ÖMG SIMAI/UMI

8. Österreichisches Mathematikertreffen

Nachbarschaftstagung in Kooperation mit SIMAI und UMI

VIII Convegno della Società Matematica Austriaca
Convegno–Incontro in Cooperazione con SIMAI e UMI

8th Meeting of the Austrian Mathematical Society
Joint Conference in Cooperation with SIMAI and UMI

September 22 – 26, 2003, Bozen / Bolzano

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Welcome

The board of the Austrian Mathematical Society and the local conference organizers welcome you to the 8th meeting of the Austrian Mathematical Society in Bozen-Bolzano, September 22 – 26, 2003, held as a joint conference in cooperation with the Unione Matematica Italiana and the Società Italiana di Matematica Applicata e Industriale. The conference aims, in particular, at fostering the collaboration between the Austrian and Italian mathematical communities.

The meeting takes place in the conference facilities of the European Academy Bozen-Bolzano. The scientific program starts on Monday, September 22, 2003, at 9:00 a.m. in the Auditorium of the European Academy; it continues until the afternoon of Friday, September 26.

The conference language is English.

We thank our sponsors who provided generous support for the conference: The Free University of Bolzano, the Austrian Federal Ministry for Education, Science and Culture, the Cultural Office of the Governor of Tyrol, the City of Bolzano, the Raiffeisenverband Südtirol, the Tiroler Sparkasse Bank AG Innsbruck and the University of Innsbruck. We also thank the European Academy for their support in organizing the conference.


bm:bwk


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General information

Conference location:

The conference takes place in the lecturing halls of the European Academy of Bozen-Bolzano.

EURAC
Drususallee 1/Viale Druso 1
I-39100 Bozen/Bolzano

Conference office:

The conference office is located in room "Seminar 1" of the European Academy. The opening hours are

Monday,	September 22,	8:00 – 14:00,	15:00 – 17:00.
Tuesday,	September 23,	8:00 – 14:00,	15:00 – 17:00.
Wednesday,	September 24,	8:00 – 14:00.	
Thursday,	September 25,	8:00 – 14:00,	15:00 – 17:00.
Friday,	September 26,	8:00 – 14:00.	

In addition, a conference desk will be open on Sunday, September 21, in the lobby of the European Academy from 17:00 – 19:00.

E-Mail: `oemg2003@uibk.ac.at`
Telephone: 0039 0471 055 045

Registration:

Registration of participants takes place on

Sunday, September 21, 17:00 – 19:00,
Monday, September 22, 8:00 – 14:00

in the lobby of the European Academy as well as during the opening hours of the conference office from Monday – Friday.

Further information on the conference can be found at the conference webpage `http://www.oemg.ac.at/Bozen2003`.

Technical equipment of the lecturing halls:

All rooms are equipped with overhead projectors, laptop, beamer, DVD- and CD-drives, flipchart and pin board.

Internet access during conference:

Computer terminals are available for participants of the conference, located at the Library of the European Academy during its opening hours (9:00 – 18:00).

Lunch and dinner:

There are numerous restaurants and pubs in the center of Bolzano, in the close vicinity of the conference location. A list of restaurants is being handed to you with the conference folder. In addition, there is the possibility to have lunch at the cafeteria of the Free University of Bolzano at a moderate price. Entering the cafeteria and paying requires that you have a Guest Card. In case you ordered a Guest Card with your registration, you will find it, together with directions, in your conference folder.

Coffee breaks:

Coffee is served free of charge to participants on

Monday,	10:00 – 10:15	and	16:00 – 16:15,
Tuesday,	9:30 – 9:45	and	16:00 – 16:15,
Wednesday,	9:30 – 9:45,		
Thursday,	9:30 – 9:45	and	15:45 – 16:00,
Friday,	9:30 – 9:45.		

In addition, a coffee shop is at your disposal all day, located in the ground floor of the EURAC building.

Local transportation:

You can get pre-paid combination tickets for bus, train and city bus for 5, 10, and 25 Euros as well as weekly tickets for 25 Euros (usable for 30 bus trips in the region). You can get these tickets in the local tobacco shops, at the train ticket counters or directly from the bus driver. The weekly cards are available at the train ticket counters and the tourist offices. Please consult Südtiroler Verkehrsverbund, `http://www.suedtirol.info` under "Services" for detailed information.

Information about the congress venue Bozen-Bolzano:

Bozen-Bolzano ist the capital of South Tyrol. For more information about its history and culture please visit the web page of the Bozen-Bolzano Tourist Authority: `http://www.sudtirol.com/bolzano`.

Information about EURAC – the South Tyrolean Research Center:

The European Academy Bozen-Bolzano is the largest research center of the region, addressing the areas of "Language and Law", "Minorities and Autonomies", "Alpine Environment", "Management and Corporate Culture", "Genetic Medicin". The new building of the EURAC was constructed by the architect Klaus Kada (Graz) and is also the seat of the Permanent Secretary of the Alpine Convention. For more information, see `http://www.eurac.edu`.

Information about the Free University of Bozen-Bolzano:

The Free University of Bozen-Bolzano was founded in 1997 as a free, state-recognized university. It incorporates the School of Economics, the Faculty of Computer Science, the Faculty of Education and the degree course in Logistics and Production Engineering. For more information about the Free University of Bozen-Bolzano please visit the web page `http://www.unibz.it`.

Conference organization and committees

Program committee:

Franco Brezzi (Università di Pavia)
Christian Buchta (Universität Salzburg)
Christian Krattenthaler (Universität Wien)
Gerhard Larcher (Universität Linz)
Michael Oberguggenberger (Universität Innsbruck, chair)
Otmar Scherzer (Universität Innsbruck)
Aljosa Volcic (Università di Trieste)
Wolfgang Woess (Universität Graz)

Organization committee:

Manfred Husty (Universität Innsbruck)
Yuriy Kaniovskyi (Free University of Bozen-Bolzano)
Michael Oberguggenberger (Universität Innsbruck, chair)
Alexander Ostermann (Universität Innsbruck)
Franz Pauer (Universität Innsbruck)
Heinrich Reitberger (Universität Innsbruck)
Otmar Scherzer (Universität Innsbruck)

Local conference organization:

Anna Bombasaro (Universität Innsbruck)
Thomas Fetz (Universität Innsbruck)
Manfred Husty (Universität Innsbruck)
Andreas Kraxner (Universität Innsbruck)
Gertrud Matt (Universität Innsbruck)
Michael Oberguggenberger (Universität Innsbruck)
Alexander Ostermann (Universität Innsbruck)

Conference office:

Gertrud Matt (Universität Innsbruck)

Coordinators of minisymposia:

1. **Harmonic Analysis:**
   Leonede De Michele (Università di Milano Bicocca), on behalf of
   Alessandro Figà-Talamanca (Università di Roma La Sapienza)
   Wolfgang Woess (Universität Graz)

2. **Mathematics in Industry:**
   Heinz Engl (Universität Linz),
   Mario Primicerio (Università di Firenze)

3. **Convex Geometry:**
   Christian Buchta (Universität Salzburg),
   Aljosa Volcic (Università di Trieste)

4. **Microlocal Analysis:**
   Michael Oberguggenberger (Universität Innsbruck),
   Luigi Rodino (Università di Torino)

Coordinators of sections:

1. **Algebra:**
   Ulrich Oberst (Universität Innsbruck)
   Franz Pauer (Universität Innsbruck)

2. **Number Theory:**
   Fritz Schweiger (Universität Salzburg)
   Robert Tichy (Technische Universität Graz)

3. **Discrete Mathematics, Algorithms:**
   Michael Drmota (Technische Universität Wien)
   Wilfried Imrich (Montanuniversität Leoben)

4. **Mathematical Logic, Theoretical Computer Science:**
   Ruth Breu (Universität Innsbruck)
   Christoph Kollreider (Universität Innsbruck)

5. **Geometry:**
   Peter Gruber (Technische Universität Wien)
   Hellmuth Stachel (Technische Universität Wien)

6. **Functional Analysis, Harmonic Analysis:**
   James Bell Cooper (Universität Linz)
   Michael Grosser (Universität Wien)

7. **Real and Complex Analysis,**
   Ordinary Differential Equations:
   Ludwig Reich (Universität Graz)
   Peter Szmolyan (Technische Universität Wien)

8. **Topology, Differential Geometry:**
   Andreas Cap (Universtät Wien)
   Ottmar Loos (Universität Innsbruck)

9. **Financial and Industrial Mathematics:**
   Gerhard Larcher (Universität Linz)
   Wolfgang Runggaldier (Università di Padova)

10. **Numerical Mathematics, Scientific Computing:**
    Winfried Auzinger (Technische Universität Wien)
    Alexander Ostermann (Universität Innsbruck)

11. **Probability Theory, Statistics:**
    Herwig Friedl (Technische Universität Graz)
    Gilg Seeber (Universität Innsbruck)

12. **Partial Differential Equations, Calculus of Variations:**
    Maria Hoffmann-Ostenhof (Universität Wien)
    Peter Wagner (Universität Innsbruck)

13. **History and Philosophy of Mathematics:**
    Christa Binder (Technische Universität Wien)
    Heinrich Reitberger (Universität Innsbruck)

14. **Mathematics Teaching:**
    Karl Fuchs (Universität Salzburg)
    Manfred Kronfellner (Technische Universität Wien)

Teachers' Meeting:

Franz Pauer (Universität Innsbruck)
Heinrich Reitberger (Universität Innsbruck)

Universities of the Applied Sciences Meeting:

Susanne Teschl (Fachhochschule Technikum Wien)
Karl Unterkofler (Fachhochschule Vorarlberg)

Conference opening

Conference opening ceremony:

Monday, September 22, 9:00 – 10:00, Auditorium of the European Academy. Inaugural addresses will be given by

Prof. Heinz Engl,
President of the Austrian Mathematical Society,

Prof. Carlo Sbordone,
President of the Unione Matematica Italiana,

Prof. Mario Primicerio,
President of the Società Italiana Matematica Applicata e Industriale,

Dr. Werner Stuflesser,
President of the European Academy Bozen-Bolzano,

Dr. Friedrich Schmidl,
President of the Free University of Bozen-Bolzano.

Scientific program:

The scientific program starts on Monday, September 22 at 10:00 with the plenary talk of Enrico Bombieri.

Evening reception:

The official evening reception (sponsored by the Free University of Bozen-Bolzano) takes place on Monday, September 22, 19:00, at the Free University of Bozen-Bolzano, Sernesistr. 1 / Via Sernesi 1.

Scientific program

Abbrevations:

A	Auditorium
CH	Conference Hall
S3 – S5	Seminar 3 – 5
SA	Seminar A

Plenary Lectures

Enrico Bombieri (Princeton) Mon 10:00 A

The Rosetta stone of L-functions.

Helmut Prodinger (Johannesburg) Mon 15:00 A

Analysis of algorithms and its relation to combinatorics, number theory, and probability theory.

Alberto Bressan (Trieste) Tue 08:30 A

Hyperbolic systems of conservation laws.

Christian Lubich (Tübingen) Tue 15:00 A

Numerical integrators for quantum dynamics.

Helmut Groemer (Tucson) Wed 08:30 A
Stability problems in the theory of convex sets.

Claudio Procesi (Roma) Thu 08:30 A
Finite dimensional representations of algebras.

Wolfgang Runggaldier (Padova) Fri 08:30 A
Mathematics and the financial markets.

Award-Winners of the Austrian Mathematical Society

Andreas Cap (Wien) Tue 16:15 A
A remarkable class of overdetermined systems of PDE's.

Jörg Maximilian Thuswaldner (Leoben) Thu 16:00 A
Number systems and fractals.

Michael Kunzinger (Wien) Thu 17:00 A
Geometric theory of generalized functions.

Public Lecture

Bruno Buchberger (Linz) Thu 18:00 A
Mathematik und Informatik: Eine Liebeserklärung.

The public lecture will be held in German with simultaneous Italian translation.

Minisymposium 1: Harmonic Analysis

Fulvio Ricci (Pisa) Thu 09:45 A
L^p-spectral multipliers for the Laplacian acting on 1-forms on the Heisenberg group.

Viktor Losert (Wien) Thu 10:30 A
Groups of polynomial growth.

Franz Lehner (Graz) Thu 11:15 A
Noncommutative probability and spectral computations on discrete groups.

Tim Joshua Steger (Sassari) Thu 11:55 A
Tempered irreducible unitary representations of the free group.

Minisymposium 2: Mathematics in Industry

Immanuel Bomze (Wien) Tue 09:45 A
Optimization of functions with rank-two variation over a box.

Iacopo Borsi (Firenze) Tue 10:20 A
Mathematical modelling for solving environmental problems.

Lorenzo Fusi (Firenze) Tue 10:55 A
A mathematical model for wax deposition in the flow of a waxy crude oil.

Ingenuin Gasser (Hamburg) Tue 11:30 A
On a model to describe tunnel fires.

Andreas Obereder (Linz) Tue 12:05 A
3-dimensional hot rolling simulation.

Minisymposium 3: Convex Geometry

Rolf Schneider (Freiburg) Wed 09:45 A
Convexity methods for random tessellations.

Matthias Reitzner (Wien) Wed 10:40 A
Limit theorems for convex hulls of random points.

Carla Peri (Milano) Wed 11:20 A
On relative isoperimetric inequalities.

Andrea Colesanti (Firenze) Wed 12:00 A
New connections between convex geometry and calculus of variations.

Minisymposium 4: Microlocal Analysis

Paolo Boggiatto (Torino) Fri 09:45 A
Localization operators with L^p-symbols on modulation spaces.

Todor Gramchev (Cagliari) Fri 10:30 A
An abstract approach to the study of local solvability of PDEs with multiple characteristics.

Günther Hörmann (Innsbruck) Fri 11:15 A
Singularity interactions in generalized function algebras.

Peter Wagner (Innsbruck) Fri 11:55 A
Explicit calculation of fundamental solutions.

Section 1: Algebra

Erhard Aichinger (Linz) Tue 09:45 S5
A bound on the number of polynomial functions that leads to a decidability result for near-rings.

Gerhard Dorfer (Wien) Tue 10:15 S5
On the lattice profile of pseudorandom number sequences.

Günther Eigenthaler (Wien) Tue 10:45 S5
Congruence classes in universal algebra.

Wolfgang Herfort (Wien) Tue 11:15 S5
Classification of finite groups containing a CC-subgroup.

Johann Wiesenbauer (Wien) Tue 11:45 S5
On finite p-rings with small radical.

Hermann Kautschitsch (Klagenfurt) Wed 09:45 S5
Kommutative Ringe mit Feedback-Cyclization-Eigenschaft.

Daniel C. Mayer (Graz) Wed 10:15 S5
Classical and modern scope of 2-stage metabelian 3-groups with factor commutator group of type (3,3).

Karl-Georg Schlesinger (Wien) Wed 10:45 S5
Trialgebras and extended topological quantum field theories.

Reinhard Winkler (Wien) Wed 11:15 S5
Abelsche Gruppenaktionen auf der geordneten Zahlengeraden.

Section 2:
Number Theory

Fritz Schweiger (Salzburg) Mon 16:15 S3
Lyapunov exponents for multidimensional continued fractions.

Willi More (Klagenfurt) Mon 16:45 S3
Fermat's factoring method for $n = pq$.

Friedrich Pillichshammer (Linz) Mon 17:15 S3
Symmetrized digital nets with minimal order of L_2-discrepancy.

Klaus Scheicher (Linz) Mon 17:45 S3
On the characterization of canonical number systems.

Bernhard Schratzberger (Salzburg) Mon 18:15 S3
S-expansions in dimension two.

Clemens Fuchs (Graz) Tue 16:15 S3
Polynomial Diophantine m-tuples.

Franz Halter-Koch (Graz) Tue 16:45 S3
Arithmetik von Kongruenzmonoiden.

Günter Lettl (Graz) Tue 17:15 S3
Parametrized solutions of Diophantine equations.

Oliver Pfeiffer (Leoben) Tue 17:45 S3
Kombinatorisch motivierte polynomielle diophantische Gleichungen.

Section 3:
Discrete Mathematics, Algorithms

Rainer Mlitz (Wien) Mon 11:15 S3
Zur Darstellung von Matroiden.

Arnold Richard Kräuter (Leoben) Mon 11:45 S3
Upper bounds for the permanent of positive matrices.

Wilfried Imrich (Leoben) Mon 12:15 S3
Counting quotient graphs and subgroups of given index in free products of cyclic groups.

Bernhard Krön (Wien) Mon 12:45 S3
Free subgroups of groups acting on graphs.

Michael Drmota (Wien) Tue 09:45 S3
The height of digital search trees.

Alois Panholzer (Wien) Tue 10:15 S3
Distribution results for Steiner-distances in certain tree families.

Wolfgang Steiner (Wien) Tue 10:45 S3
On m-ary search trees generated by van der Corput sequences.

Günther Karigl (Wien) Tue 11:15 S3
Discrete modelling of homology searching and interlocking of chromosomes.

Bertran Steinsky (Graz) Tue 11:45 S3
Simple random walk on special fractal trees.

Clemens Heuberger (Graz) Thu 15:00 S4
Signed digit expansions in elliptic curve cryptography.

Bernhard Gittenberger (Wien) Thu 15:30 S4
Extended admissible functions and Gaussian limiting distributions.

Dietmar Dorninger (Wien) Thu 16:00 S4
On characteristic polynomials of molecular graphs.

Ilse Fischer (Klagenfurt) Thu 16:30 S4
A method for proving polynomial enumeration formulas.

Section 4:
Mathematical Logic, Theoretical Computer Science

Aart Middeldorp (Innsbruck) Thu 09:45 S5
Automating the dependency pair method.

Walther Neuper (Graz) Thu 10:15 S5
Fallstudie zur formalen Grundlegung von Werkzeugen für Angewandte Mathematik.

