karlsruhe Institute of Technology, DE)*, **Orbital stability investigations for travelling waves in a nonlinearly supported beam**, COAUTHORS: Kaori Nagatou, P. Joseph McKenna

Daniel Wilczak (*Jagiellonian University, Kraków, PL)*, **Computing of families of invariant tori surrounding elliptic periodic orbits**

Continuous Real Rational Functions and Related Topics

ORGANIZER: Krzysztof Kurdyka (*Université de Savoie, FR)*

TALKS:

Krzysztof Kurdyka (*Université de Savoie, FR)*, **Arc-analytic and continuous rational functions**

Wojciech Kucharz (*Jagiellonian University, Kraków, PL)*, **Rational maps in real algebraic geometry**

Jean-Philippe Monnier (*Université d'Angers, FR)*, **Reguluous functions**, COAUTHORS: G. Fichou, J. Huisman, F. Mangolte

Frederic Mangolte (*Université d'Angers, FR)*, **Approximating curves on real rational surfaces**, COAUTHOR: Janos Kollàr

Differential Algebra and Galois Theory

ORGANIZER: Zbigniew Hajto (*Jagiellonian University, Kraków, PL)*

TALKS:

Askold Khovanskii (*University of Toronto, CA)*, **Signatures of branched coverings**

Masa-Hiko Saito (*University of Kobe, JP)*, **Geometry of moduli spaces of linear connections on curves and differential equations of Painlevé type**

Luis Narváez-Macarro (*University of Seville, ES)*, **Symmetry properties of the roots of Bernstein-Sato polynomials and duality of D-modules**

Marius van der Put (*University of Groningen, NL)*, **Stokes matrices for the quantum differential equations of some Fano varieties**

Discrete Structures in Algebra, Geometry, Topology, and Computer Science

ORGANIZERS: Eva-Maria Feichtner (*University of Bremen, DE)*
Dmitry Feichtner-Kozlov (*University of Bremen, DE)*

TALKS:

Mario Salvetti (*University of Pisa, IT)*, **Discrete methods for the topological study of some Configuration Spaces**

Martin Raussen (*Aalborg University, DK)*, **Directed algebraic topology and applications**

Louis Rowen (*Bar-Ilan University, IL)*, **Structures in tropical algebra**

Fluid Dynamics

ORGANIZERS: Piotr B. Mucha (*University of Warsaw, PL)*
Agnieszka Świerczewska-Gwiazda (*University of Warsaw, PL)*

TALKS:

Josef Malek (*Charles University, Prague, CZ)*, **On large data analysis of Kolmogorovs two equation model of turbulence**

Reinhard Farwig (*Technische Universitaet, Darmstadt, DE)*, **On the energy equality of the Navier-Stokes equations**

Milan Pokorný (*Charles University, Prague, CZ)*, **Steady compressible Navier-Stokes-Fourier system with slip boundary conditions**

Piotr Gwiazda (*University of Warsaw, PL)*, **Flows of fluids described by an implicit constitutive equation characterized by a maximal monotone graph**

Geometric and Quantitative Rigidity

ORGANIZER: Marta Lewicka (*University of Pittsburgh, USA)*

TALKS:

Daniel Faraco (*Madrid, ES)*, **Families of quasiregular mappings and nonlinear elliptic systems**

Cristinel Mardare (*Paris 6, FR)*, **Nonlinear Korn inequalities and existence of minimizers in nonlinear elasticity**

Caterina Ida Zeppieri (*Bonn University, DE)*, **A rigidity estimate for fields with prescribed curl**

Patrizio Neff (*Universität Duisburg-Essen, DE)*, **A canonical extension of Korn's first inequality to $\mathrm{H}(Curl)$ motivated by gradient plasticity with plastic spin**,
COAUTHORS: Dirk Pauly, Karl-Josef Witsch

How Mathematics Illuminates Biology

Organizers: Marta Tyran-Kamińska (*University of Silesia, PL)*
Michael C. Mackey (*McGill University, CA)*

Talks:

Fabien Crauste (*Universite Claude Bernard Lyon, FR)*, **Fighting the infection: analysis of a model of the CD8 T-cell immune response**

Wilhelm Huisinga (*University of Potsdam, DE)*, **Intregrating cell-level kinetics into pharmacokinetic models to predict the effect of anti-HIV drugs in vivo**

Mirosław Lachowicz (*University of Warsaw, PL)*, **A mesoscopic model of DNA denaturation**

Ryszard Rudnicki (*Institute of Mathematics, PAS & University of Silesia, PL)*, **Piecewise deterministic processes in biological models**

Hyperbolic Conservation Laws

Organizers: Piotr Gwiazda (*University of Warsaw, PL)*
Agnieszka Świerczewska-Gwiazda (*University of Warsaw, PL)*

Talks:

Boris Andreianov (*Université de Franche-Comté, Besançon, FR)*, **Conservation laws with discontinuous flux**

Miroslav Bulíček (*Charles University, Prague, CZ)*, **On scalar hyperbolic laws with discontinuous fluxes**

Philippe G. LeFloch (*Université Pierre et Marie Curie (Paris 6), FR)*, **Compressible fluid flows with finite energy**

Athanasios E. Tzavaras (*University of Crete, GR)*, **The equations of polyconvex elasticity and the problem of dynamic cavitation**

Implicitly Constituted Material Models: Modeling and Analysis

Organizers: Josef Malek (*Charles University, CZ)*
Endre Süli (*University of Oxford, UK)*

Talks:

Vít Průša (*Charles University, Prague, CZ)*, **An introduction to implicit theories to describe the response of bodies**

Jens Frehse (*University of Bonn, DE)*, **On Prandtl-Reuss mixtures**

Miroslav Bulíček (*Charles University, Prague, CZ)*, **On the analysis of unsteady flows of implicitly constituted incompressible fluids**

Endre Süli (*University of Oxford, UK)*, **Existence of global weak solutions to implicitly constituted kinetic models of incompressible homogeneous dilute polymers**

Infinite-dimensional Dynamical Systems with Time Delays

Organizers: Tibor Krisztin (*University of Szeged, HU)*
Hans-Otto Walther (*Universitat Giessen, DE)*

Talks:

Hans-Otto Walther (*Universitat Giessen, DE)*, **Evolution systems for differential equations with variable time lags**

Bernhard Lani-Wayda (*University of Giessen, DE)*, **Hopf bifurcation for retarded FDE and for semiflows**

Tibor Krisztin (*University of Szeged, HU)*, **The attractor of slow oscillation for delayed negative feedback**

Ferenc Hartung (*University of Pannonia, Veszprém, HU)*, **Smooth dependence on parameters of solutions in functional differential equations with state-dependent delays**

Knot Theory and its Ramification

Organizer: Józef H. Przytycki (*George Washington University)*

Talks:

Seiichi Kamada (*Hiroshima University, JP)*, **Graphical description of branched coverings and 2-dimensional braids**

Józef H. Przytycki (*George Washington University, USA)*, **Distributivity versus associativity in the homology theory of algebraic structures**

Krzysztof Putyra (*Columbia University, USA)*, **Odd Khovanov homology for tangles**

Joanna Kania-Bartoszyńska (*National Science Fundation, USA)*, **Quantum invariants of 3-manifolds and their asymptotics**

Matchbox Dynamics

Organizer: Krystyna Kuperberg (*Auburn University, USA)*

Talks:

Alex Clark (*Leicester University, UK)*, **Spongy matchbox manifolds**, Coauthor: Krystyna Kuperberg

Steve Hurder (*University of Illinois at Chicago, USA)*, **Cohomology and smooth embeddings for matchbox manifolds**

Olga Lukina (*Leicester University, UK)*, **Dynamics of graph matchbox manifolds**

Ana Rechtman (*University of Strasbourg, FR)*, **Topological entropy of the dynamics of the Kuperberg minimal set**, Coauthor: Steven Hurder

On Solutions to the Euler Equations of Incompressible Fluids

Organizer: Xinyu He (*University of Warwick, UK*)

Talks:

Luigi Carlo Berselli (*Pisa University, IT*), **On the long-time behavior of 2D dissipative Euler equations**

Philip Boyland (*University of Florida, USA*), **Topology and exponential growth in two-dimensional Euler flow**

Camillo De Lellis (*Universität Zürich, CH*), **Dissipative Hoelder solutions of the incompressible Euler equations**