Markus Moschner (Wien) Thu 10:45 S5
Supporting Mizar by methods of mathematical knowledge management.

Section 5:
Geometry

Helmut Pottmann (Wien) Tue 16:15 S4
On the geometry of distance functions.

Johannes Wallner (Wien) Tue 16:45 S4
Error propagation in geometric constructions.

Gunter Weiss (Dresden) Tue 17:15 S4
Tschirnhausen revisited.

Peter Schmitt (Wien) Tue 17:45 S4
Kachelungen: Mustermengen und ihre Species.

Johann Brauchart (Graz) Thu 09:45 S4
Minimal energy point sets.

Paola Cuoghi (Modena) Thu 10:15 S4
Brunn-Minkowski type inequalities for the first eigenvalue of a class of elliptic operators.

Paolo Salani (Firenze) Thu 10:45 S4
Geometric properties of solutions to elliptic equations.

Aljosa Volcic (Trieste) Thu 11:15 S4
An inequality for dual mixed volumes of bounded Borel sets.

Riccardo Ghiloni (Trento) Thu 11:45 S4
On the space of real algebraic morphisms.

Manfred Husty (Innsbruck) Fri 09:45 S4
Bricard motions.

Hellmuth Stachel (Wien) Fri 10:15 S4
Räumliche Verzahnungen, von Disteli bis Phillips.

Friedrich Manhart (Wien) Fri 10:45 S4
Zur affinen Differentialgeometrie euklidischer Minimalflächen.

Hans Havlicek (Wien) Fri 11:15 S4
A three-dimensional Laguerre geometry.

Otto Röschel (Graz) Fri 11:45 S4
Generalisations of the oloid.

Section 6:
Functional Analysis, Harmonic Analysis

Roland Steinbauer (Wien) Thu 11:15 S5
Generalized flows and singular ODEs on differentiable manifolds.

Michael Kunzinger (Wien) Thu 11:45 S5
Generalized connections and curvature.

Maria Gabriella Kuhn (Milano) Thu 15:00 S5
Growth of matrix coefficients characterizes the principal series of the free group.

Alessandro Veneruso (Genova) Thu 15:30 S5
Littlewood-Paley decompositions on nilpotent Lie groups.

Wolfgang Woess (Graz) Thu 16:00 S5
Harmonic functions on lamplighter graphs.

Gilbert Helmberg (Innsbruck) Fri 09:45 S5
A construction concerning $(l^p)' \subset l^q$.

Hans Jarchow (Zürich) Fri 10:15 S5
Carleson measures for classical spaces of analytic functions.

Maura Salvatori (Milano) Fri 10:45 S5
Tight affine frames of multivariate box splines.

Bernhard Burgstaller (Linz) Fri 11:15 S5
Some multidimensional Cuntz algebras.

Section 7:
Real and Complex Analysis, Ordinary Differential Equations

Ludwig P. Reich (Graz) Mon 11:15 S4
Analytic solutions of the generalized Böttcher equation in the complex domain.

Elmar Teufl (Graz) Mon 11:45 S4
Asymptotic problems related to iterative functional equations.

Ligia-Loretta Cristea (Graz) Mon 12:15 S4
Discrepancies on the Sierpinski carpet.

Peter Dörfler (Leoben) Mon 12:45 S4
A Markov type inequality for higher derivatives.

Peter Szmolyan (Wien) Mon 16:15 S4
Geometric analysis of delayed Hopf bifurcations.

Russell Johnson (Firenze) Mon 16:45 S4
Bifurcation in nonautonomous differential systems.

Mauro Marini (Firenze) Mon 17:15 S4
Principal solutions for half-linear differential equations.

Pierpaolo Omari (Trieste) Mon 17:45 S4
Positive solutions of an indefinite mean curvature problem.

Marco Sabatini (Trento) Tue 09:45 S4
On the period function of plane centers.

Gabriele Villari (Firenze) Tue 10:15 S4
Periodic solutions of a forced differential equation in presence of a separatrix.

Fabio Zanolin (Udine) Tue 10:45 S4
On the dynamics of some planar maps associated to nonlinear Hill's equations with an indefinite weight.

Alois Steindl (Wien) Tue 11:15 S4
Is the "Skytower" stable?

Nikola Popovic (Wien) Tue 11:45 S4
A geometric analysis of the Lagerstrom model.

Joachim Bauer (Duisburg) Tue 12:15 S4
Ausnahmepunkte und Ausnahmemengen bei Abbildungen von Mannigfaltigkeiten.

Section 8: Topology, Differential Geometry

Karen Elsner (München) Mon 11:15 S5
Dimensionally reduced gravity: Dressing group as Poisson-Lie action.

Armin Rainer (Wien) Mon 11:45 S5
Choosing roots of polynomials smoothly and lifting smooth curves over invariants.

Fulvia Spaggiari (Modena) Mon 16:15 A
Four-manifolds with special homotopy.

Alberto Cavicchioli (Modena) Mon 16:45 A
Connected sum decompositions of four-manifolds.

Lucia Alessandrini (Parma) Mon 17:15 A
Kähler and balanced threefolds.

Section 9: Financial and Industrial Mathematics

Ezio Venturino (Torino) Tue 16:15 S5
A dynamical model for the monetary circuit.

Thomas Breuer (Dornbirn) Tue 16:45 S5
Overcoming dimensional dependence of maximum loss.

Jörn Sass (Linz) Tue 17:15 S5
Portfolio optimization under partial information: An HMM for the stock returns.

Georg Propst (Graz) Tue 17:45 S5
Computation of steady states in flue gas washers.

Pierpaolo Montana (Roma) Fri 09:45 S3
Financial immunization as a semi-infinite programming problem.

Section 10: Numerical Mathematics, Scientific Computing

Vittoria Demichelis (Torino) Wed 09:45 S4
Modified splines for the evaluation of certain finite-part integrals.

Alexander Ostermann (Innsbruck) Wed 10:15 S4
Exponential Runge-Kutta methods.

Mechthild Maria Thalhammer (Innsbruck) Wed 10:45 S4
Variable stepsize linear multistep discretizations of singular perturbation problems.

Bernhard Quatember (Innsbruck) Wed 11:15 S4
Simulation of the three-dimensional flow of blood in stenosed coronary arteries: mesh generation issues.

Section 11: Probability Theory, Statistics

Sara Brofferio (Graz) Thu 16:30 S5
Random walks on the affine group and stability of the auto-regressive model.

Maximilian Thaler (Salzburg) Thu 17:00 S5
A limit theorem for iterated maps preserving an infinite measure.

Reinhard Viertl (Wien) Fri 09:45 CH
Unscharfe Wahrscheinlichkeitsverteilungen.

Thomas Fetz (Innsbruck) Fri 10:15 CH
Sets of joint probability measures generated by random sets.

Mirjam Duer (Darmstadt) Fri 10:45 CH
A stochastic algorithm for global optimization.

Lothar Heinrich (Augsburg) Fri 11:15 CH
Gaussian limits of multiparameter empirical K-functions of spatial Poisson processes.

Barbara Rüdiger (Bonn) Fri 11:45 CH
Stochastic differential equations with non Gaussian additive noise on Banach spaces.

Section 12: Partial Differential Equations, Calculus of Variations

Ernesto Buzano (Torino) Wed 09:45 S3
Complex powers of hypoelliptic operators.

Roland Steinbauer (Wien) Wed 10:15 S3
The relativistic Vlasov-Klein-Gordon system I: Local classical solutions.

Gerald Teschl (Wien) Wed 10:45 S3
The relativistic Vlasov-Klein-Gordon system II: Global weak solutions.

Peter Berglez (Graz) Wed 11:15 S3
Solutions of a generalized Stokes-Beltrami system in the neighbourhood of an isolated singularity.

Gerhard Kirchner (Innsbruck) Wed 11:45 S3
Mindlin's, Boussinesq's and Cerruti's problems and their generalizations to n-dimensional half-spaces.

Christian Schmeiser (Wien) Thu 09:45 S3
Macroscopic limits of kinetic models for chemotaxis.

Vera Miljanovic (Wien) Thu 10:15 S3
Convergence to equilibrium for a linearized cometary flow equation.

Carlota Cuesta (Wien) Thu 10:45 S3
Travelling waves for a one dimensonal BGK model.

Yasmin Dolak (Wien) Thu 11:15 S3
The Keller-Segel model with small diffusivity.

Klemens Fellner (Wien) Thu 11:45 S3
Applying entropy entropy-dissipation methods.

Hannelore Brandt (Wien) Thu 15:00 S3
Indirect reciprocity.

Rada Maria Bombosi (Wien) Thu 15:30 S3
Remarks on dimension reduction of the Gross-Pitaevskii equation.

Thomas Ostergaard Sorensen (München) Thu 16:00 S3
Regularity of molecular wavefunctions and electron densities.

Claudia Garetto (Torino) Thu 16:30 S3
Local theory of pseudo-differential operators in Colombeau algebras.

Michela Eleuteri (Trento) Thu 17:00 S3
Hölder continuity results for a class of functionals with non standard growth.

Section 13: History and Philosophy of Mathematics

Christa Binder (Wien) Tue 17:15 A
Mathematics in Vienna – 100 years ago.
On the situation of mathematics in Vienna in the years 1903 and 1904, when the Mathematical Society in Vienna was founded.

Hans-Joachim Girlich (Leipzig) Wed 11:45 S5
Kolmogorov (1903-1987), Bruno de Finetti's problem, and Levy processes.

Section 14: Mathematics Teaching

Joachim Bauer (Duisburg) Thu 09:45 CH

Zur Hochschuldidaktik der Vektoranalysis und des Differentialformenkalküls.

Giorgio T. Bagni (Roma) Thu 10:15 CH

Numbers and polynomials: a model of Robinson arithmetics in mathematics education.

Karl Josef Fuchs (Salzburg) Thu 16:00 CH

Fundamentale Ideen als ordnende Prinzipien und Orientierungshilfe. Bemerkungen zur fachdidaktischen Ausbildung im Lehramt Mathematik und Informatik.

Walther Neuper (Graz) Thu 16:30 CH

Reflexion als didaktisches Prinzip und als Designprinzip für Mathematik-Lernsoftware.

Olusegun Ebenezer Adeboye (Serekunda) Thu 17:00 CH

Algebral: A tool for further skills in mathematical problem solving.

Adjoined program

Teachers' Meeting

The program of the Teachers' Meeting comprises, in addition, Thursday's plenary lecture, the talks of the Mathematics Teaching Section and Thursday evening's public lecture.

Heinrich Reitberger (Innsbruck) Thu 10:45 CH
Wolfgang Gröbner - ein Südtiroler Mathematiker.

Franz Pauer (Innsbruck) Thu 11:45 CH
Gröbnerbasen - das wesentliche Hilfsmittel zum Rechnen mit Polynomen in mehreren Variablen.

Gerhard Wanner (Genf) Thu 15:00 CH
Über das Lösen von Differentialgleichungen.

Universities of the Applied Sciences Meeting

Bruno Buchberger (Linz) Fri 09:45 SA

Mathematik an Fachhochschulen:
Fachliche und didaktische Überlegungen.

Clemens Heuberger (Graz) Fri 11:00 SA

Eine kurze Einführung in die Computeralgebrasysteme Mathematica und Maple.

Franz Embacher (Wien) Fri 14:00 SA

Das Projekt mathe online.

The lectures are followed by a general discussion of goals and planning of future projects at 15:00.

Meetings and public program

General Assembly, ÖMG:

The General Assembly of the Austrian Mathematical Society will convene on Tuesday, September 23, 2003, at 18:15 in the Auditorium, EURAC. Members of the Austrian Mathematical Society are invited to participate.

The general assembly is preceded by a historical survey talk on the history of the Austrian Mathematical Society by **Christa Binder** (Wien):

Mathematics in Vienna – 100 years ago.
On the situation of mathematics in Vienna in the years 1903 and 1904, when the Mathematical Society in Vienna was founded,

at 17:15 in the Auditorium of EURAC.

Public lecture:

Participants of the conference are invited to attend the public lecture addresing the theme "Mathematics and Computer Science" on Thursday, September 25, at 18:00 in the Auditorium of EURAC.

Bruno Buchberger (Linz)
Mathematik und Informatik: Eine Liebeserklärung
(Mathematics and Computer Science – a Declaration of Love)

The lecture is open to the general public and will be given in German, a simultaneous translation into Italian is provided.

Book exposition:

A book exposition sponsored by Wagnersche Universitätsbuchhandlung Innsbruck is open during the first three conference days in the Conference Hall of EURAC. Opening hours:

Monday, 13:00–18:00,
Tuesday, 9:00–18:00,
Wednesday, 9:00–13:00.

Social program

Evening Reception:

On Monday, September 22, the Free University of Bolzano invites the conference participants to an official evening reception at 19:00, taking place at the new building of the Free University of Bozen-Bolzano, Sernesistr. 1 / Via Sernesi 1.

Evening Concert:

An evening concert, sponsored by the City of Bolzano, takes place on Wednesday, September 24, at 20:30, in the Auditorium of Eurac, Drususallee 1 / Viale Druso 1. It is a jazz concert with the renowned Italian Jazz musicians Gianluigi Trovesi (clarinet and saxophone) and Gianna Coscia (accordion).

Conference Excursion:

Please check your registration and find additional current information at the conference desk.

Wednesday, September 24, departure from Bolzano at 14:00, return by 19:00. Meeting point at Waltherplatz / Piazza Walther, Bozen/Bolzano at 14:00.

Two options are available:

1. Scenic hike and visit to castles: Bolzano-Missiano-Appiano-Castle of Korb-Castle of Boymont. Casual clothes and light hiking shoes recommended.

2. Gardens of Trauttmandorff Castle and Tyrolean Museum of Tourism.

Further Events and Excursions:

- Monday, September 22, 14:00: Visit to the old parish church of Gries and scenic walk along the Guncina promenade. Meeting point: Talfer bridge/Ponte Talvera, right bank near newspaper stand at 14:00.

- Tuesday, September 23, 14:00: Art-historical tour through the city of Bolzano and visit to the archeological museum (Ötzi – the man from the ice). Meeting point: Waltherplatz / Piazza Walther, in front of Walther monument at 14:00.

- Tuesday, September 23 at 21:00: Wine tasting event at the Castle of Maretsch (situated in the center of Bozen/Bolzano, Claudia de Medici-Straße 12 / Via Claudia de Medici 12).

- Thursday, September 25, 14:00: "Water Wall" and Oswald Promenade, Castle of Runkelstein. Meeting point: In front of archeological museum at 14:00.

Further Program:

These excursions and visits are offered free of charge by the Free University of Bolzano. Please register at the conference office.

- Ahtila-Exposition: On September 20, the Museion of Bolzano opens an exposition of the work of Eija Liisa Ahtila, a cinematographic artist of world-wide recognition.

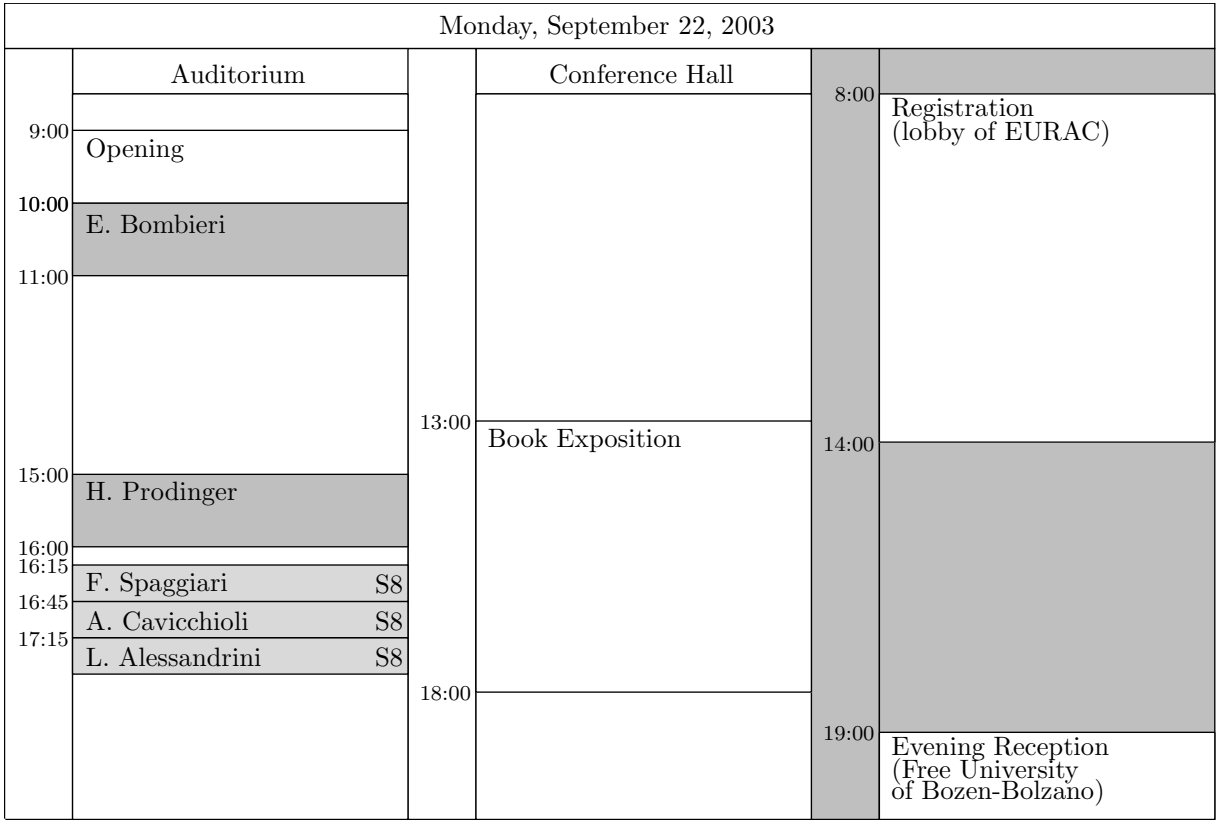
- Visit to the University of Bolzano: The Free University of Bolzano will arrange tours of the university building at two afternoons. Announcements of the exact schedule are available at the conference office.