Stephen Carl Preston (*University of Colorado at Boulder, USA*), **Geometric aspects of blowup for axisymmetric fluids**

Optimal Stopping and Applications

Organizers: F. Thomas Bruss (*Universite Libre de Bruxelles, BE*)
Krzysztof Szajowski (*Wrocław University of Technology, PL*)

Talks:

Goran Peskir (*School of Mathematics, Manchester, UK*), **The golden ratio rule**

J. Michael Steele (*University of Pennsylvania, Philadelphia, USA*), **Distribution and concentration in optimal decision problems**

Alexander Tartakovsky (*University of Southern California, Los Angeles, USA*), **Nearly minimax procedures for detecting a change in distribution**

Alexander Gnedin (*University of London, UK*), **Best-choice problems in the last twenty years**

Probabilistic Methods for Partial Differential Equations

Organizer: Dan Crisan (*Imperial College, London, UK*)

Talks:

Terry Lyons (*University of Oxford, UK*), **The expected signature of a stochastic process. Some new PDE's and some applications**

Andrew Stuart (*University of Warwick, UK*), **Filtering the Navier-Stokes equation**

Nizar Touzi (*Ecole Polytechnique, Paris, FR*), **Viscosity solutions of fully nonlinear path-dependent PDEs**

Dan Crisan (*Imperial College, London, UK*), **Gradient bounds for solutions of semi-linear partial differential equations**

Progress in 'Chemical Reaction Network Theory'

ORGANIZERS: Carsten Wiuf (*University of Copenhagen, DK)*
Elisenda Feliu (*University of Copenhagen, DK)*

TALKS:

Casian Pantea (*Imperial College, London, UK)*, **The global attractor conjecture and the Persistence Conjecture in mass-action systems**, COAUTHORS: Gheorghe Craciun, Fedor Nazarov

Elisenda Feliu (*University of Copenhagen, DK)*, **Qualitative inference on switch-like behaviour in networks of interacting species**

Murad Banaji (*University of Portsmouth, UK)*, **From convex geometry to stability in chemical reaction networks**

Mirela Domijan (*University of Warwick, UK)*, **Some observations on interaction graphs of mass-action reaction networks**

Semigroups of Operators: Theory and Applications

ORGANIZERS: Adam Bobrowski (*Lublin University of Technology, PL)*
Yuri Tomilov (*TU Dresden, DE)*
Ralph Chill (*TU Dresden, DE)*

TALKS:

Jacek Banasiak (*University of KwaZulu-Natal, ZA & Technical University of Łódź, PL)*, **Structured population models with fast migration – the case of a reducible migration matrix**

Charles Batty (*St. John's College, Oxford, UK)*, **Functional calculus for semigroup generators**

Jose Gale (*University of Zaragoza, ES)*, **Extension problem and fractional powers of operators**

Lutz Weis (*Universität Karlsruhe, DE)*, **Evolution equations in square function spaces**

Stochastic Models in Biosciences and Climatology

ORGANIZER: Samy Tindel (*University of Nancy, FR)*

TALKS:

Frederi Viens (*Purdue University, USA)*, **Long-range dependence in stochastic systems: the case of paleoclimatology**

Nicolas Champagnat (*INRIA Nancy, FR)*, **Adaptive dynamics in an individual-based, multi-resources chemostat model**

Samy Tindel (*Université de Lorraine, FR)*, **A stochastic model for bacteriophage systems**

6 Satellite Thematic Sessions

Algebraic and Geometric Methods in Nonlinear PDEs, Mechanics and Field Theory

ORGANIZERS: Vyacheslav S. Kalnitsky (*Saint Petersburg State University, RU*)
Alexandre M. Vinogradov (*Levi-Civita Institute, IT*)

TALKS:

Alexandre M. Vinogradov (*Levi-Civita Institute, IT)*, **Assembling Lie algebras from lieons**

Janusz Grabowski (*Institute of Mathematics, PAS, PL)*, **Tulczyjew triples in mechanics and field theories**

Jerzy Kijowski (*Center for Theoretical Physics of PAS, PL)*, **Jets of solutions of variational PDS's: fundamental symplectic structure and basic properties**