- Hesse-exposition in Bolzano: Bolzano is the third station, after Berlin and Calw, hosting the multimedia exposition "WeltFlechtWerk – Die Einheit hinter den Gegensätzen", which was conceived and realized at the occasion of Hermann Hesse's 125th birthday in 2002. The exposition takes place at the Library of the Free University of Bozen-Bolzano.

Overview

Abbrevations:

S1 – S14	Section 1 – 14
MS1 – MS4	Minisymposium 1 – 4
TM	Teachers' Meeting
UAS	Universities of the Applied Sciences Meeting


Monday, September 22, 2003
Auditorium
Conference Hall
9:00
Opening
10:00
E. Bombieri
11:00
15:00
H. Prodinger
16:00
16:15
F. Spaggiari S8
16:45
A. Cavicchioli S8
17:15
L. Alessandrini S8
13:00
Book Exposition
18:00
8:00
Registration
(lobby of EURAC)
14:00
19:00
Evening Reception
(Free University
of Bozen-Bolzano)

Monday, September 22, 2003					
	Seminar 3		Seminar 4		Seminar 5
11:15	R. Mlitz S3	11:15	L. Reich S7	11:15	K. Elsner S8
11:45	A. Kräuter S3	11:45	E. Teufl S7	11:45	A. Rainer S8
12:15	W. Imrich S3	12:15	L. Cristea S7		
12:45	B. Krön S3	12:45	P. Dörfler S7		
16:15	F. Schweiger S2	16:15	P. Szmolyan S7		
16:45	W. More S2	16:45	R. Johnson S7		
17:15	F. Pillichshammer S2	17:15	M. Marini S7		
17:45	K. Scheicher S2	17:45	P. Omari S7		
18:15	B. Schratzberger S2				

Tuesday, September 23, 2003

	Auditorium		Conference Hall
8:30	A. Bressan	9:00	
9:30			Book Exposition
9:45	I. Bomze MS2		
10:20	I. Borsi MS2		
10:55	L. Fusi MS2		
11:30	I. Gasser MS2		
12:05	A. Obereder MS2		
15:00	Ch. Lubich		
16:00			
16:15	A. Cap		
17:00			
17:15	Ch. Binder S13		
18:00			
18:15	General Assembly of the Austrian Mathematical Society		

21:00	Wine Tasting Castle Maretsch

Tuesday, September 23, 2003					
	Seminar 3		Seminar 4		Seminar 5
9:45	M. Drmota S3	9:45	M. Sabatini S7	9:45	E. Aichinger S1
10:15	A. Panholzer S3	10:15	G. Villari S7	10:15	G. Dorfer S1
10:45	W. Steiner S3	10:45	F. Zanolin S7	10:45	G. Eigenthaler S1
11:15	G. Karigl S3	11:15	A. Steindl S7	11:15	W. Herfort S1
11:45	B. Steinsky S3	11:45	N. Popovic S7	11:45	J. Wiesenbauer S1
		12:15	J. Bauer S7		
16:15	C. Fuchs S2	16:15	H. Pottmann S5	16:15	E. Venturino S9
16:45	F. Halter-Koch S2	16:45	J. Wallner S5	16:45	Th. Breuer S9
17:15	G. Lettl S2	17:15	G. Weiss S5	17:15	J. Sass S9
17:45	O. Pfeiffer S2	17:45	P. Schmitt S5	17:45	G. Propst S9

Wednesday, September 24, 2003					
	Auditorium		Conference Hall		
8:30	H. Groemer	9:00			
9:30			Book Exposition		
9:45	R. Schneider MS3				
10:40	M. Reitzner MS3				
11:20	C. Peri MS3				
12:00	A. Colesanti MS3	13:00		14:00	Excursions
				19:00	
				20:30	Jazz Concert (Auditorium Eurac)

Wednesday, September 24, 2003					
	Seminar 3		Seminar 4		Seminar 5
9:45	E. Buzano S12	9:45	V. Demichelis S10	9:45	H. Kautschitsch S1
10:15	R. Steinbauer S12	10:15	A. Ostermann S10	10:15	D. Mayer S1
10:45	G. Teschl S12	10:45	M. Thalhammer S10	10:45	K. Schlesinger S1
11:15	P. Berglez S12	11:15	B. Quatember S10	11:15	R. Winkler S1
11:45	G. Kirchner S12			11:45	H. Girlich S13

Thursday, September 25, 2003					
	Auditorium		Conference Hall		
8:30	C. Procesi				
9:30					
9:45	F. Ricci MS1		9:45	J. Bauer S14	
10:30	V. Losert MS1		10:15	G. Bagni S14	
11:15	F. Lehner MS1		10:45	H. Reitberger TM	
11:55	T. Steger MS1		11:45	F. Pauer TM	
			15:00	G. Wanner TM	
16:00	J. Thuswaldner		16:00	K. Fuchs S14	
16:45			16:30	W. Neuper S14	
17:00	M. Kunzinger		17:00	O. Adeboye S14	
17:45					
18:00	B. Buchberger				
19:30					

Thursday, September 25, 2003					
	Seminar 3		Seminar 4		Seminar 5
9:45	Ch. Schmeiser S12	9:45	J. Brauchart S5	9:45	A. Middeldorp S4
10:15	V. Miljanovic S12	10:15	P. Cuoghi S5	10:15	W. Neuper S4
10:45	C. Cuesta S12	10:45	P. Salani S5	10:45	M. Moschner S4
11:15	Y. Dolak S12	11:15	A. Volcic S5	11:15	R. Steinbauer S6
11:45	K. Fellner S12	11:45	R. Ghiloni S5	11:45	M. Kunzinger S6
15:00	H. Brandt S12	15:00	C. Heuberger S3	15:00	M. Kuhn S6
15:30	R. Bombosi S12	15:30	B. Gittenberger S3	15:30	A. Veneruso S6
16:00	Th. Sorensen S12	16:00	D. Dorninger S3	16:00	W. Woess S6
16:30	C. Garetto S12	16:30	I. Fischer S3	16:30	S. Brofferio S11
17:00	M. Eleuteri S12			17:00	M. Thaler S11

Friday, September 26, 2003					
	Auditorium		Conference Hall		Seminar A
8:30	W. Runggaldier				
9:30					
9:45	P. Boggiatto MS4	9:45	R. Viertl S11	9:45	B. Buchberger UAS
10:30	T. Gramchev MS4	10:15	Th. Fetz S11		
		10:45	M. Duer S11	11:00	C. Heuberger UAS
11:15	G. Hörmann MS4	11:15	L. Heinrich S11		
11:55	P. Wagner MS4	11:45	B. Rüdiger S11		
				14:00	F. Embacher UAS
				15:00	Discussion

Friday, September 26, 2003					
	Seminar 3		Seminar 4		Seminar 5
9:45	P. Montana S9	9:45	M. Husty S5	9:45	G. Helmberg S6
		10:15	H. Stachel S5	10:15	H. Jarchow S6
		10:45	F. Manhart S5	10:45	M. Salvatori S6
		11:15	H. Havlicek S5	11:15	B. Burgstaller S6
		11:45	O. Röschel S5		

Abstracts

Algebral: A tool for further skills in mathematical problem solving

Olusegun Ebenezer Adeboye
Bakoteh Upper Basics

The importance of algebra to further mathematical analysis has always been a problem among young school leavers. This paper aims to dissect the need for effective teaching of algebra as a foundation for advanced mathematical problem solving.

Section: Mathematics Teaching.

A bound on the number of polynomial functions that leads to a decidability result for near-rings

Erhard Aichinger
Johannes Kepler Universität Linz

Given a finite zero-symmetric near-ring with identity N, we ask whether N has any of the following properties:

1. There is a group G such that N is isomorphic to the inner automorphism near-ring $I(G)$.
2. There is a finite group G such that N is isomorphic to the near-ring $I(G)$.
3. N is compatible, i.e., it has a faithful compatible N-group.

In particular, we investigate whether there is an algorithm that tells whether a given N has any of these properties. The fact that such an algorithm exists is based on the following theorem:
Theorem. *Let N be a finite near-ring, and let $m := |N|$. If there is a group G such that N is isomorphic to $I(G)$, then there is a group H with $|H| \leq m^{2^{m+1}}$ such that N is isomorphic to $I(H)$.*
Using a similar result, we prove that is decidable whether a given near-ring is compatible in the sense of S.D.Scott.
Recently, we have proved that the variety of near-rings is generated by its finite members. We explain which information this gives on the decidability of certain word-problems for near-rings.

Section: Algebra.

Kähler and balanced threefolds

Lucia Alessandrini
Università di Parma

The situation we shall consider is the following: let M be a compact complex manifold of dimension n, let Y be an analytic subset of M of codimension at least two, such that the open subset $M \setminus Y$ can be endowed with a Kähler metric. Such a situation often occurs: for instance, when M is a Moishezon manifold, there is a projective manifold which is a modification of M, hence M is Kähler outside the center of the modification. Since there exist non-projective Moishezon manifolds, it is clear that the existence of a Kähler metric outside an analytic subset does not imply that the whole manifold is Kähler. Therefore we shall look for hermitian metrics on M with weaker properties, as balanced metrics, or for weaker geometrical conditions, as the class C of Fujiki. We get, among other results, that if M is a threefold and Y is a smooth curve in M such that $M \setminus Y$ is Kähler, then M always carries a balanced metric. Current's techniques are employed to characterize Kähler, balanced and class-C manifolds.

Section: Topology, Differential Geometry.

Numbers and Polynomials: a Model of Robinson Arithmetics in Mathematics Education

Giorgio T. Bagni
Università di Roma

Looking for analogies and differences in different situations is educationally (and, in general, mathematically) interesting: abstraction itself is based upon interpretation of analogies and upon consideration of similar problems in different contexts. Non-standard models of PA are not educationally simple to be proposed; it is interesting to present models of Q non-isomorphic to N: for instance we denote by Z*[x] the set whose elements are 0 and all polynomials with integral coefficients with positive leading coefficients: Z*[x] with addition and multiplication is a model of Q; it is educationally interesting to notice that it is not a model of PA. The order in Z*[x], defined according to axioms of Q, allows us to introduce considerations about infinity in Z*[x]. Let us define p prime in Z*[x] if it is different from 0 and from 1 and if there are not two elements belonging to Z*[x], both of them different from 1, whose product is p; we prove by elementary methods that if the non-constant polynomial Q(x) is not primitive then there are two prime polynomials A(x), B(x) such that Q(x) = A(x)+B(x). Finally, the representation of real numbers by regular continued fractions allows us to introduce by analogy the representation of functions that cannot be written as a fraction whose numerator and denominator are polynomials.

Section: Mathematics Teaching.

Ausnahmepunkte und Ausnahmemengen bei Abbildungen von Mannigfaltigkeiten

Joachim Bauer
Universität Duisburg

Ist $f : M^n \to M^{'n}$ eine stetige Abbildung vom Grad c zweier orientierbarer geschlossener Mannigfaltigkeiten, so erwartet man "in der Regel", dass ein Punkt $y \in M^{'n}$ mindestens $|c|$ Urbildpunkte hat. Hat er weniger Urbildpunkte, so heißt er ein Ausnahmepunkt und $|c| - \#(f^{-1}(y))$ sein Defekt.
Analog spricht man von Dimensionsdefekt, wenn bei einer Abbildung $f : M^{n+k} \to M^{'n}$
$dim\ f^{-1}(y) < k$ bzw. $dim\ f^{-1}(Y) < k + dim\ Y$ für einen Punkt $y \in M^{'n}$ bzw. einen Teilraum $Y \subset M^{'n}$ gilt. Dieser Defektbegriff wurde von H. Hopf eingeführt.
Es werden Sätze des Inhalts angegeben, dass unter geometrisch signifikanten Voraussetzungen über f die auftretenden Defekte nicht zu groß bzw. nicht zu zahlreich bzw. topologisch nicht zu kompliziert sein können.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Zur Hochschuldidaktik der Vektoranalysis und des Differentialformenkalküls

Joachim Bauer
Universität Duisburg

Gelegentlich finden wir in Lehrbüchern und Monographien eine mathematische oder realwissenschaftliche Theorie stufenförmig dargestellt. Eine so präsentierte Theorie gilt als "leicht", da man auf jeder Stufe von ihrer Richtigkeit überzeugt wird.
"Schwer" möchte man eine Theorie nennen, bei deren Präsentation man von vorne herein "alles richtig" machen muss.
An einen stufenförmigen Aufbau sind folgende Forderungen zu stellen.

I: Die nullte Stufe entspricht einer naiven vorwissenschaftlichen Version der zu explizierenden Begriffe, während die n-te (letzte) Stufe äquivalent der gebräuchlichen Darstellung des gegenwärtigen Standes dieser Theorie ist.

II: Der Übergang von der k-ten zur (k + 1)-ten Stufe wird in der Weise vollzogen, dass die zentalen Begriffe der (k + 1)-ten Stufe die Explikate und Formalisierungen der entsprechenden Begriffe auf der k-ten Stufe sind.

Ein solcher Aufbau bietet dort, wo er möglich ist, hochschuldidaktische und methodische Vorteile: Eine Theorie, die sich stufenweise erlernen lässt, erscheint "natürlich" und ist daher wohlmotiviert und leicht erlernbar. Bei einer stufenlos aufgebauten, auf den aktuellen Stand des vollen mathematischen Wissens präsentierten Theorie kommt man erst verhältnismäßig spät zu anwendbaren Resultaten. Oft muss dann der Anwender selbst für bescheidene Anwendungen den gesamten begriffstechnischen Apparat erlernen. Eine stufenweise aufgebaute Theorie gestattet vielfach bereits Anwendungen auf der k-ten Stufe mit $k < n$.
In diesem Vortrag wird ein Stufenaufbau der klassischen Vektoranalysis und des Kalküls der alternierenden Differentialformen dargestellt, der die Forderungen I und II erfüllt.
Während man bei dem üblichen Aufbau des Differentialformenkalküls zunächst die multilineare Algebra entwickeln muss, kann bei der hier

gewählten Darstellung auf diesen Vorspann verzichtet werden. Wer will, kann dann auf der letzten Stufe die multilineare Algebra aus dem Differentialformenkalkül erhalten. Auf dieser letzten Stufe wird die Differentialform als vom Koordinatensystem unabhängiges Objekt durch den Modellmodul eines transitiven Modulsystems konzipiert. In der klassischen Vektoranalysis wird ein von der üblichen Lehrbuchdarstellung abweichender elementarer Beweis des Integralsatzes von Gauß auf jeder Stufe gegeben, der von Stufe zu Stufe "richtiger" wird. Als Nebenresultat erhält man aus der "Physikerdefinition" der Vektordifferentialoperatoren als "dichteartige" Bildungen, dass aus ihrer Existenz auf einem Gebiet des Raumes bereits ihre Stetigkeit folgt.

Section: Mathematics Teaching.

Solutions of a generalized Stokes-Beltrami system in the neighbourhood of an isolated singularity

Peter Berglez
Technische Universität Graz

In different parts of applied mathematics Stokes-Beltrami systems are considered. Here we deal with generalized Stokes-Beltrami systems which occur in the theory of the generalized axially symmetric potential theory for example. For a wide class of such systems the solutions can be represented using certain differential operators acting on holomorphic functions called generators. To obtain the solutions defined in the neighbourhood of an isolated singularity we have to investigate the properties of the generators of the zero-solution. With this we can give an explicit representation of these potentials in the neighbourhood of isolated singularities. Using integral operators we can extend the class of systems for which the solutions can be represented in an explicit way.

Section: Partial Differential Equations, Calculus of Variations.

Mathematics in Vienna – 100 years ago. On the situation of mathematics in Vienna in the years 1903 and 1904, when the *Mathematical Society in Vienna* was founded.

Christa Binder
Technische Universität Wien

Gustav von Escherich (1849–1935, professor of mathematics at the University of Vienna, founder of the Viennese analytic school, 1903 rector of the university), Emil Müller (1861–1927, who came 1902 from Königsberg to the Technische Hochschule in Vienna, the *father* of the Viennese school of geometry) and Ludwig Boltzmann (1844–1906, world famous physicist, professor for theoretical physics at the University of Vienna since 1902) decided to found a Mathematical Society in Vienna in autumn 1903. The first session was on January 14, 1904, where Escherich was elected to be president with Müller as first vicepresident and Wilhelm Wirtinger (1865–1945, professor at the University of Vienna since autumn 1903) as second vicepresident. Boltzmann had withdrawn, probably because of health reasons.
This talk will describe the situation under the chairs Escherich, Franz Mertens and Wirtinger (University of Vienna), Moriz Allé, Emanuel Czuber and Müller (Technische Hochschule) as well as Oskar Simony and Theodor Tapla (Hochschule für Bodenkultur).
Moreover, besides the mathematicians already mentioned also those will be presented who gave the first talks at the society: Josej Plemelj, Gustav Herglotz, Hans Hahn, Heinrich Tietze, Gustav Kohn and Josef Grünwald.

Section: History and Philosophy of Mathematics.

Localization operators with L^p-symbols on modulation spaces

Paolo Boggiatto
Università di Torino

Localization operators acting on modulation spaces are studied considering symbols in $L^p(\mathbb{R}^{2n})$. From one basic result on boundedness we derive various consequences for particular cases of localization as well as Weyl operators. We study then compactness proving some general results for symbols in L^p with $p < \infty$ and for bounded symbols vanishing at infinity. These results are then generalized by interpolation and reformulated in order to include modulation spaces with polynomial dominated weights.