M. Eugenia Rosado Marìa (*Universidad Politécnica de Madrid, ES)*, **Involutivity of the Hamilton–Cartan equations of a second-order Lagrangian admitting a first-order Hamiltonian formalism**

Elizaveta Vishnyakova (*Ruhr-Universitat Bochum, DE)*, **On the splitting problem for a complex homogeneous supermanifold**

Norbert Poncin (*Université du Luxembourg, LU)*, **Lie infinity algebroids, higher morphisms and symmetries**

Diego Catalano-Ferraioli (*Universidade Federal da Bahia (UFBA), BR)*, **Contact geometry of parabolic Monge–Ampere equations**

Gaetano Vilasi (*Universitá degli Studi di Salerno, IT)*, **Einstein metrics with 2-dimensional killing leaves: geometric and physical aspects**

Anisotropic Parabolic Problems and their Applications

ORGANIZERS: Piotr B. Mucha
Piotr Rybka (*University of Warsaw, PL*)

TALKS:

Christiane Kraus (*Weierstrass Institute, Berlin, DE)*, **The Stefan problem with inhomogeneous and anisotropic Gibbs–Thomson law**

José M. Mazón (*Universitat de Valencia, ES)*, **The 1-harmonic flow with values into a sphere**

Piotr Minakowski (*University of Warsaw, PL)*, **Visco-plastic model of a ultrafine structure formation inducted by high pressure torsion (HPT)**

Agnieszka Świerczewska-Gwiazda (*University of Warsaw, PL)*, **On flows of fluids described by an implicit constitutive relation**

Aneta Wróblewska (*University of Warsaw, PL)*, **Motion of rigid bodies in a non-Newtonian fluid with nonstandard rheology**

Combinatorics

Organizers: Jarosław Grytczuk (*Jagiellonian University, PL*)
Michał Karoński (*Adam Mickiewicz University, Poznań, PL*)
Mariusz Woźniak (*AGH University of Science & Technology, PL*)

Talks:

Andrzej Dudek (*Western Michigan University, USA)*, **On restricted Ramsey numbers**

Jarosław Grytczuk (*Warsaw University of Technology, PL)*, **Graph theoretic variations on Graham's greatest common divisor problem**

Andrzej Grzesik (*Jagiellonian University, Kraków, PL)*, **Flag algebra calculus**

Wilfried Imrich (*Montanuniversität Leoben, AT)*, **The endomorphism distinguishing number of graphs**

Gyula O. H. Katona (*Hungarian Academy of Sciences, HU)*, **Forbidden intersection patterns in the families of subsets**

Jakub Kozik (*Jagiellonian University, Kraków, PL)*, **Entropy compression in graph coloring problems**

Michał Lasoń (*Jagiellonian University, Kraków, PL)*, **Splitting multidimensional necklace problem**

Wojciech Lubawski (*Jagiellonian University, Kraków, PL)*, **Online list coloring of matroids**

Grzegorz Matecki (*Jagiellonian University, Kraków, PL)*, **Saks–West's conjecture on semi-antichains and unichain coverings is FALSE**

Katarzyna Mieczkowska (*Adam Mickiewicz University, Poznań, PL)*, **On Erdos' extremal problem on matchings in hypergraphs**

Jakub Przybyło (*AGH University of Science and Technology, Kraków, PL)*, **An application of Combinatorial Nullstellensatz within neighbour distinguishing edge colouring algorithms**

Mariusz Woźniak (*AGH University of Science and Technology, Kraków, PL)*, **Edge colorings and the number of palettes**

Günter M. Ziegler (*Freie Universität Berlin, DE)*, **Cutting polygons, and the permutahedron**

Andrzej Żak (*AGH University of Science and Technology, Kraków, PL)*, **(H, k)-stable graphs with minimum cost**

Delay Equations in Biomedical Applications

Organizer: Urszula Foryś (*University of Warsaw, PL*)

Talks:

Maria Barbarossa (*Technische Universität München, DE)*, **Delays in the cell-cycle of proliferating tumor cells**

Antoni Leon Dawidowicz (*Jagiellonian University, PL)*, **On some properties of the system of differential equations with a delayed parameter**, Coauthor: Anna Poskrobko