Minisymposium 4: Microlocal Analysis.

The Rosetta stone of L-functions

Enrico Bombieri
Institute for Advanced Study, Princeton

This survey lecture is a presentation of the three main aspects of general L-functions, namely analytic, automorphic and geometric, with an overview of the main conjectures related to them.

Plenary Lecture.

Remarks on dimension reduction of the Gross-Pitaevskii equation

Rada Maria Bombosi
Universität Wien

Recently, there have been experimental advances in achieving and observing Bose-Einstein condensation (BEC) in trapped atomic vapors. The properties of a BEC at temperatures much smaller than the critical condensation temperature are modelled by the Gross-Pitaevskii equation (GPE). I discuss the evolution of the BEC governed by the GPE. Particular emphasis is given to the dimension reduction for disk shaped and cigar shaped condensates. Analytical results and numerical experiments are presented.

Section: Partial Differential Equations, Calculus of Variations.

Optimization of functions with rank-two variation over a box

Immanuel Bomze
Telekom Austria AG, Wien

This presentation deals with optimization of functions that depend on (large-scale) data via a linear transformation of rank two. An algorithm is presented which - under mild assumptions - finds the global solution with polynomial-time complexity in the worst case, provided the critical points of the objective can be controlled with the same effort. Moreover, for important subclasses of objectives including the linear-fractional, and the quadratic case, we arrive at a linear-time algorithm. For both cases, small simulation studies are provided to illustrate the average case runtime behaviour. As a possible application, sensitivity of cost assessment in telecommunication networks is addressed where the problems may have tens of thousands of variables.

Minisymposium 2: Mathematics in Industry.

Mathematical Modelling for Solving Environmental Problems

Iacopo Borsi
Università di Firenze

Mathematical methods could be a very useful tool in studying and solving environmental problems. In particular, we shall describe some techniques to model soils and groundwater pollution. The numerical simulations based on these models could be used as forecasting tool in water management and restoration.
Moreover, we shall also focus on the open problems and on the wide variety of possible application fields.

Minisymposium 2: Mathematics in Industry.

Indirect reciprocity

Hannelore Brandt
Universität Wien

Theories attempting to explain the evolution of cooperation are based on many different aspects. Kin selection (dependent on genetic relatedness), as well as group selection have for a long time dominated the discussion. However, cooperation and mutual aid among non-kin seems to be a hallmark of human societies, and requires more elaborate explanations. Its evolution is most frequently ascribed to reciprocation, displaying two basic possible mechanisms. In direct reciprocation, the return of a helpful action is expected from the recipient. In indirect reciprocation, the return is expected from a third party. This second form seems considerably more problematic, indeed almost paradoxical. But since direct reciprocity between two partners works only if the interaction is repeated sufficiently often, indirect reciprocity seems to be an hopeful candidate for explaining acts of assistance given to recipients who are unlikely ever to be able to return the kindness.

Section: Partial Differential Equations, Calculus of Variations.

Minimal Energy Point Sets

Johann Brauchart
Technische Universität Graz

Point sets on a d-dimensional unit sphere S^d embedded in the Euclidean space $\mathbb{R}^{d+1}$ have a variety of applications in such fields as computational complexity, crystallography, electrostatics and numerical integration. Given a suitable continuous function $G : (0, 2] \to \mathbb{R}$ satisfying some additional assumptions, the G-energy of an N-point set $X_N = \{x_1, \ldots, x_N\} \subseteq S^d$ is

$$E(G; X_N) = \frac{1}{N^2} \sum_{j \neq k} G(\|x_j - x_k\|).$$

We give results on properties of point sets X_N^* for which the minimal G-energy

$$E(G; X_N^*) = \min_{X_N \subseteq S^d} E(G; X_N)$$

is attained.

Section: Geometry.

Hyperbolic Systems of Conservation Laws

Alberto Bressan
S.I.S.S.A., Trieste

The talk will survey recent advances and research directions in the theory of hyperbolic systems of conservation laws. In one space dimension, the Cauchy problem is well posed, within a domain of functions with small total variation. Entropy weak solutions can be obtained as the unique limits of vanishing viscosity approximations. On the other hand, little is yet known in the case of large data, and for systems in several space dimensions.

Plenary Lecture.

Overcoming Dimensional Dependence of Maximum Loss

Thomas Breuer
Fachhochschule Vorarlberg

Maximum Loss has been proposed as a risk measure superior in some respects to Value at Risk and to Expected Shortfall. But Maximum Loss over admissibility domains with a specified probability mass shows a peculiar kind of dimensional dependence: for a fixed portfolio depending and fixed probability mass, the inclusion of additional empty or highly correlated risk factors increases Maximum Loss.
Here we propose a way to overcome this counter-intuitive effect: if we characterise the admissibility domain by its Mahalanobis radius instead of its probability mass, the inclusion of additional empty risk factors or of highly correlated risk factors does not affect Maximum Loss.

Section: Financial and Industrial Mathematics.

Random walks on the affine group and stability of the auto-regressive model

Sara Brofferio
Technische Universität Graz

The random process defined recursively by the equation

$$Y_n^y = a_n Y_{n-1}^y + B_n \qquad Y_0^y = y$$

where $\{(a_n, B_n)\}_n$ is a sequence of random i.i.d. variable with values in $R_+^* \times R^d$, is known as (first order) auto-regressive model and has been deeply studied since '70. Besides his various applications, its understanding is strictly related to the study of the iterated products of random affine transformations of the form $(a, B) : x \mapsto ax + B$, that are one of the reference group on the study of random walks on non-Abelian structures. The study of the case $E[\log a_1] = 0$ is particularly delicate, because there are neither strong contractive nor dilating phenomena. We will first detail the geometrical behavior of the trajectories of the random walks on the group in this critical case. In a second time, we apply this result to the study of dependence on the starting point of the auto-regressive model, proving then it possesses a local contraction property. It is also possible to determine a speed for this local contraction and give some higher dimensional generalization.

Section: Probability Theory, Statistics.

Mathematik und Informatik: Eine Liebeserklärung

Bruno Buchberger
RISC Universität Linz und FH Hagenberg

Obwohl viele meinen, dass Mathematik natürlich vom Rechnen handelt und damit heute der Computer im Zentrum der Mathematik stehen müsste, und obwohl manche meinen, dass Informatik ("Computer Science", die Wissenschaft vom Rechnen) ja im Wesentlichen eine Disziplin der Mathematik sein müsste, haben sich Mathematik und Informatik ziemlich voneinander entfernt bzw. waren die beiden Disziplinen für die meisten nie wirklich nahe beisammen. Für viele Mathematiker ist der Computer höchstens wegen LaTeX, e-mail und Web interessant und manche Mathematiker sind sogar stolz darauf, dass der Computer in ihrer Wissenschaft darüberhinaus keine Rolle spielt. Umgekehrt sind die meisten Informatiker überzeugt, dass sie eigentlich keine Mathematik brauchen.

Ich bedaure diesen Zustand zutiefst und halte dem entgegen, dass es sowohl wissenschaftstheoretisch also auch praktisch für beide Disziplinen äußerst lähmend ist, wenn die Kluft aufrechterhalten wird. In der Tat sind Mathematik und Informatik in ihrer Methodik ein ununterscheidbares Ganzes: Sie bilden zusammen mit der Logik die "Denktechnologie", die sich in einem evolutiven Prozess von der "Beobachtungstechnologie" getrennt hat. Beobachten, Denken und Handeln bilden den grundlegenden Dreischritt des wissenschaftlichen Weltbilds und der wissenschaftliche Methode, mit der Welt umzugehen. Auch wenn Beobachten, Denken und Handeln im Idealfall ein integriertes Ganzes darstellen, ist die Unterscheidung von Beobachten, Denken und Handeln grundlegend und die klare Trennung insbesondere von Beobachten und Denken (Mathematik im weitesten Sinne) der Schlüssel für die Entwicklung der wissenschaftlichen Methode über die Jahrhunderte und insbesondere die rasante Entwicklung der letzten Jahrzehnte. Mathematik, in deren Zentrum der Computer steht, ist die Erfüllung der Mathematik mit den technologischen Mitteln der heutigen Zeit und das Ergebnis der Selbstanwendung der Mathematik auf sich selbst. Und Informatik als formale Denkdisziplin ist die Essenz der Informatik und in diesem Sinne ununterscheidbar von zeitgemäßer Mathematik, auch wenn natürlich die

technologische Realisierung des Phänomens des Rechnens einen ingenieurwissenschaftlichen Aspekt enthält, der über den Bereich der Mathematik hinausgeht.
Mathematik, Logik, Informatik zusammengesehen als das Magma zeitgemäßer Denktechnologie ist faszinierend und so alt wie die Menschheit und so jung wie die expandierende Zukunft. Im Vortrag werde ich diese Liebeserklärung an die integrierte Sicht und Praxis von Mathematik, Logik und Informatik an Beispielen detaillieren.
Der Vortrag richtet sich an Forscher, Lehrer, Studierende in den Bereichen Mathematik und Informatik und Anwender, aber auch an Bildungs-, Technologie- und Wirtschaftspolitiker.

Public Lecture.

Mathematik an Fachhochschulen: Fachliche und didaktische Überlegungen

Bruno Buchberger
RISC Universität Linz und FH Hagenberg

Die wissenschaftliche Methode ist gekennzeichnet durch den Dreischritt:

Beobachten (Modell Erstellen)

Denken (Schließen, Arbeiten im Modell)

Anwenden (Interpretieren)

Die Mathematik ist die über die Jahrhunderte verfeinerte Kultur des Schließens. Zu einer *integralen Betrachtung* der Mathematik (und damit auch zu einer integralen Mathematik-Ausbildung) gehören auch das Modell-Erstellen und das Interpretieren – und zwar seit eh und je.

In der heutigen Zeit kommt ein neuer Aspekt dazu: *"der Computer"*. Dieser ist jedoch nichts Anderes als die konsequente Fortsetzung des Grundanliegens der Mathematik nach "systematischem Problemlösen" und ist durch eine Selbstanwendung der wissenschaftlichen Methode – einschließlich der Methode der Mathematik (dem Schließen) – auf die Mathematik entstanden.
Dies bedeutet praktisch, dass heute faktisch alle algorithmischen mathematischen Verfahren als fertige "Black Boxes" in mathematischen *Software-Systemen* wie Mathematica, Maple etc. zur Verfügung stehen und damit alles, was von der Mathematik angewandt werden kann, "auf Knopfdruck" und mit immer größerer Effizienz und für immer komplexere Daten angewandt werden kann. Das bringt neue Chancen aber auch neue didaktische Herausforderungen für den Mathematik-Unterricht.
Für den Entwurf und die Analyse von Grundsätzen für die Mathematik-Ausbildung an Fachhochschulen unterscheide ich zwei Typen von Fachhochschulen-Studiengängen:

A) informatik-, insbesondere software-orientierte Studiengänge

B) alle anderen Studiengänge (soweit in ihnen Mathematik unterrichtet wird).

Ich werde mich dabei vor allem auf Grundsätze für die methodischen und didaktischen und weniger auf die inhaltlichen Aspekte konzentrieren, weil die Auswahl von Inhalten für den Mathematikunterricht sehr stark von den jeweiligen Inhalten der Studiengänge abhängt und abhängen soll.
Sowohl bei A), als auch bei B) ist bei der Festlegung der Methodik, der Didaktik und auch des Inhalt der Mathematik-Ausbildung von den jeweiligen *Berufsbildern* auszugehen. Bei den FHn steht das Berufsbild des "Problemlösers" im jeweiligen Fachgebiet im Vordergrund, bei FH des Typs A) insbesondere das Berufsbild des Ingenieurs, der aus vorhandenen Software- und Hardwarekomponenten plus selbst entwickelten Komponenten ein Gesamt-IT-System, das eine gegebene Anforderung im betrieblichen Zusammenhang erfüllt, entwerfen und realisieren können soll.
Daraus ergeben sich folgende Lehrziele für die Mathematik-Ausbildung an Fachhochschulen:

Sprache der Mathematik: Beherrschung der Sprache der Mathematik, das ist im Wesentlichen die Sprache der Prädikatenlogik (oder einer Teilsprache davon) in den gängigen Ausprägungen, einschließlich des Verständnisses, dass die Basiskonstrukte von Programmiersprachen Teil der Sprache der Mathematik sind und einschließlich der gängigsten Notationen für die mathematischen Sprachkonstrukte in den derzeitigen mathematischen Software-Systemen.
Modellieren: Die wichtigsten im jeweiligen Fachgebiet vorkommenden mathematisierbaren Problemstellungen in mathematische Probleme übersetzen können und wissen, wie man die entsprechenden bekannten mathematischen Lösungsverfahren in den mathematischen Software-Systemen benutzt. (Hier spielt insbesondere auch das Erarbeiten von Problemverständnis und Lösung im Team eine große Rolle!)
Schließen: Bei Studiengängen des Typs B) ist ein anschauliches Verständnis, wie und warum diese Verfahren funktionieren und welche rechnerischen Eigenschaften sie haben, ausreichend. Extensive experimentelle Erfahrung mit den Verfahren ist hier wichtig.
Bei Studiengängen des Typs A) sollte zusätzlich geübt werden, wie man einfache mathematische Überlegungen im Rahmen der Prädikatenlogik formal sauber durchführen kann und wie man eigene Ideen für einfache mathematische Algorithmen realisiert und mit den in den mathematischen Software-Systemen vorhandenen Algorithmen kombinieren kann.
Interpretieren: Die Ergebnisse interpretieren und kritisch beurteilen können.
Beim Entwurf der mathematischen Inhalte der Mathematik-Lehrveranstaltungen für die einzelnen Studiengänge sollte man im Idealfall von einigen interessanten gründlich ausgearbeiteten *Fallstudien* ausgehen, die im Wesentlichen das Anwendungsgebiet der Mathematik im jeweiligen Fach umreißen, und von da *top-down* die nötigen mathematischen Inhalte planen. Bei der Durchführung des Unterrichts sollte man dann aus Gründen der Zeitökonomie, aber auch der leichteren Verständlichkeit eher *bottom-up* und nach dem *"White-Box / Black-Box Prinzip"* vorgehen, bis man schließlich bei der Präsentation der Fallstudien anlangt.

Universities of the Applied Sciences Meeting.

Some multidimensional Cuntz algebras

Bernhard Burgstaller
Universität Linz

Following closely the article of J. Cuntz [C], where the Cuntz algebra was initiated in 1977, we construct a certain type of multidimensional Cuntz algebras.
One has given d sets of classical Cuntz algebras $\mathcal{O}_{n_1}, ..., \mathcal{O}_{n_d}$, where the n_i are mutually prime integers ≥ 2, and one claims that the collectivity of their generating isometries interact in a specific, quasi-abelian fashion. Then the C^*-algebra $\mathcal{O}_n$ $(n = \{n_1, ..., n_d\})$ which is generated by the union of the algebras $\mathcal{O}_{n_i}$, shares many properties of the classical Cuntz algebra.
We view $\mathcal{O}_n$ as a d-dimensional variant of the classical Cuntz algebra which is also emphasized by the isomorphism

$$\mathcal{O}_n \cong P(A \rtimes \mathbb{Z}^d)P$$

for some AF-algebra A and some projection P.

[C] J. Cuntz, *Simple C^*-Algebras Generated by Isometries,* Commun. math. Phys. 57 173–185 (1977).

Section: Functional Analysis, Harmonic Analysis.

Complex powers of hypoelliptic operators

Ernesto Buzano
Università di Torino

Let $S(m,g)$ be the Hörmander class of symbols with weight m and metric g. We denote by $\Psi(m,g)$ the space of pseudodifferential operators with Weyl symbol in $S(m,g)$.
Given a non-negative hypoelliptic operator A in $\Psi(m,g)$, with symbol a such that $\operatorname{Re} a > -c_0|\operatorname{Im} a|$, we show that for all complex numbers z with $\operatorname{Re} z > 0$, the power A^z is a hypoelliptic operator in $\Psi(m^{\operatorname{Re} z}, g)$. As an application we show that $\Psi(m,g) \subset S_p \iff m \in L^p$, where $1 \leq p < \infty$ and S_p is the Schatten-von Neumann class.

Section: Partial Differential Equations, Calculus of Variations.

A remarkable class of overdetermined systems of PDE's

Andreas Cap
Universität Wien

I will report on joint work in progress with T. Branson, M. Eastwood, and R. Gover. Using tools from finite dimensional representation theory of semisimple Lie algebras, we obtain an algorithm to rewrite a large class of quasi-linear overdetermined systems on manifolds in closed form. This leads to upper bounds on the dimension of the spaces of solutions, which can be shown to be sharp, as well as to computable obstructions to the existence of solutions.
The motivation and the ideas for this work come from questions on conformally invariant differential operators on Riemannian manifolds. I will discuss this background as well as some applications in that direction in the lecture.

Award-Winner of the Austrian Mathematical Society.

Connected sum decompositions of four-manifolds

Alberto Cavicchioli
Università di Modena e Reggio Emilia

If M^3 is a closed connected 3-manifold and $\alpha\colon\ \pi_1(M) \to G_1 * G_2$ is an isomorphism, then M can be decomposed, up to diffeomorphism, into a connected sum $M_1 \# M_2$ of closed connected 3-manifolds such that $\pi_1(M_i) \cong G_i$ for $i = 1, 2$. This result is known as *Kneser' s conjecture*. It fails in dimension greater than 4. Recently, it has been shown that Kneser's conjecture holds stably in dimension 4, that is, if one allows additional connected sums with copies of $\mathbb{S}^2 \times \mathbb{S}^2$. However, there are counterexamples to the unstable version of Kneser's conjecture in dimension 4. Let now M^4 be a closed connected oriented 4-manifold in the category TOP (resp. PL = DIFF). The aim of the talk is to present some algebraic conditions under which M^4 decomposes into a non-trivial connected sum, up to homotopy equivalence. Then we illustrate some splitting results for closed 4-manifolds with special fundamental group. The techniques involved in the proofs are based on obstruction arguments and surgery theory.

Section: Topology, Differential Geometry.

New connections between convex geometry and calculus of variations

Andrea Colesanti
Università di Firenze

The Brunn-Minkowski inequality and the solution of the Minkowski problem have a fundamental relevance in the theory of convex bodies. It was recently proved that these results admit various counterparts in the context of Calculus of variations and elliptic partial differential equations, where the role of the volume is played by classic variational functionals such as: the first eigenvalue of the Laplace operator, the capacity and the torsional rigidity. In the talk we will briefly review these results.

Minisymposium 3: Convex Geometry.

Discrepancies on the Sierpinski Carpet

Ligia-Loretta Cristea
Technische Universität Graz

We introduce several types of discrepancies of point sequences on the Sierpinski carpet and establish various estimates relating them. We approach the s-dimensional case, for $s > 1$.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Travelling waves for a one dimensonal BGK model

Carlota Cuesta
Technische Universität Wien

We consider a one dimensional kinetic BGK model, regarded as a relaxation model for scalar conservation laws. We study existence of small amplitude travelling waves via perturbation of a constant state. A projection method, introduced by Caflisch and Nikolaenko to study existence of shock waves for the Boltzmann equation, provides a decoupling of the travelling wave equation into an ordinary differential equation and an integro-differential equation.

Section: Partial Differential Equations, Calculus of Variations.

Brunn-Minkowski type inequalities for the first eigenvalue of a class of elliptic operators

Paola Cuoghi
Università di Modena e Reggio Emilia

The Brunn-Minkowski inequality in its original states that the volume (i.e. the n-dimensional Lebesgue measure) raised to the power $1/n$ is a concave function over the class of n-dimensional convex bodies (that is convex and compact sets with non-empty interior) endowed with the Minkowski addition; note that n is the order of homogeneity of the volume in the Euclidean n-dimensional space. Quite surprisingly, a result of the same fashion holds for the first eigenvalue λ of the Laplace operator (Brascamp and Lieb, 1976), asserting that λ raised to the reciprocal of its homogeneity order is a concave function in the class of convex bodies. We extended the result given by Brascamp and Lieb to the first eigenvalue of the *p-Laplace operator*, for $p > 1$. In this talk it is proposed a sketch of our proof, which holds also for the case $p = 2$ (that is the Laplace operator), but it differs completely from the proof presented by Brascamp and Lieb.

Section: Geometry.

Modified splines for the evaluation of certain finite-part integrals

Vittoria Demichelis
Università di Torino

Two classes of polynomial splines, which are optimal approximations on a finite interval of the real line, are considered: the quasi interpolatory splines and the nodal splines. Interpolatory conditions of Hermite type are imposed at the endpoints of the approximation interval [1]. The modified splines, obtained by imposing endpoints conditions, retain the approximation properties of the unmodified ones and satisfy the conditions required by a uniform convergence theorem for finite-part integrals which are derivatives of weighted Cauchy principal value integrals [2]. Consequently, these modified splines can be used in the numerical evaluation of such finite-part integrals.

[1] V. Demichelis, P. Rabinowitz, *Finite-part integrals and modified splines,* submitted (2003).

[2] P. Rabinowitz, *Uniform convergence results for finite-part integrals which are derivatives of Cauchy principal value integrals,* Workshops on Analysis celebrating the 60th birthday of Peter Vertesi and in memory of Otto Kis and Arpad Elbert. Alfred Renyi Institute of Mathematics, Budapest, 2001.

Section: Numerical Mathematics, Scientific Computing.

The Keller-Segel model with small diffusivity

Yasmin Dolak
Technische Universität Wien

Chemotaxis, which can be defined as the biased migration of cells towards or away from chemical gradients, has been studied mathematically by many authors. We study the classical model for chemotaxis, the so-called Keller-Segel model, which is a drift-diffusion equation for the cell density coupled with an elliptic equation describing the evolution of the chemoattractant. We consider the case of small diffusivity and investigate the limit as the diffusion coefficient goes to zero. Considering a model where the drift term vanishes at high cell densities leads to a nonlinear equation which allows the formation of shocks in the limit. Moreover, we look at the long term behaviour of solutions.

Section: Partial Differential Equations, Calculus of Variations.

On the lattice profile of pseudorandom number sequences

Gerhard Dorfer
Technische Universität Wien

Let $(\eta_n)_{n=0}^{\infty}$ be a sequence of elements in some field $\mathbb{K}$. For given $s \geq 1$ and $N \geq 2$ we say that (η_n) passes the s-dimensional N-lattice test if the vectors $\{\underline{\eta}_n - \underline{\eta}_0 \mid 1 \leq n \leq N - s\}$ span $\mathbb{K}^s$, where $\underline{\eta}_i = (\eta_i, \eta_{i+1}, \ldots, \eta_{i+s-1})$. The greatest s such that (η_n) satisfies the s-dimensional N-lattice test is called the *lattice profile* of (η_n) at N and is denoted by $S((\eta_n), N)$.
We specify significant properties of the lattice profile and study the relationship between $S((\eta_n), N)$ and the Nth *linear complexity* $L((\eta_n), N)$ which is the least order L of a linear recurrence relation over $\mathbb{K}$

$$\eta_{n+L} = \alpha_0\eta_n + \alpha_1\eta_{n+1} + \ldots + \alpha_{L-1}\eta_{n+L-1}, \quad 0 \leq n \leq N - L - 1,$$

satisfied by the first N terms of (η_n).
The linear complexity profile and the lattice profile provide information on the intrinsic structure of a sequence and for instance can be utilized as quality measures for pseudorandom number sequences.

Section: Algebra.

On characteristic polynomials of molecular graphs

Dietmar Dorninger
Technische Universität Wien

We consider molecular graphs whose vertices and edges are both weighted by real numbers corresponding to Coulomb and resonance integrals of the underlying chemical compounds. Given a molecular graph G we derive recursive procedures to find the characteristic polynomials of graphs that are obtained when new vertices and edges carrying new weights are added to G or vertices and edges of G are substituted. Exploiting these recursions, if G is a cycle or path, we obtain explicit formulas for the characteristic polynomials in which Chebyshev polynomials occur. Since the zeros of the characteristic polynomials approximately correspond to the energy values of electrons it is of interest to know about the influence of new atoms when added to a given compound or when atoms of a compound are substituted. For this end we determine factors of the characteristic polynomials that do not depend on the weights of the newly introduced atoms and their bonds which leads to the investigation of common divisors of Chebyshev polynomials.

D. Dorninger, H. Länger, *On characteristic polynomials of molecular graphs with heteroatoms*, Int. J. Pure Appl. Math, to appear.

Section: Discrete Mathematics, Algorithms.

The Height of Digital Search Trees

Michael Drmota
Technische Universität Wien

It has been expected by Kesten that the height of symmetric digital search trees is asymptotically concentrated at (at most) two consecutive levels. In this talk I present a proof of this conjecture with help of the first and second moment method that relies on a precise asymptotic analysis of the second moments of the profile.

Section: Discrete Mathematics, Algorithms.

A stochastic algorithm for global optimization

Mirjam Duer
Technische Universität Darmstadt

Finding the (global) maximum of a function over a set of constraints is, in general, a difficult task. Two types of methods have been used for this purpose: Deterministic procedures (like Branch-and-Bound) and stochastic algorithms. This talk introduces a stochastic optimization algorithm called Improving Hit-and-Run (IHR). We discuss possible stopping criteria and report on the performance of the algorithm when solving fractional optimization problems, a class of problems arising from applications in economics.
This is joint work with Zelda B. Zabinsky and Charoenchai Khompatraporn (University of Washington).

Section: Probability Theory, Statistics.

A Markov type inequality for higher derivatives

Peter Dörfler
Montanuniversität Leoben

Let $\|.\|$ be the weighted L^2-norm with Laguerre weight $w(t) = \exp(-t)$. Let P_n be the set of all complex polynomials whose degree does not exceed n, and let $\gamma_n^{(\nu)} := \sup_{p \in P_n} \big(\|p^{(\nu)}\|/\|p\|\big)$, $p^{(\nu)}$ being the ν-th derivative of p. The talk deals with the asymptotic value of $\gamma_n^{(\nu)}$ as $n \to \infty$.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Congruence classes in universal algebra

Günther Eigenthaler
Technische Universität Wien

In the talk, a new book with the same title will be presented, written by the authors Ivan Chajda, Günther Eigenthaler and Helmut Länger, published by the Heldermann Verlag, Lemgo (Germany), 2003. The book has 230 pages and is divided into 12 chapters: 1. Preliminaries, 2. Examples of algebraic structures, 3. Congruence conditions, 4. Congruence classes and subalgebras, 5. Extension properties of congruences and their classes, 6. Regularity and its modifications, 7. Coherence and its modifications, 8. Local congruence conditions, 9. Characterization of congruence classes, 10. Ideals in universal algebra, 11. Directly decomposable congruence classes, 12. One-block congruences.

Section: Algebra.

Hölder continuity results for a class of functionals with non standard growth

Michela Eleuteri
Università di Trento

In this seminar we would like to present some regularity results for scalar minimizers of functionals with nonstandard growth (see [M]), also in the case of a minimization problem with obstacle. We deal with functionals of the following type:

$$\mathcal{F}(u,\Omega) := \int_\Omega f\big(x,u(x),Du(x)\big)\,\mathrm{d}x,$$

where Ω is a bounded open set of $\mathbb{R}^n$, while $f : \Omega \times \mathbb{R} \times \mathbb{R}^n \longrightarrow \mathbb{R}$ is a Carathéodory function and $u \in W^{1,1}_{\mathrm{loc}}(\Omega,\mathbb{R})$. The main assumption is that f satisfies a $p(x)$-type growth, that is

$$|z|^{p(x)} \le f(x,u,z) \le L\big(1+|z|^{p(x)}\big)$$

where $p(x) > 1$ is a *variable growth exponent* and it is continuous and f satisfies suitable assumptions of convexity with respect to the variable z. Such type of energies owe their importance to the fact that several models (also non variational) coming from Mathematical Physics are built using a variable growth exponent (see [R], [AM2]). Under sharp assumption on the modulus of continuity of $p(x)$ we prove regularity results for the minimizers. In particular, if $p(x)$ is Hölder continuous, the gradient is Hölder continuous too. A model functional that satisfies our assumption is:

$$\int_\Omega a(x,u)|Du|^{p(x)}\,\mathrm{d}x,$$

where $a(x,u)$ is a bounded function which is far from zero and continuous. The results are contained in [E1],[E2] and generalize the results contained in [AM1].

[AM1] E. Acerbi, G. Mingione, *Regularity results for a class of functionals with nonstandard growth*, Arch. Ration. Mech. Anal.,156, 121–140 (2001).

[AM2] E. Acerbi, G. Mingione, *Regularity results for stationary electro-rheological fluids*, Arch. Ration. Mech. Anal., 164 no. 3, 213–259 (2002).

[E1] M. Eleuteri, *Hölder continuity results for a class of functionals with non standard growth*, to appear on Boll. Un. Mat. Ital.

[E2] M. Eleuteri, *Regularity results for the obstacle problem and for the double obstacle problem under non-standard growth condition*, in preparation.

[M] P. Marcellini, *Regularity and existence of solutions of elliptic equations with p, q-growth conditions*, J. Differential Equations, 90, no. 1, 1–30 (1991).

[R] M. Růžička, *Electrorheological fluids: modeling and mathematical theory*, Lecture notes in Mat. 1748, Springer Verlag, Berlin, Heidelberg, New York, 2000.

Section: Partial Differential Equations, Calculus of Variations.

Dimensionally reduced gravity: Dressing group as Poisson-Lie action

Karen Elsner
Max-Planck-Institut für Physik, München

The integrable sector of Einstein's equations comprises all solutions with two commuting Killing vector fields. It is obtained from the four dimensional theory via dimensional reduction. The resulting differential equation is called the Ernst equation. Although this equation can be brought into Lax form, it differs in essential features from other integrable systems, since its spectral parameter is spacetime dependent. Nevertheless, several methods from the theory of integrable systems can be applied with slight modifications. After introductory remarks, we will briefly explain how a Poisson-Lie action for the Ernst equation has been constructed by Korotkin and Samtleben. Secondly, we will introduce the group of dressing transformations of the Ernst system as formulated by Bernard, Julia, Regnault. In contrast to other integrable systems, these two concepts are not related in an obvious manner in case of the Ernst equation. It is, thus, the purpose of this talk to explain, how the dressing group can be realized as Poisson-Lie action in this particular setting.

Section: Topology, Differential Geometry.

Das Projekt mathe online

Franz Embacher
Universität Wien

Die unter `http://www.mathe-online.at/` frei zur Verfügung stehende Plattform bietet einen Pool an Materialien zum Lernen von Mathematik und, in zunehmendem Maße, Werkzeuge zur Gestaltung von Unterrichtsabläufen. Ursprünglich auf den Stoff der Oberstufe (Sekundarstufe II) fokussiert, werden nun verstärkt Einsatzszenarien für Universitäten, Fachhochschulen und pädagogische Akademien entwickelt. Inhalt:

- Das "stehende" Angebot: Visualisierungen, Tests, Hintergründe, Online-Werkzeuge und die jeweils zugrunde liegenden didaktischen Konzepte.
- Die von BenutzerInnen gestaltete Komponente: Open Studio und das Werkzeug der Lernpfade.
- Das Projekt "Perspektiven für einen zeitgemäßen Mathematikunterricht" – Einsatzformen in der Schule.
- Das Projekt "Neue Medien in der Mathematik-Ausbildung" – Einsatzformen in Universität, Fachhochschule und pädagogischer Akademie.

Universities of the Applied Sciences Meeting.

Applying Entropy Entropy-Dissipation Methods

Klemens Fellner
Technische Universität Wien

The talk presents in two examples entropy entropy-dissipation methods, which provide explicit estimates on monotonely (decaying) entropy functionals based on bounds of the entropy in terms of the entropy-dissipation (eg. logarithmic Sobolev inequalities).
The first example discusses the intermediate time asymptotics of diffusion dominated porous media (type) equations with convection resp. absorption term, where the solutions approach Barenblatt-Pattle profiles with polynomial rate.
The second class of examples consider reaction-diffusion systems on bounded Neumann domains modelling reversible chemical reactions, where exponential convergence to the chemical equilibrium can be shown provided strong enough a-priori estimates.

Section: Partial Differential Equations, Calculus of Variations.

Sets of joint probability measures generated by random sets

Thomas Fetz
Universität Innsbruck

The uncertainties of the parameters λ_k of a model $g(\lambda_1, \ldots, \lambda_n)$ are described by random sets or by sets of probability measure generated by random sets. A special set of joint probability measures can be generated by using the formula for the joint plausibility measure. The goal is to generate further sets of joint probability measures by adding or dropping certain constraints, such that the joint uncertainty of all parameters $(\lambda_1, \ldots, \lambda_n)$ is modelled according to different types of independence such as strong independence, epistemic independence und unkown interaction.

Section: Probability Theory, Statistics.

A method for proving polynomial enumeration formulas

Ilse Fischer
Universität Klagenfurt

Many enumeration formulas are polynomials in certain parameters if others are fixed. For example the number of subsets of $\{1, 2, ..., n\}$ with k elements is given by the binomial coefficient, which is a polynomial in n for fixed k. I will present an elementary method for proving such enumeration formulas, i.e. polynomial enumeration formulas of combinatorial objects which depend on an integer parameter n and that factorize into distinct linear factors over $\mathbb{Z}$. Roughly speaking the idea is to prove such enumeration formulas by "explaining" the zeros of the enumeration polynomial. More precisely the method is divided into the following three steps.
1. Extension of the combinatorial interpretation: Typically the admissible domain of n is a set S of non-negative integers. In the first step of our method we have to find (most likely new) combinatorial objects indexed by an arbitrary integer n which are in bijection with the original objects for n in S.
2. The extending objects are enumerated by a polynomial: The extension of the combinatorial interpretation in the previous step has to be chosen such that the extending objects are enumerated by the same polynomial as the original objects. Moreover the degree of this polynomial has to be computed.
3. Exploring "natural" linear factors of the polynomial: Finally one has to find the n's for which there exist none of these objects, i.e. one has to compute the (integer) zeros of the polynomial.
Moreover I will report on applications and extensions of this method, most remarkable a refinement of the Bender-Knuth (ex-)Conjecture.

Section: Discrete Mathematics, Algorithms.

Fundamentale Ideen als ordnende Prinzipien und Orientierungshilfe. Bemerkungen zur fachdidaktischen Ausbildung im Lehramt Mathematik und Informatik.

Karl Josef Fuchs
Universität Salzburg

Die Fachdidaktik ist eine Disziplin im Spannungsfeld zwischen Praxis und Theorie. In der sogenannten Stoffdidaktik wird sie der Ausbildung durch eine Mathematik / Informatik in der Schule / für die Schule gerecht.
Darüber hinaus hat die Fachdidaktik aber die Lehramtstudierenden zu befähigen, den Unterricht zielgerichtet zu planen. Obwohl es schwer ist, solche allgemein gültigen Techniken zu formulieren, erweisen sich doch Modellbilden, Algorithmisieren und Approximieren als zeitlose Inhalte und Strategien der Mathematik und Informatik. Beispiele aus den aktuellen Lehrplänen der beiden Unterrichtsfächer sollen dies verdeutlichen.

Section: Mathematics Teaching.