Urszula Foryś (*University of Warsaw, PL)*, **Gompertz model with delays**

Anping Liu (*China University of Geosciences, CN)*, **Periodic solution of Marchuk model**

Ting Liu (*China University of Geosciences, CN)*, **Impulsive logistic equation in tumour growth modelling**

Jan Poleszczuk (*University of Warsaw, PL)*, **Time delays in biochemical reactions**

Ryszard Rudnicki (*Silesian University, Katowice, PL)*, **Equations with retarded arguments in cell cycle models**

Geometric Methods in Calculus of Variations

Organizer: Marcella Palese (*University of Torino, IT*)

Talks:

Jerzy Kijowski (*Center for Theoretical Physics of PAS, PL)*, **New cosmology: an example of a novel class of natural variational principles**

Jana Musilova (*Masaryk University, Brno, CZ)*, **On the inverse problem of the calculus of variations in nonholonomic setting**

Peter T. Nagy (*Debrecen University, HU)*, **On infinite dimensional holonomy groups**

Marcella Palese (*University of Torino, IT)*, **Globally variational dynamical forms**

Olga Rossi (*University of Ostrava, CZ)*, **Euler–Lagrange equations and exterior differential systems**

David Saunders (*University of Ostrava, CZ)*, **Projective metrizability in Finsler geometry**

Ekkehart Winterroth (*University of Torino, IT)*, **Cohomology and conservation laws**

Geometric Topology

Organizers: Jerzy Dydak (*University of Tennessee, USA*)
Danuta Kołodziejczyk (*Warsaw University of Technology, PL*)
Stanisław Spież (*Institute of Mathematics, PAS, PL*)

Talks:

Matija Cencelij (*Ljubliana, SI)*, **On gropes and their fundamental groups**

Alexander Dranishnikov (*Gainsville, USA)*, **On md-small manifolds**

Jerzy Dydak (*Knoxville, USA)*, **Large scale absolute extensors**

Danuta Kołodziejczyk (*Warsaw, PL)*, **New results on homotopy dominations of polyhedra and some related problems not only in homotopy theory**

Michael Levin (*Negev, IL)*, **Covering L^p spaces by balls**

Wacław Marzantowicz (*Poznań, PL)*, **Smooth equivariant functions of compact closed orientable surfaces and related topics**

Denise de Mattos (*Sao Carlos, BR)*, **On the no existence of G-equivariant maps**

Manuel Moron (*Madrid, ES)*, **q-cones: A toy example on combinatorics and topology of simplicial complexes**

Andrzej Nagórko (*Warsaw, PL)*, **New topics in Nobeling manifold theory**

Piotr Nowak (*Warsaw, PL)*, **Controlled coarse homology and applications**

Dusan Repovs (*Ljubliana, SI)*, **New results on codimension one manifold factors**

Francisco R. Ruiz del Portal (*Madrid, ES)*, **There are not R^3-orientation reversing minimal homeomorphisms**

Witold Rosicki (*Gdańsk, PL)*, **On the uniqueness of the decomposition of manifolds, polyhedra and continua into cartesian products**

Jose M. R. Sanjurjo (*Madrid, ES)*, **Topology and uniform persistence in dynamical systems**

Edivaldo Lopes dos Santos (*Sao Carlos, BR)*, N/A

Stanisław Spież (*Warsaw, PL)*, **Generalized manifolds in products of curves**

Bronisław Wajnryb (*Rzeszów, PL)*, **Parabolic isometries of a proper, $CAT(0)$ cube complex**

Tatsuhiko Yagasaki (*Kyoto, JP)*, **Groups of volume-preserving diffeomorphisms of noncompact manifolds and mass flow toward ends**

Mykhaylo Zarichnyi (*Rzeszów, PL)*, N/A

Andreas Zastrow (*Gdańsk, PL)*, **A combinatorial description of the fundamental group of the Menger Cube**

Geometry in Dynamics

Organizers: Alex Clark (*Leicester University, UK*)
Krystyna Kuperberg (*Auburn University, USA*)

Talks:

Robbert Fokkink (*Delf University, Netherlands)*, **On paperfolding and Knaster continua**

Álvaro Lozano Rojo (*University of Zaragoza, Spain)*, **A universal space for Cantor expansive dynamics**

Pablo Gonzalez Sequeiros (*University of Santiago de Compostela, Spain)*, **Affability of laminations defined by repetitive planar tilings**

Takashi Tsuboi (*University of Tokyo, Japan)*, **Homeomorphism groups of commutator width one**

Paweł Walczak (*University of Łódź, Poland)*, **Godbillon–Vey class in codimension > 1: a Riemannian approach**

Szymon M. Walczak (*University of Łódź, Poland)*, **Metric diffusion along compact foliations**

Klaudiusz Wójcik (*Jagiellonian University, Poland)*, **Lefschetz sequences and chaotic dynamics**

Piotr Zgliczyński (*Jagiellonian University, Poland)*, **Geometric methods in the dynamics of dissipative PDEs**

Homotopy Theory

ORGANIZERS: David Blanc (*Univeristy of Haifa, IL*)
Marek Golasinski (*Nicolaus Copernicus University, PL*)

TALKS:

Clark Barwick (*Massachusetts Institute of Technology, USA)*, **N/A**

Martin Markl (*Czech Academy of Science, CZ)*, **The geometric biassociahedron**

Jesper Grodal (*University of Copenhagen, DK)*, **F-isomorphism in group cohomology implies p-fusion isomorphism, when p is odd**

Dietrich Notbohm (*Vrije Universiteit, Amsterdam, NL)*, **Almost complex structures on quasi toric manifolds**

Carles Casacuberta (*University of Barcelona, ES)*, **N/A**

Matan Prezma (*Ben-Gurion University, IL)*, **Homotopy normal maps**

Emmanuel Dror-Farjoun (*Hebrew University of Jerusalem, IL)*, **N/A**

Vladimir Sharko (*National Academy of Sciences, UA)*, **Crossed complexes and application**

Debasis Sen (*University of Haifa, IL)*, **A spectral sequence for Bredon cohomology**

Anicetto Murillo (*University of Malaga, ES)*, **Algebraic models of non connected spaces via the Lawrence–Sullivan construction**

Norio Iwase (*Kyushu University, JP)*, **On the equivariant systolic category**

Marek Golasinski (*Nicholas Copernicus University, Toruń, PL)*, **Free and properly discontinuous actions of discrete groups on homotopy circles**

Simona Paoli (*University of Leicester, UK)*, **n-fold groupoids, n-types and n-track categories**

Michał Kukieła (*Nicholas Copernicus University, Toruń, PL)*, **Non-compact discrete Morse theory and rayless spaces**

Zbigniew Błaszczyk (*Nicholas Copernicus University, Toruń, PL)*, **Free actions of alternating groups on products of spheres**

Infinite Dimensional Dynamical Systems with Time Delays

ORGANIZERS: Tibor Krisztin (*University of Szeged, HU*)
Hans-Otto Walther (*University of Giessen, DE*)

TALKS:

Maria Barbarossa (*Munich, DE)*, **Linearized stability of neutral equations with state-dependent delay: Applications in population dynamics**

Jayme De Luca (*Sao Carlos, BR)*, **Galerkian approximation for an orbit of variational electrodynamics with state-dependent delay of neutral type**

Wojciech Czernous (*Gdańsk, PL)*, **Classical solutions of hyperbolic IBVPs with state dependent delays on a cylindrical domain**

Ábel Garab (*Szeged, HU)*, **Unique periodic orbits of a delay differential equation**

Philipp Getto (*BCAM, Bilbao, ES)*, **A differential equation with state dependent delay describing stem cell population dynamics**

Pierre Magal (*Bordeaux, FR)*, **Center manifold for vector valued travelling waves problems**

Yukihiko Nakata (*BCAM, Bilbao, ES)*, **Global dynamics of an infection-age structured epidemic model**

Mihály Pituk (*Veszprém, HU)*, **Cone positivity for linear functional differential equations**

Alexander Rezounenko (*Kharkov, UA)*, **Qualitative properties of solutions to parabolic partial differential equations with state-dependent delays**

Gergely Röst (*Szeged, HU)*, **Asymptotic smoothness, compact attractors and persistence in fading memory spaces**

Wolfgang Ruess (*Essen, DE)*, **Flow invariance for differential equations with state dependent delay**