Polynomial Diophantine m-tuples

Clemens Fuchs
Technische Universität Graz

A set of m polynomials $\{a_1, \ldots, a_m\}$ with integer coefficients, which are not all constant, is called a polynomial Diophantine m-tuple, if for all $1 \leq i < j \leq m$ the following holds: $a_i \cdot a_j + 1 = b_{ij}^2$, where $b_{ij} \in \mathbb{Z}[x]$. The main problem is finding an upper bound for m. In this talk, we will give a survey on known results, beginning with a short introduction to the classical theory of Diophantine m-tuples. The talk will also include recent results (jointly with A. Dujella) in this subject area.

Section: Number Theory.

A mathematical model for wax deposition in the flow of a waxy crude oil.

Lorenzo Fusi
Università di Firenze

In this work we present a mathematical model for the flow of a waxy crude oil in a laboratory experimental loop, taking into account wax deposition phenomena. Waxy crude oils are mineral oils charachterized by a high concentration of wax, or paraffin. The latter may be dissolved or segregated as solid crystals, for sufficiently low temperatures. The flow is studied in a laboratory experimental loop, i.e. a closed system in which the oil is being circulated by a pump. Due to the presence of crystals, the material behaves like a gel which can be modelled as a Bingham fluid with rheological parameters (yield stress and viscosity) depending on the amount and state of the segregated phase. The evolution of the crystals is in turn influenced by the flow. The system is studied in non-isothermal conditions. For what wax deposition is concerned, we consider the mechanism of shear dispersion and molecular diffusion which are responsible for the formation of a solid deposit on pipe walls. Other mechanisms as Brownian diffusion and gravity settlings are neglected. The mathematical problem arising from the model is a free boundary problem with two free boundaries: the inner plug of the Bingham fluid and the deposit at the wall. We prove well posedness of such a problem performing a quasi-steady approximation for the velocity field. We also determine a condition for the cooling rate of the pipe wall that ensures that the two boundaries will never touch each other (causing the stop of the flow).

Minisymposium 2: Mathematics in Industry.

Local theory of pseudo-differential operators in Colombeau algebras

Claudia Garetto
Università di Torino

We present a local theory of pseudo-differential operators acting on the Colombeau algebras of generalized functions $\mathcal{G}_c(\Omega)$ and $\mathcal{G}(\Omega)$. Several issues relating to mapping properties, kernels and regularity theory are discussed.

Section: Partial Differential Equations, Calculus of Variations.

On a Model to Describe Tunnel Fires

Ingenuin Gasser
Universität Hamburg

We present a model derived to describe fire events in vehicular tunnels. We discuss the derivation from the compressible Navier-Stokes equations. Analytical result concerning the stationary and the transient model are presented. We show numerical simulations and comparisons to real tunnel fires.

Minisymposium 2: Mathematics in Industry.

On the Space of Real Algebraic Morphisms

Riccardo Ghiloni
Università di Trento

We present several results concerning basic properties of the spaces of morphisms between real algebraic varieties. Our results show a surprising intrinsic rigidity of Real Algebraic Geometry and illustrate the great distance which, in some sense, exists between this geometry and Real Nash one. Let us give an example of this rigidity. We say that a real algebraic variety X is rigid if, for each irreducible real algebraic variety Z, the set of all nonconstant regular morphisms from Z to X is finite. We are able to prove that, given a compact smooth manifold M of positive dimension, there exists an uncountable family $\{M_i\}_{i\in I}$ of rigid affine nonsingular real algebraic varieties diffeomorphic to M such that, for each $i \neq j$ in I, M_i is not biregularly isomorphic to M_j.

Section: Geometry.

Kolmogorov (1903-1987), Bruno de Finetti's problem, and Levy processes

Hans-Joachim Girlich
Universität Leipzig

The centenary of Andrei Kolmogorov's birthday should be good reason for remembering Bruno de Finetti's contribution to homogeneous stochastic processes which significantly influenced Kolmogorov's as well as Paul Levy's work in probability theory.

Section: History and Philosophy of Mathematics.

Extended admissible functions and Gaussian limiting distributions

Bernhard Gittenberger
Technische Universität Wien

We consider an extension of Hayman's notion of admissibility to bivariate generating functions $f(z,u)$ that have the property that the coefficients a_{nk} satisfy a central limit theorem, i.e., there exist sequences μ_n and σ_n ($\sigma_n \to \infty$) such that

$$\sum_{k \le \mu_n + x\sigma_n} a_{nk} = a_n \Phi(x) + o(a_n)$$

where Φ is the standard normal distribution function. It is shown that these admissible functions have certain closure properties. Thus, there is a large class of functions for which it is possible to check this kind of admissibility automatically. We apply this concept to various combinatorial examples.

Section: Discrete Mathematics, Algorithms.

An abstract approach to the study of local solvability of PDEs with multiple characteristics

Todor Gramchev
Università di Cagliari

We propose an abstract approach for the study of local solvability in C^∞ and Gevrey classes of PDE with multiple characteristics. The main tool is a construction of asymptotic solutions with nonclassical phase functions.

Minisymposium 4: Microlocal Analysis.

Stability Problems in the Theory of Convex Sets

Helmut Groemer
University of Arizona

Many theorems in the classical theory of convex bodies state that under certain conditions a convex body must be of a special type, for example a sphere or an ellipsoid. More recently the stability of such theorems has been studied. That means, it has been investigated how much a convex body deviates from the special type if the characterizing conditions are only approximately satisfied. Similar stability problems arise when one wishes to estimate the deviation of two convex bodies from each other if some information concerning the proximity of their respective sections or projections is available. After introducing appropriate deviation measures for convex bodies I will discuss various representative stability results and problems. Knowledge of the theory of convex sets is not a prerequisite for understanding the lecture.

Plenary Lecture.

Arithmetik von Kongruenzmonoiden

Franz Halter-Koch
Universität Graz

Kongruenzmonoide natürlicher Zahlen sind die einfachsten Beispiele arithmetisch interessanter Monoide ohne eindeutige Primfaktorisierung. Der vorgestellte abstrakte Rahmen zu ihrer Behandlung ist auch auf Nicht-Hauptordnungen in Holomorphieringen globaler Körper und eine große Klasse endlich erzeugter Integritätsbereiche anwendbar.

Section: Number Theory.

A Three-dimensional Laguerre Geometry

Hans Havlicek
Technische Universität Wien

We investigate the Laguerre geometry which arises from the 3-dimensional real local algebra $\mathbb{L} := \mathbb{R}(\epsilon)$, where $\epsilon^3 = 0$. This algebra generalizes the well known algebra of real dual numbers.
The Laguerre geometry based on $\mathbb{L}$ has as point set the projective line $\mathbb{P}(\mathbb{L})$ over $\mathbb{L}$. The chains (circles) of this geometry are the real sublines of $\mathbb{P}(\mathbb{L})$. The projective line over $\mathbb{L}$ can be seen as the real affine 3-space on the vector space $\mathbb{L}$ together with an affine plane of "improper points". (So this is not the projective extension, where a projective plane is added.) We associate with each improper point the set of all chains through this point. In this way each improper point is represented – in terms of the affine space on $\mathbb{L}$ – via an equivalence class of curves (lines, parabolas, or cubic parabolas). We describe these systems of curves thus improving an earlier result of H.J. Samaga.

Section: Geometry.

Gaussian Limits of Multiparameter Empirical K-Functions of Spatial Poisson Processes

Lothar Heinrich
Universität Augsburg

We prove functional central limit theorems for two types of set-indexed estimators of the reduced second meoment measure in case of a homogeneous Poisson process which is observed on a unboundedly growing sampling window in R^d. This allows (at least in principle) to determine the asymptotic distribution of the maximal deviation between empirical and true second-moment measure (under the Poisson assumption) over certain classes of index-sets admitting a parameter representation. The case of symmetric rectangular index-sets is studied in detail and, based on it, two goodness-of-fit tests for checking the Poisson hypothesis with known resp. unknown intensity are suggested.

Section: Probability Theory, Statistics.

A construction concerning $(l^p)' \subset l^q$

Gilbert Helmberg
Universität Innsbruck

For $1 < p < \infty$ let $\frac{1}{p} + \frac{1}{q} = 1$. Given a sequence of complex numbers β_k $(1 \le k < \infty)$ satisfying $\sum_{k=1}^{\infty} |\beta_k|^q = \infty$, a sequence $a = \{\alpha_k\}_{k=1}^{\infty} \in l^p$ is constructed such that $\sum_{k=1}^{\infty} |\alpha_k \beta_k| = \infty$.

Section: Functional Analysis, Harmonic Analysis.

Classification of Finite Groups containing a CC-subgroup

Wolfgang Herfort
Technische Universität Wien

A proper subgroup M of a group G is called a CC-subgroup of G if the centralizer $C_G(m)$ of every $m \in M^{\#} = M \setminus \{1\}$ is contained in M. In this paper we classify all finite groups containing a CC-subgroup, extending work of many authors. As an application we classify infinite profinite groups, locally finite groups and certain classes of topological groups containing a CC-subgroup.

Section: Algebra.

Signed Digit Expansions in Elliptic Curve Cryptography

Clemens Heuberger
Technische Universität Graz

Elliptic curve cryptography relies on the fact that multiples xP, where P is a point of an elliptic curve and x is an integer, can be computed quickly. This can be achieved using signed digit expansions for x.
In some cryptosystems, linear combinations $x^{(1)}P_1 + \cdots + x^{(d)}P_d$ have to be computed, where $P_1, \ldots, P_d$ are points on an elliptic curve and $x^{(1)}, \ldots, x^{(d)}$ are integers.
We present an algorithm to compute an optimal digit expansion for this purpose and give an average case analysis for it. For $d = 2$, this involves studying a fractal set in the plane.

Section: Discrete Mathematics, Algorithms.

Eine kurze Einführung in die Computeralgebrasysteme Mathematica und Maple

Clemens Heuberger
Technische Universität Graz

Maple und Mathematica sind die derzeit in Lehre, Forschung und Anwendungen wohl verbreitetsten Computeralgebrasysteme, also Mathematik-Software, die ihr Schwergewicht auf die symbolische (im Gegensatz zur numerischen) Lösung verschiedenster mathematischer Probleme legen. Sie erledigen einerseits Routineaufgaben schneller und zuverlässiger, als es durch Rechnung "mit Papier und Bleistift" möglich wäre, und ermöglichen überhaupt erst die Lösung so mancher komplexerer Probleme. Außerdem sind beide mit sehr mächtigen Programmier-Schnittstellen ausgestattet, was die Implementierung eigener Erweiterungen ermöglicht. Schließlich sind auch die graphischen Fähigkeiten der Systeme immer wieder schnelle Hilfen bei der praktischen Lösung von Problemen.
Der Vortrag wird zunächst die Möglichkeiten der beiden Systeme in einem Rundgang durch verschiedene mathematische Gebiete demonstrieren. In einem zweiten Schritt werden die Grundzüge der Bedienung von beiden Paketen anhand einfacher mathematischer Probleme soweit erläutert, wie es für die praktische Arbeit unabdingbar ist. Selbstverständlich kann dadurch nur ein winziger Bruchteil der Fähigkeiten der Systeme abgedeckt werden, weitere Details können jederzeit in den online Hilfen nachgeschlagen werden. In einem abschließenden Teil wird vor häufigen Fehlerquellen gewarnt und die Beschränkungen der beiden Systeme sollen aufgezeigt werden.

Universities of the Applied Sciences Meeting.

Bricard motions

Manfred Husty
Universität Innsbruck

In 1897 R. Bricard ([1]) found three types of non-convex octahedra which have a finite mobility. Mobile octahedra have since then attracted the interest of many mathematicians and geometricians (see e.g. Stachel [2] for references). Within this paper we investigate the relative motion between adjacent faces of these three types of movable polyhedra and show the relations between movable octahedra and self motions of so called 3-3 Stewart-Gough manipulators. As a byproduct we find a complete characterization of all infinitesimal mobile octahedra.

[1] R. Bricard, *Mémoire sur la théorie de l'octaédre articulé*, J. math. pur. appl., Liouville, vol. 3, 113–148 (1897).

[2] H. Stachel, *Zur Einzigartigkeit der Bricardschen Oktaeder*, J. Geom., vol. 28, 41–56 (1987).

Section: Geometry.

Singularity interactions in generalized function algebras

Günther Hörmann
Universität Innsbruck und Universität Wien

Algebras of generalized functions extend distribution theory to allow for nonlinear operations without regularity restrictions on the operands. Combined with a thorough analytic backbone this flexibility has been at the heart of new developments and theories involving nonlinearities with strongly singular objects in partial differential equations as well as differential geometry. Can we still hope for meaningful and precise information on the location or propagation of singularities in such an extended situation? We review intrinsic concepts of regularity for generalized functions, which extend distribution theoretic notions in a compatible way. The emphasis will be on wave front sets and applications to generalized solutions of partial differential equations.

Minisymposium 4: Microlocal Analysis.

Counting Quotient Graphs and Subgroups of Given Index in Free Products of Cyclic Groups

Wilfried Imrich
Montanuniversität Leoben

This talk is concerned with the parity of the number of subgroups of given index in free products of cyclic groups, the starting point being the result of Stothers that the number N_n of subgroups of index n in the modular group is odd if $n = 2^k - 3$ or $2(2^k - 3)$. Similar results are known for Hecke groups, $Z_3 * Z_3$ and $Z_5 * Z_5$.
Here the parity problem for N_n is solved for the groups $Z_2 * Z_p$, $Z_p * Z_p$ and $Z_2 * Z_2 * Z_p$ for $p = 2^k + 1$; it is joint work with Weiping Yao.
The proofs involve formal power series, that is, generating functions, for the numbers of certain quotient graphs of Cayley graphs of free products of cyclic groups and rather intricate recursions.

Section: Discrete Mathematics, Algorithms.

Carleson measures for classical spaces of analytic functions

Hans Jarchow
Universität Zürich
Co-author: Urs Kollbrunner

We consider standardly weighted Bergman spaces A^p_α on the open unit disc D in the complex plane, $\alpha > -1$, $0 < p, q < \infty$. An (α, p, q)-Carleson measure is a measure μ on D such that $f \mapsto f$ defines an operator $J_\mu : A^p_\alpha \to L^q(\mu)$. We characterize, in terms of μ, existence and boundedness of J_μ, further compactness, order boundedness etc. We will also discuss briefly modifications which are needed to incorporate the scale of classical Hardy spaces H^p.

Section: Functional Analysis, Harmonic Analysis.

Bifurcation in nonautonomous differential systems

Russell Johnson
Università di Firenze

We discuss the phenomena of stability breakdown and bifurcation in one-parameter families of non-autonomous differential equations. When the parameter is "small" we use an averaging technique together with integral manifold theory to develop analogues of the classical transcritical and saddle-node bifurcation patterns. We relate our results to certain theorems of Burd-Kolesov-Krasnoselskii.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Discrete Modelling of Homology Searching and Interlocking of Chromosomes

Günther Karigl
Technische Universität Wien

During meiosis diploid chromosome sets are reduced to haploid ones through the separation of homologous chromosomes from each other. This reduction is essential for sexually reproducing organisms to compensate for the fusion of chromosomes during fertilization. We discuss a cellular automaton model as well as a stochastic model in order to describe the process of searching and interlocking of chromosomes in the cell nucleus. The models reflect spatial and temporal behaviour of chromosomes during meiotic pairing and will be compared to each other.

Section: Discrete Mathematics, Algorithms.

Kommutative Ringe mit Feedback-Cyclization-Eigenschaft

Hermann Kautschitsch
Universität Klagenfurt

Die Feedback-Cyclization- Eigenschaft ist eine strengere Form der Polzuordnungseigenschaft. Es werden notwendige, aber auch hinreichende Bedingungen dafür angegeben und speziell auf Systeme über Polynomringe angewendet.

Section: Algebra.

Mindlin's, Boussinesq's and Cerruti's problems and their generalizations to n-dimensional half-spaces

Gerhard Kirchner
Universität Innsbruck

We consider explicit solutions to generalizations of classical boundary value problems in half-spaces. The main tool in the construction is the convolution of distributions.

Section: Partial Differential Equations, Calculus of Variations.

Upper bounds for the permanent of positive matrices

Arnold Richard Kräuter
Montanuniversität Leoben

In this talk I would like to present a new upper bound for the permanent of positive square matrices given in terms of easily computable parameters that depend on the entries of the underlying matrix only. It will be shown that this bound is best possible (i.e., for given parameters there will always be a suitable matrix for which the bound is attained) and that it improves previously obtained results (for positive or nonnegative matrices) under certain conditions.

Section: Discrete Mathematics, Algorithms.

Free subgroups of groups acting on graphs

Bernhard Krön
Universität Wien

Let a group act almost transitively on a graph which is "tree-like" in the sense that it is quasi-isometric to a tree. What can we say about the existence of free subgroups?
Theorem of Gromov and Woess: A group has a finitely generated Cayley graph X which is quasi-isomeric to a tree if and only if it has a finitely generated free subgroup F of finite index. In other words: if and only if it has a finitely generated free subgroup which acts almost transitively on X. In this situation any orbit of F is dense in the end space of X.
We relax the condition of X being a locally finite Cayley graph to the condition that X is any (non-locally finite) connected graph which is quasi-isometric to a tree. If no end of X is fixed by the whole group then there is still a free subgroup F such that all its orbits are dense in the (metric) end space. In general, this does not mean that F is acting (metrically) almost transitive on X. But we can formulate a similar result which involves invariant lines of the generators of F.
These results are joint work with R.G. Möller.

Section: Discrete Mathematics, Algorithms.