Integrable Systems

ORGANIZER: Maciej Błaszak (*Adam Mickiewicz University, PL*)

TALKS:

Maciej Błaszak (*Adam Mickiewicz University, Poznań, PL)*, **Bi-presymplectic chains**

Adam Doliwa (*University of Warmia and Mazury, Olsztyn, PL)*, **On Desargues' theorem, integrability of the non-commutative discrete KP system, and the quantum pentagon equation**

Maciej Dunajski (*University of Cambridge, UK)*, **Solitons from Geometry**

Krzysztof Marciniak (*Linköping University, SE)*, **Stäckel transform and Stäckel systems**

Marco Pedroni (*University of Bergamo, IT)*, **An inertia 'paradox' for incompressible stratied Euler fluids**

Anatoliy K. Prykarpatsky (*Ivan Franko State Pedagogical University, Drohobych, UA)*, **Differential-algebraic structures and the Lax type integrability**

Maria Przybylska (*University of Zielona Góra, PL)*, **Solvable linearizations of non-integrable cases of Euler-Poisson equations**

Stefan Rauch-Wojciechowski (*Linköping University, SE)*, **How many integrals needs for integrability?**

Nils Rutstam (*Linköping University, SE)*, **Dynamics of the tippe top**

Artur Sergyeyev (*Silesian University, Opava, CZ)*, **Explicit construction of recursion operators for multidimensional integrable dispersionless systems**

Knot Theory and its Ramification

ORGANIZERS: Józef H. Przytycki (*George Washington University, USA*)
Bronisław Wajnryb (*Rzeszów University of Technology, PL*)
Paweł Traczyk (*University of Warsaw, PL*)

TALKS:

Michał Jabłonowski (*University of Gdańsk, PL)*, **Linked surfaces and different singularity set of their projections**

Gyo Taek Jin (*Korea Advanced Institute of Science and Technology, KR)*, **Arc index of pretzel knots of type** $(-p, q, r)$, COAUTHOR: Hwa Jeong Lee

Seiichi Kamada (*Hiroshima University, JP)*, **Graphical description of branched coverings and 2-dimensional braids**, COAUTHOR: J. Scott Carter

Naoko Kamada (*Nagoya City University, JP)*, **Polynomial invariants and surface bracket polynomials of twisted links**

Joanna Kania-Bartoszyńska (*National Science Foundation, USA)*, **Quantum invariants of 3-manifolds and their asymptotics**

Kanako Oshiro (*Japan Women's University, JP)*, **A G-family of quandles and handlebody-link invariants**, COAUTHORS: Atsushi Ishii, Masahide Iwakiri, Yeonhee Jang

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Józef H. Przytycki (*George Washington University, USA)*, **Distributivity versus associativity in the homology theory of algebraic structures**

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Witold Rosicki (*University of Gdańsk, PL)*, **Quandle cocycle invariants for knots, knotted surfaces and knotted 3-manifolds**

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Konstantin Zarembo (*Nordic Institute for Theoretical Physics*)

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F. Thomas Bruss (*ULB, Bruxelles, BE*)
Krzysztof Szajowski (*Wrocław University of Technology, PL*)

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Masami Yasuda (*Chiba University, JP)*, **Odds Problem in optimal multiple stopping**, COAUTHOR: Katsunori Ano

Quasiconformal Mappings and Complex Dynamical Systems

ORGANIZERS: Mark Elin (*ORT Braude College, IL*)
Anatoly Golberg (*Holon Institute of Technology, IL*)
Stanisława Kanas (*Rzeszów University of Technology, PL*)
Toshiyuki Sugawa (*Tohoku University, JP*)

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Matti Vuorinen (*University of Turku, FI)*, **Teichmuller's extremal problem in the n-space**

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Vesna Manojlović (*University of Belgrade, RS)*, **Gromov hyperbolicity and quasihyperbolic geodesics**, COAUTHORS: P. Koskela, P. Lammi

Stanisława Kanas (*Rzeszów University of Technology, PL)*, **Harmonic mappings related to some fixed analytic functions**

Dariusz Partyka (*The State School of Higher Education in Chełm, The John Paul II Catholic University of Lublin, PL)*, **The Schwarz type inequalities for plane harmonic mappings in the unit disk**, COAUTHORS: K. Sakan, J. Zając

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ORGANIZER: Marek Ptak (*University of Agriculture, Kraków, PL*)
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7 Research Posters

Logic, Foundations

— 1.1 —

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Almost disjointness and its generalizations

— 1.2 —

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***R*-L-filters, their fuzzifications and generalizations**

— 1.3 —

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Identities in varieties generated by algebras of subalgebras

Algebra, Number Theory, Algebraic Geometry

— 2.1 —

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Noncommutative pfaffians and the quasi-spin algebra

— 2.2 —

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Structure of p-complements of finite groups and p-regular class sizes

— 2.3 —

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On the regularity of a graph related to conjugacy classes of groups

— 2.4 —

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Primeness, primitivity and radicals in near-rings of continuous functions

— 2.5 —

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Elliptic and Krichever formal group laws

— 2.6 —

Olga Dashkova odashkova@yandex.ru
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On locally soluble AFM-groups

— 2.7 —

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On hyperelliptic surfaces and their blow-ups

— 2.8 —

Michał Farnik Michal.Farnik@gmail.com
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On the Chevalley conjecture and related projectivity criteria

— 2.9 —

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On the discrepancy of some generalized Kakutani's sequences of partitions

— 2.10 —

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Poisson structure on the dual Hopf algebra

— 2.11 —

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A natural sequence with all algebraic numbers & e, π, etc.

— 2.12 —

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Félix Marcelo
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On the integral locus of symmetric algebras

— 2.13 —

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Products of homogeneous subspaces in free Lie algebras

— 2.14 —

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— 2.15 —

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— 2.16 —

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Denis Blackmore
The New Jersey Institute of Technology, Newark, USA

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— 2.17 —

Vladimir V. Sergeichuk
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Canonical matrices for systems of forms and linear mappings

— 2.18 —

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On permutable fuzzy subgroups

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— 2.20 —

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Mirjana Vuković mirvuk48@gmail.com
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On Krasner–Vuković's paragraded structures and some open questions

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A 9×9 matrix algebra (not) satisfying certain identities

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On the dimensions of projective indecomposable modules for simple groups of Lie type

Geometry, Topology, Global Analysis

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— 3.2 —

Adina Balmuş adina.balmus@uaic.ro
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Cotangent bundles with para-Kähler structures of natural diagonal lift type

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Ring of flag vectors

— 3.7 —

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Irina Markina irina.markina@uib.no
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Sharp Lipschitz constants for the distance ratio metric

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On principal left ideals of βG

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Adaptive sampling of variable bandwidth functions

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Moduli spaces of relatively semi-stable sheaves on some Calabi–Yau-type 3-folds

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On the border of geometry and topology – fractal dimension, fractal star bodies and star metrics

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General fractional calculus and evolution equations

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Dynamical analytic multifunctions

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Gromov hyperbolicity and quasihyperbolic geodesics

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Mean periodic continuations of solutions of convolution equations

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Solution of delay systems via combined orthogonal functions and polynomial series

— 4.24 —

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Grothendieck-Lidskiĭ theorem for subspaces and factor spaces of L_p-spaces

— 4.25 —

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The centenary of the Riesz representation theorem: recent progress in characterization of Radon integrals

— 4.26 —

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Braided tensor product of Hilbert spaces twisted by corepresentation of quantum codouble

— 4.27 —

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Generalized Hake's property for a Kurzweil–Henstock type integral

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On neighborhoods of analytic functions

— 4.29 —

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— 4.30 —

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Generalized Hake's property for a Kurzweil–Henstock type integral

— 4.35 —

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Existence and Ulam–Hyers stability results for coupled fixed point problems

— 4.36 —

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Stabilization of a class of distributed parameter systems with non-monotone infinitesimal generators

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Liénard's polynomial system

— 5.4 —

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— 5.8 —

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Piotr Biler Piotr.Biler@math.uni.wroc.pl
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Jan Burczak jb@impan.pl
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Victor Zvyagin zvg@math.vsu.ru
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Chi-Ru Yang cryang@math.cts.nthu.edu.tw
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— 10.1 —

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MS – Mini-Symposium
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