Growth of matrix coefficients characterizes the principal series of the free group

Maria Gabriella Kuhn
Università di Milano-Bicocca

Let Γ be the nonabelian free group on a finite symmetric set $A = A^{-1}$ of generators. Denote by $|\cdot|$ the length with respect to A. A representation (π, H_π) of Γ is *tempered* if

$$\phi_\pi(\varepsilon) = \sum_{x\in\Gamma} |\langle \pi(x)v, v\rangle|^2 e^{-\varepsilon|x|} < +\infty$$

for every positive ε and every choice of v in the representation space H_π. A *multiplicative* function $h : \Gamma \to \mathbb{C}$ is a function such that $h(a_1a_2\dots a_n) = h(a_1)h(a_2)\dots h(a_n)$ if $a_1a_2\dots a_n$ is a reduced word. To every multiplicative function it is possible to associate a representation π_h as described in [K-S]: under suitable conditions on the $h(a)_{a\in A}$ π_h will be tempered and irreducible. Let π_s belong either to the principal isotropic series [FT-P] or to the principal anisotropic series [FT-S] representations of Γ. For special choices of the $h(a)_{a\in A}$ the representation π_h is equivalent to π_s. For every $\varepsilon > 0$ let

$$\phi_s(\varepsilon) = \sum_{x\in\Gamma} |\langle \pi_s(x)v, v\rangle|^2 e^{-\varepsilon|x|} \text{ and } \phi_h(\varepsilon) = \sum_{x\in\Gamma} |\langle \pi_h(x)v, v\rangle|^2 e^{-\varepsilon|x|}\ .$$

It is known that (except for the two endpoint representations) $\phi_s(\varepsilon) \simeq \frac{1}{\varepsilon}$. In [K-S] it is shown that , under genericity conditions, $\phi_h(\varepsilon) \simeq \frac{1}{\varepsilon^2}$. Of course those conditions *are not* satisfied when h gives rise to the spherical series and in the same paper we conjectured that the condition

$$\phi_h(\varepsilon) \simeq \frac{1}{\varepsilon}$$

is necessary and sufficient to recover, inside the class of the π_h, the spherical series. We show that this conjecture is true: $\phi_h(\varepsilon) \simeq \frac{1}{\varepsilon}$ if and only if, up to a twist by some unitary character, π_h is equivalent to one of the π_s.

[FT-P] A. Figà-Talamanca, A. M. Picardello, *Harmonic Analysis on Free Groups*, Lecture Notes in Pure and Appl. Math., 87, Marcel Dekker, New York, 1983.

[FT-S] A. Figà-Talamanca, T. Steger, *Harmonic Analysis for Anisotropic Random Walks on Homogeneous Trees*, Memoir A. M. S., 531, American Mathematical Society, Providence, Rhode Island, 1994.

[K-S] M. G. Kuhn, T. Steger, *More irreducible boundary representations of free groups*, Duke Math. J., 82, 381–436 (1996).

Section: Functional Analysis, Harmonic Analysis.

Geometric Theory of Generalized Functions

Michael Kunzinger
Universität Wien

This talk is intended to provide an overview of the development of a "nonlinear distributional geometry" which has recently taken place within the theory of nonlinear generalized functions ([1–5]). Originating in infinite dimensional analysis and initially applied mainly to problems in nonlinear partial differential equations involving singularities, algebras of generalized functions have increasingly found applications to problems of a primarily geometric nature, in particular in general relativity and in symmetry group analysis of differential equations.
This widened range of applicability in turn has brought about additional requirements on the basic building blocks of the theory of nonlinear generalized functions itself. In particular, the questions of diffeomorphism invariance of the construction and of an intrinsic formulation of the theory on differentiable manifolds came to the fore.
In this presentation we outline the structural aspects of the ensuing developments and highlight some applications of the resulting theory in general relativity.

[1] M. Grosser, E. Farkas, M. Kunzinger, R. Steinbauer, *On the Foundations of Nonlinear Generalized Functions I, II*, Mem. Amer. Math. Soc. 153, No. 729 (2001).

[2] M. Grosser, M. Kunzinger, M. Oberguggenberger, R. Steinbauer, *Geometric Theory of Generalized Functions*, Mathematics and its Applications 537, Kluwer, 2001.

[3] M. Grosser, M. Kunzinger, R. Steinbauer, J. Vickers, *A Global Theory of Algebras of Generalized Functions*, Adv. Math. 166, No. 1, 50–72 (2002).

[4] M. Kunzinger, *Generalized functions valued in a smooth manifold*, Monatsh. Math., 137, 31–49 (2002).

[5] M. Kunzinger, R. Steinbauer, J. Vickers, *Intrinsic characterization of manifold-valued generalized functions*, Proc. London Math. Soc., 87 (2), 451–470 (2003).

Award-Winner of the Austrian Mathematical Society.

Generalized Connections and Curvature

Michael Kunzinger
Universität Wien

Over the past few years, nonlinear generalized functions in the sense of J.F. Colombeau have been extended to a functorial theory on differentiable manifolds ([1]). This development in turn has allowed to generalize a number of concepts of smooth differential geometry to encompass situations where the objects of interest are singular (distributional) and appear in a genuinely nonlinear context ("nonlinear distributional geometry").
In this talk we give a short overview of this line of research with emphasis on a theory of generalized connections on principal fiber bundles and in particular of linear generalized connections on differentiable manifolds [2,3]. The ensuing generalized pseudo-Riemannian geometry has found promising applications in general relativity (analysis of singular space-time metrics).

[1] M. Grosser, M. Kunzinger, M. Oberguggenberger, R. Steinbauer, *Geometric Theory of Generalized Functions*, Mathematics and its Applications 537, Kluwer, 2001.

[2] M. Kunzinger, R. Steinbauer, *Generalized pseudo-Riemannian Geometry*, Trans. Amer. Math. Soc. 354, no. 10, 4179–4199 (2002).

[3] M. Kunzinger, R. Steinbauer, J. Vickers, *Generalized connections and curvature*, preprint (2003).

Section: Functional Analysis, Harmonic Analysis.

Noncommutative probability and spectral computations on discrete groups

Franz Lehner
Technische Universität Graz

We survey some aspects of noncommutative probability theory which are relevant for the problem of computing spectra of convolution and transition operators on discrete groups, in particular free product groups.

Minisymposium 1: Harmonic Analysis.

Parametrized solutions of Diophantine equations

Günter Lettl
Karl-Franzens-Universität Graz

We introduce a new notion of parametrized solutions of Diophantine equations, which might enable one to generalize a conjecture of E. Thomas on families of Thue-equations.

Section: Number Theory.

Groups of polynomial growth

Viktor Losert
Universität Wien

We give a survey of results (some of them more recent) on the structure of groups of polynomial growth.

Minisymposium 1: Harmonic Analysis.

Numerical integrators for quantum dynamics

Christian Lubich
Universität Tübingen

The numerical solution of the time-dependent Schrödinger equation poses challenges that are not met by standard numerical integration methods. In different physical settings, the difficulties arise from the presence of different time scales and highly oscillatory solution behaviour, or from high dimensionality of the equation. In this talk I review recent numerical approaches to such problems. Some emphasis will be given to theoretical error bounds, which – together with numerical experiments – are important in identifying and comparing merits and flaws of different numerical methods and in guiding the way to improved methods.

Plenary Lecture.

Zur affinen Differentialgeometrie euklidischer Minimalflächen

Friedrich Manhart
Technische Universität Wien

Die Blasche-Metrik einer Fläche im R^3 gehört zur Konformenklasse der euklidischen zweiten Grundform, die auf Minimalflächen spezielle Form hat. Im Vortrag wird das Verhalten affiner Invarianten insbesondere bei Assoziation untersucht. Dabei ergeben sich auch Beziehungen zur Differentialgeometrie bezüglich der zweiten (euklidischen) Grundform.

Section: Geometry.

Principal solutions for half-linear differential equations

Mauro Marini
Università di Firenze

Principal solutions of the nonoscillatory half-linear differential equation are investigated. It is shown that the property of the principal solutions to be smallest solutions in a neighbourhood of infinity continue to holds also in the half-linear case. In addition it is proved that principal solutions can be fully characterized by means of two different integral criteria, which reduce to that one well-known in the linear case.
The presented results have been achieved in a joint research with Mariella Cecchi (University of Florence) and Zuzana Dosla (University of Brno).

Section: Real and Complex Analysis, Ordinary Differential Equations.

Classical and modern scope of 2-stage metabelian 3-groups with factor commutator group of type (3,3)

Daniel C. Mayer
Daimler Chrysler Consult

The following problems arise for the absolute 3-genus field $K^* = (K|\mathbb{Q})^*$ of a cyclic cubic number field K, whose conductor f is divisible exactly by two primes p, q, whence K^* is a bicyclic bicubic field:

1. to find the structure of the 3-class group $Syl_3Cl(K^*)$ of K^*,
2. to determine the absolute Galois group $G = G(K_1^*|\mathbb{Q})$ of the first Hilbert 3-class field K_1^* of K^* over $\mathbb{Q}$.

G is a 2-stage metabelian 3-group, since $G' = G(K_1^*|K^*) \simeq Syl_3Cl(K^*)$ is abelian. The factor commutator group $G/G' \simeq G(K^*|\mathbb{Q})$ is of type $(3,3)$. We denote by $G = G_1 > G_2 > \ldots > G_m = 1$ the descending central series of class $m-1 \geqq 1$ of G with $G_{i+1} = [G_i, G]$. In particular, $G_2 = [G, G] = G'$. Then we have the following

Theorem.

Let h denote the 3-class number of K.

1. G is abelian of type $(3,3)$, iff $h = 3$.

2. G is metabelian of maximal class, iff $h = 9$.

3. G is metabelian of class 2, order 27, and exponent 3, iff $h = 9$ and the principal factors of K are either $\{pq, p^2q^2\}$ or $\{p^2q, pq^2\}$. In this case, $G' \simeq (3)$.

4. G is metabelian of class 3 and order 81, iff $h = 9$ and the principal factors of K are either $\{p, p^2\}$ or $\{q, q^2\}$. In this case, $G' \simeq (3,3)$.

[1] B. Nebelung, *Klassifikation metabelscher 3-Gruppen mit Faktorkommutatorgruppe vom Typ* $(3,3)$ *und Anwendung auf das Kapitulationsproblem*, Inauguraldissertation, Köln, 1989.

[2] A. Derhem, *Sur les corps cubiques cycliques de conducteur divisible par deux premiers*, Casablanca, 2002.

[3] D. C. Mayer, *Class Numbers and Principal Factorizations of Families of Cyclic Cubic Fields with Discriminant* $d < 10^{10}$, Univ. Graz, Computer Centre, 2002.

Section: Algebra.

Automating the Dependency Pair Method

Aart Middeldorp
Universität Innsbruck

Developing automatable methods for proving termination of term rewrite systems has become an active research area in the past few years. The dependency pair method of Arts and Giesl is one of the more popular such methods. However, there are several obstacles that hamper its successful automation. We present several new ideas to overcome these obstacles.

Section: Mathematical Logic, Theoretical Computer Science.

Convergence to equilibrium for a linearized cometary flow equation

Vera Miljanovic
Technische Universität Wien

We apply an entropy entropy-dissipation approach to show strong convergence to equilibrium for a class of linear spatially inhomogeneous kinetic equations with periodic boundary conditions. We introduce suitable projection operators and orthogonality relations to unify the treatment of different equations such as discrete velocity models or a linearized equation modelling cometary flows.

Section: Partial Differential Equations, Calculus of Variations.

Zur Darstellung von Matroiden

Rainer Mlitz
Technische Universität Wien

Es ist wohlbekannt, daß nicht jedes Matroid durch die linear unabhängigen Mengen eines Vektorraums darstellbar ist. Es stellt sich nun die Frage, ob es zu jedem Matroid eine Halbgruppe von Abbildungen auf der Grundmenge des Matroids gibt derart, daß die Halbgruppe auf genau allen unabhängigen Teilmengen jede Abbildung interpoliert. Es kann einerseits gezeigt werden, daß eine derartige Halbgruppe stets existiert. Stellt man an die Halbgruppe keine zusätzlichen Bedingungen, können allerdings auch manche Nichtmatroide dargestellt werden. Andererseits gibt es Matroide, auf deren Grundmenge keine universale Algebra definiert werden kann, für die die Halbgruppe der Endomorphismen das Matroid im obigen Sinn darstellt.

Section: Discrete Mathematics, Algorithms.

Financial Immunization as a semi-infinite programming problem

Pierpaolo Montana
Università di Roma I

In this paper is presented a reformulation of the classical results on immunization strategies of single liability of Fisher and Weyl and the multiple liabilities of Redington in terms of the modern super-replication theory.
With this reformulation expressed mathematically as a problem of semi-infinite programming, the results of Fisher-Weyl and later results of Shiu and Montrucchio-Peccati, are encompassed, and in some cases generalized.
The connection with the supereplication theory is highlighted and also with the short fall risk approach.
As a final application, some numerical results are given in special cases, using the mathematical methods of semi-infinite programming.

Section: Financial and Industrial Mathematics.

Fermat's Factoring Method for $n = pq$

Willi More
Universität Klagenfurt

Let $n = pq$ with $p < q$ the product of two odd (unknown) primes. The aim is to find a non-trivial factorisation of n. Fermat suggested to factor n we should try to find positive integers x and y so that $n = x^2 - y^2 = (x - y)(x + y)$.
Let $t = \lfloor \sqrt{n} \rfloor$, then $t^2 < n < (t+1)^2$. Searching $(t+1)^2 - n$, $(t+2)^2 - n$, $\ldots$, $(t + k)^2 - n = s^2$ for a square s^2 results in $n = (t + k)^2 - s^2$ with $p = t + k - s$ and $q = t + k + s$ which we call Fermat factorisation in step k.
Using a conjecture by Schinzel and Sierpiński we will show that there exists infinitely many such n which will be factored by Fermat's method in step $k > k_0$ for any given k_0.

This is joint work with Johannes Schoißengeier.

Section: Number Theory.

Supporting Mizar by Methods of Mathematical Knowledge Management

Markus Moschner
Universität Wien
Co-author: Grzegorz Bancerek, TU Bialystok, Poland

Mizar is a language designed by A. Trybulec (Bialystok, Poland) [1] in the early seventies in order to represent mathematical text and proof suitable for automated processing.

It is the fundament for the proof checker with the same name. Because classical logic and Tarski-Grothendieck Set Theory are the basic ingredients [2] most mathematicians need no relearning for a fruitful practice. Its unusual declarative style benefits human approaches. In exchange the rigorosity of writing mathematical text is discouraging.

Mizar grew as a single system (with its own repository of mathematical content) without much interchange with other systems - what was common for many other proof tools, too. The last years have seen efforts to overcome such separations for the benefit of joining strengths of single systems automated procedures: summarized within Mathematical Knowledge Management, where both mathematics and computer science are needed for tackling problems.

Summarized will be ongoing work and concepts on problems: 1) transformation of Mizar content into more widespread formats suitable for theorem provers or content repositories - particularly OMDoc[3] and MBase[4]; 2) easing the proof burden for writing Mizar content such that a "Mizar author" does not need to concentrate on many small or routine tasks which includes utilization of theorem provers and repositories.

[1] A. Trybulec, *The Mizar Logic Information Language*, Studies in Logic, Grammar and Rhetoric, Vol. 1, Bialystok, 1980.

[2] G. Bancerek, *Tarski-Grothendieck Set Theory as a Basis of Knowledge Management System for Mathematics*, 36th Conference of History of Logic, 1990.

[3] M. Kohlhase, OMDoc, *Towards an Internet Standard for the Administration, Distribution and Teaching*, Proceedings of Artificial Intelligence and Symbolic Computation Springer LNAI, 2000.

[4] M. Kohlhase, A. Franke, *MBase: Representing Knowledge and Context for the Integration of Mathematical Software Systems*, Journal of Symbolic Computation 23:4, 365–402 (2001).

Section: Mathematical Logic, Theoretical Computer Science.

Fallstudie zur formalen Grundlegung von Werkzeugen für Angewandte Mathematik

Walther Neuper
Technische Universität Graz

Algebra Systeme sind unverzichtbare Werkzeuge für mathematische Berechnungen und ihre grafische Darstellung zum Lösen von Gleichungen und Vereinfachen von Termen. Nicht zu brauchen sind sie jedoch für exakte mathematische Argumentation: es fehlt ihnen (zumindest den kommerziell verfügbaren Algebra Systemen) die formal-logische Grundlegung. Theorem Prover hingegen stehen auf solidem logischen Grund und werden zunehmend eingesetzt, um Eigenschaften von Hard- und Softwaresystemen mechanisch exakt zu beweisen. Der weitaus überwiegende Teil der Anwendung von Mathematik gilt jedoch der algorithmischen Konstruktion von gesuchten Größen eines Modells aus den gegebenen Größen – das können Theorem Prover wiederum nicht.

Die 'formalen Methoden' der Softwaretechnologie haben Werkzeuge zur mathematischen Modellierung von sicherheits-kritischen Hard- und Softwaresystemen etabliert. Ihr theoretischer Ansatz lässt sich direkt übertagen auf die Beschreibung von Aufgabenstellungen der angewandten Mathematik.

Eine solche Aufgabenstellung dient als Fallbeispiel, um die verschiedenen Ansätze von Algebra Systemen, Theorem Provern und Formalen Methoden beim Beschreiben und Lösen der Aufgabenstellung zu demonstrieren und zu diskutieren.

Section: Mathematical Logic, Theoretical Computer Science.

Reflexion als didaktisches Prinzip und als Designprinzip für Mathematik-Lernsoftware

Walther Neuper
Technische Universität Graz

'Mathematik ist die Methode schrittweise formalen Operierens, wobei jeder Schritt begründbar ist!' Mathematische Begründung ist letztendlich ein formaler Beweis, also selbst wiederum formales Operieren – rekursiv auf sich selbst angewandt. Die rekursive Anwendung der Mathematik auf sich selbst ergibt sich aus dem Wesen menschlichen Denkens, das sich durch Reflexion von anderen Daseinsformen abgrenzt.
In diesem Sinne wurde Reflexion durch guten Mathematikunterricht seit jeher befördert, und eine Deklaration als didaktisches Prinzip bringt nichts Neues.
Neu sind jedoch die Möglichkeiten der Mathematik und Softwaretechnologie, 'Reflexion' auf Computern zu transparent zu machen: Software 'kann Mathematik' nicht nur (als Black-Box wie ein Algebrasystem), sondern stellt auch das Wissen und die Funktionen der Software dar, die dieses 'Mathematik-Können' steuern.
Der Vortrag stellt den Prototypen eines solchen Mathematik-Systems vor und diskutiert seine technischen Gegebenheiten sowie didaktische Implikationen.

Section: Mathematics Teaching.

3-dimensional Hot Rolling Simulation

Andreas Obereder
Universität Linz

In the simulation of hot rolling processes some effects of interest (e.g. broadening, deformation of the work roll, outlet profiles.) can only be calculated in a three-dimensional simulation. Such 3D-Simulations are numerically expensive. Therefore a fast quasi-stationary description in Eulerian coorinates with deformation-updates via streamline integration was developed. The used plastic material law is implemented as nonlinear Newton fluid; the pressure terms are eliminated with a penalty formulation afterwards to avoid Mixed Finite Elements. The solution of the free boundary value resp. contact problem leads to a nonlinear variation inequality which is solved iteratively in Eulerian coordinates. The Code can handle nonlinear plastic materials, friction between roller and the slab, deformed working rolls and grid adoptions. In the results section simulations for edger and flat pass runs are presented.

Minisymposium 2: Mathematics in Industry.

Positive solutions of an indefinite mean curvature problem

Pierpaolo Omari
Università di Trieste

The existence of positive solutions is proved for the prescribed mean curvature problem for nonparametric surfaces

$$-\operatorname{div}\left(\frac{\nabla u}{\sqrt{1+\|\nabla u\|^2}}\right) = \lambda f(x,u) + g(x,u) \text{ in } \Omega, \quad u(x) = 0 \text{ on } \partial\Omega,$$

where $\Omega \subset \mathbb{R}^N$ is a bounded smooth domain, not necessarily radially symmetric. We assume that $\int_0^u f(x,s)\,ds$ is locally subquadratic at 0, $\int_0^u g(x,s)\,ds$ is superquadratic at 0 and $\lambda > 0$ is sufficiently small. A multiplicity result is also obtained, when $\int_0^u f(x,s)\,ds$ has an oscillatory behaviour near 0. We allow f and g to change sign in any neighbourhood of 0.
Our approach uses an upper and lower solution method, combined with a variational argument and a phase-plane analysis for an associated one-dimensional problem.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Exponential Runge-Kutta methods

Alexander Ostermann
Universität Innsbruck

Exponential integrators have been developed for the numerical solution of stiff differential equations. More precisely, the are intended for problems where the solution of the linearization contains fast decaying and/or highly oscillatory components. They are problem-adapted in the sense that essential properties of the exact solution of a prototypic equation are identified and mimicked by the numerical scheme.
In my talk I will discuss the construction of exponential integrators based on Runge-Kutta methods. The error analysis will be carried out in an abstract framework of sectorial operators. The talk is based on joint work with Marlis Hochbruck (Düsseldorf).

Section: Numerical Mathematics, Scientific Computing.

Distribution results for Steiner-distances in certain tree families

Alois Panholzer
Technische Universität Wien

The Steiner-distance of p selected nodes in a graph is defined as the size of the smallest subtree containing all these nodes. It is thus a natural generalization of the distance between two selected nodes. In this talk we show, how one can study this parameter for several (rooted) tree families, where we assume, that these p nodes in the tree are randomly chosen. By using a generating functions approach, we obtain limiting distribution results for a fixed number p of selected nodes when the tree-size $n \to \infty$. As an auxiliary result, we get also limiting distribution results for the size of the ancestor-tree of p randomly selected nodes, a quantitiy which is of particular interest in analyzing search tree structures and a variant of the Quicksort sorting algorithm.

Section: Discrete Mathematics, Algorithms.

Gröbnerbasen - das wesentliche Hilfsmittel zum Rechnen mit Polynomen in mehreren Variablen

Franz Pauer
Universität Innsbruck

Das Rechnen mit Polynomen in mehreren Variablen spielt in vielen Gebieten der Mathematik und ihrer Anwendungen eine bedeutende Rolle. Man braucht es nicht nur zum Lösen von Systemen polynomialer Gleichungen, sondern zum Beispiel auch zum Lösen von Systemen linearer partieller Differenzen- oder Differentialgleichungen mit konstanten Koeffizienten. Die von B. Buchberger entwickelte und nach seinem Lehrer W. Gröbner benannte Theorie der Gröbnerbasen ist heute das wesentliche Hilfsmittel dazu. Sie ist in vielen Computeralgebrasystemen (Maple, Mathematica,...) implementiert. In diesem Vortrag werden die wichtigsten Begriffe (Ideal, Termordnung, Gröbnerbasis, S-Polynom) und grundlegende Ergebnisse aus der Theorie der Gröbnerbasen (Division mit Rest, Buchbergeralgorithmus) erklärt und ihre Anwendung auf Systeme polynomialer Gleichungen sowie auf Systeme linearer partieller Differenzengleichungen besprochen.

Teachers' Meeting.

On relative isoperimetric inequalities.

Carla Peri
Università Cattolica S.C., Milano

We give an overview of results on and applications of relative isoperimetric inequalities for convex bodies.

Minisymposium 3: Convex Geometry.

Kombinatorisch motivierte polynomielle diophantische Gleichungen

Oliver Pfeiffer
Montanuniversität Leoben

Wir untersuchen die Endlichkeit der Anzahl der Lösungen der polynomiellen diophantischen Gleichung $P_n(x) = P_m(y)$, wobei die Polynome $P_n(x)$ durch die Rekursion $P_{n+1}(x) = xP_n(x) + c_nP_{n-1}(x),\ P_{-1}(x) = 0,\ P_0(x) = 1$ mit rationalen Zahlen c_n definiert seien. Solche Rekursionen haben ihren Ursprung häufig in kombinatorischen Abzählproblemen, von denen sich die Positivheit der Koeffizienten c_n auf die Rekursion und damit gewisse Regularitätseigenschaften (Vielfachheit der Extremwerte) der zugehörigen orthogonalen Polynome auf die $P_n(x)$ übertragen. Unter diesen Bedingungen lässt sich zeigen, daß die angeführte diophantische Gleichung höchstens endlich viele (unter Umständen effektiv berechenbare) ganzzahlige Lösungen besitzt.

Section: Number Theory.

Symmetrized digital nets with minimal order of L_2-discrepancy

Friedrich Pillichshammer
Universität Linz

It is a well known fact in the theory of uniform distribution modulo 1 that the symmetrization of point sets in the unit cube may result in a decreased order of L_2-discrepancy compared to the L_2-discrepancy of the unsymmetrized point set.
We consider digital $(0, m, 2)$-nets in base 2 and give conditions on the generator matrices of such nets such that the corresponding symmetrized point set has minimal order of L_2-discrepancy in the sense of the lower bound due to K. Roth.

Section: Number Theory.

A Geometric Analysis of the Lagerstrom Model

Nikola Popovic
Technische Universität Wien

We give a geometric singular perturbation analysis of a classical problem proposed by Lagerstrom to illustrate the ideas involved in the rather intricate asymptotic treatment of low Reynolds number flow. We present a geometric proof based on the blow-up method for the existence and uniqueness of solutions. Moreover, we show how asymptotic expansions for these solutions can be obtained in this framework, thereby establishing a connection to the method of matched asymptotic expansions.

Section: Real and Complex Analysis, Ordinary Differential Equations.

On the geometry of distance functions

Helmut Pottmann
Technische Universität Wien

Given a geometric object Φ in a Euclidean space or a Riemannian manifold X, the distance function d assigns to each $x \in X$ the shortest distance $d(x)$ of x to Φ. We will briefly survey our recent work on the geometry of $d(x)$ and in particular its square d^2. Fast computations as well as efficient representations of this function or approximants to it will be studied and applied to various problems in Industrial Geometry. These include surface approximation, matching problems between geometric objects and the segmentation of images.

Section: Geometry.

Finite dimensional representations of algebras

Claudio Procesi
Università di Roma

We describe some algebraic geometric methods in representation theory based on the Cayley-Hamilton identitity and formal characters.

Plenary Lecture.

Analysis of algorithms and its relation to combinatorics, number theory, and probability theory

Helmut Prodinger
University of the Witwatersrand

Analysis of Algorithms was founded by Donald Knuth 40 years ago. His motivation was to analyse algorithms as thoroughly and quantitatively as possible. This discipline has a long tradition in Austria as well. Combinatorialists are especially attracted by this field since discrete (random) structures and the appropriate tools are a major issue. Number theory and asymptotic methods also play a prominent role. While people who analysed algorithms in the early years concentrated on averages and sometimes variances, one likes nowadays to identify the limiting distributions of the relevant parameters. Significant progress has recently been made: quasi-power theorem and contraction method.
The talk will provide a few attractive examples, including Ramanujan's Q- function, singularity analysis of generating functions, sum-of-digits function, and the Quicksort distribution.

Plenary Lecture.

Computation of steady states in flue gas washers

Georg Propst
Universität Graz

A flue gas washer is a plant for the absorption of noxious components of industrial gas output. In a joint project with G.Desch and K.Horn we considered spray towers that are designed by Austrian Energy & Environment in Graz. In such a tower, SO_2 is washed out of power plant flue gas by means of artificial rain containing $CaCO_3$. In industrial practice, the plant is operated under long term constant gas and water input. We derive a mathematical model for equilibrium states that consists of a system of 9 nonlinearly coupled equations for the relevant space dependent chemical concentrations in the gas and in the water. An algorithm for the computation of solutions of the discretized model is presented; the application of the algorithm in the design and optimization of spray towers is discussed.

To be more specific, the model involves three chemical components of the gas, five ingredients of the water drops and the concentration of hydrogen ions, m_{H^+}. By assumption, in the tower the flow of gas and water drops is strictly vertically up and down, respectively. Then the equilibrium concentrations are functions of one space coordinate. We discretize by slicing the tower into N cells and derive the equilibrium balance for each cell by equating the gains and losses due to the flow, the chemical reactions and the mass transfer from the gas into the water. This gives a system of $9N$ algebraic equations. We solve this system by up-down iterations: holding the current water concentrations fixed, we solve for the corresponding gas concentrations beginning at the bottom cell (with given gas inflow) up, cell by cell, to the top. Then, holding the current gas concentrations fixed, the corresponding water concentrations are computed starting at the top cell (with given water inflow) down, cell by cell, to the bottom. In each cell the highly nonlinear electroneutrality relation for m_{H^+} has to be solved, because the pH value is needed in the balance equations for the water ingredients. This algorithm can be implemented on conventional personal computers. It converges for a broad range of plant parameters, typically in about 8 up-down iterations.

The most important application of the model and the algorithm is the determination of the efficiency of SO_2 absorption. Here, very good agreement of the numerical results and industrial expertise was found.

Section: Financial and Industrial Mathematics.

Simulation of the three-dimensional flow of blood in stenosed coronary arteries: mesh generation issues

Bernhard Quatember
Universität Innsbruck

In clinical practice, there is a need for patient-specific computer simulation studies of coronary hemodynamics, especially in stenosed sections of the epicardial arteries. Theses studies are based on the finite element method. We focus here on the automatic generation of a high-quality mesh. Such a mesh allows us to compute the solution with a specified accuracy at nearly minimal cost in terms of computing time. We use an anisotropic structured mesh with hexahedra as elements. A key issue in our mesh generation approach is the adaptation of the size of the elements to the flow conditions, especially around stenoses. Since a consequent adaptive procedure with an a posteriori error analysis would be too time intensive, we decided to use a priori criteria for the adaptation. These criteria are derived from a posteriori analyses of computed flow conditions in so-called reference flow domains. Although these criteria are in principle heuristic in nature, they nevertheless reflect a fair quantitative a priori knowledge relevant to the mesh generation procedure for the coronary artery under investigation. Using these techniques, we generated a mesh within the three-dimensionally reconstructed flow domain of a patient's circumflex artery with an eccentric stenosis (relatively low degree of eccentricity). We numerically simulated the patient's hemodynamic conditions around this stenosis for the (nearly) steady-state flow at the end of the diastole with FIDAP 8.7.0, an advanced commercial CFD software package.

Section: Numerical Mathematics, Scientific Computing.

Choosing roots of polynomials smoothly and lifting smooth curves over invariants

Armin Rainer
Universität Wien

Consider a smooth curve of polynomials having all roots real. Then the following question arises: How differentiable can the roots be parameterized? It shall be given an overview of related results. For example, there exists always a twice differentiable and with certain restrictions even a smooth parameterization. If this problem is considered from a suitable point of view, then it can be generalized in the following way: Does a smooth curve in the orbit space of a compact Lie group representation on a finite dimensional Euclidean vector space admit a smooth lift? A few results found for polynomials can be transferred to this more general situation.

Section: Topology, Differential Geometry.

Analytic solutions of the generalized Böttcher equation in the complex domain

Ludwig P. Reich
Universität Graz

We study the existence of locally analytic solutions of a class of generalized Böttcher equations in the complex domain. Our results refer to the generic case and cover the classical Böttcher equation appearing in iteration theory of rational functions. We use a modification of Cauchys method of majorants while the classical equation is mostly treated by iterating the equation. Eventually, some open questions related to the non-generic case will be discussed.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Wolfgang Gröbner - ein Südtiroler Mathematiker

Heinrich Reitberger
Universität Innsbruck

Sein Leben:

11.2.1899 geboren in Gossensaß

Jesuiteninternat in Feldkirch

Maschinenbaustudium an der TU Graz

ab 1929 Mathematikstudium an der Univ. Wien bei W. Wirtinger und Ph. Furtwängler

1932 Dissertation: Ein Beitrag zum Problem der Minimalbasen

anschließend Aufenthalt bei E. Noether in Göttingen

1933-1936 Privatgelehrter in Gossensaß

ab Herbst 1936 bei Prof. M. Picone am Istituto per le Applicazioni del Calcolo in Rom

1939 Option, danach Tätigkeit bei den Fortschritten der Mathematik in Berlin

1941 Extraordinariat in Wien

ab 1942 Luftwaffeninstitut in Braunschweig

1947 Ordinarius in Innsbruck

1970 Emeritierung

20.8.1980 Tod in Innsbruck

Sein Werk in Stichworten:

Irreduzible Ideale – Gröbner-Dualität

Struktur der Primärideale

Multiplizität – Syzygien

Differentialgleichungen und Lie-Reihen

Orthogonale Polynome – Mathematik für Physiker

Gröbner-Basen

Teachers' Meeting.

Limit theorems for convex hulls of random points

Matthias Reitzner
Technische Universität Wien

Let K be a convex body in $\mathbb{R}^d$. Choose n independent random points distributed uniformly in K, and let K_n be the convex hull of these n points. Denote by $V(K_n)$ the volume and by $N(K_n)$ the number of vertices of K_n.
The problem to determine the expected values $\mathsf{E}V(K_n)$ and $\mathsf{E}N(K_n)$ goes back to a question raised by Sylvester in 1864. Since then a large number of mathematicians contributed to this problem. In the first part of the talk we give a survey on these results. In the second part of the talk we consider higher moments of $V(K_n)$ and $N(K_n)$. We describe how estimates for the variances can be obtained, which lead to limit theorems for $V(K_n)$ and $N(K_n)$ in the case that K is a smooth convex body.

Minisymposium 3: Convex Geometry.

L^p-spectral multipliers for the Laplacian acting on 1-forms on the Heisenberg group

Fulvio Ricci
Scuola Normale Superiore, Pisa

The $(2n+1)$-dimensional Heisenberg group H_n has a left-invariant Riemannian structure which is invariant under the action of the unitary group $U(n)$ by automorphisms. The corresponding Laplace-Beltrami operator Δ_0 is a well-understood operator, and its functional calculus can be described in terms of known results on the homogeneous sub-Laplacian. The situation is quite different for the Hodge Laplacians $\Delta_k = dd^* + d^*d$ acting on differential k-forms, $k \geq 1$. The non-diagonal structure of Δ_k makes its analysis quite involved, with a level of complexity that increases with $k \leq n$. We discuss the case $k = 1$ and prove that, if m is a Hörmander-Mihlin multiplier on the positive half-line with a sufficiently high order of smoothness, then $m(\Delta_1)$ is bounded on 1-forms in L^p, for $1 < p < \infty$. The order of smoothness is measured in terms of "scale-invariant" local Sobolev norms, and τ is required to be strictly larger than $n+\frac{1}{2}$, i.e. half of the dimension of H_n as a manifold. This follows from a decomposition of the space of L^2-1-forms as the orthogonal sum of five subspaces such that on each of them the action of Δ_1 is unitarily equivalent (possibly modulo a non-trivial intertwining operator) to the action of a "scalar" differential or pseudo-differential operator related to Δ_0.

Minisymposium 1: Harmonic Analysis.

Mathematics and the financial markets

Wolfgang Runggaldier
Università di Padova

In recent years there has been a fruitful interaction between Mathematics, in particular Probability, on one hand and Finance on the other. The purpose of the presentation is to give an idea of this interaction by concentrating mainly on the problems of pricing and hedging of derivative securities, thereby discussing also the mathematical counterpart of certain economic/financial principles. The focus will be on concepts so that we shall try to keep the mathematical technicalities at a minimum by discussing mainly discrete time models.

Plenary Lecture.

Stochastic differential equations with non Gaussian additive noise on Banach spaces

Barbara Rüdiger
Universität Bonn

Stochastic integrals w.r.t. compensated Poisson random measures are defined and analyzed on (Hilbert and) Banach spaces, as natural generalization to the real valued case (preprint SFB611, Bonn, Feb. 03). These are then used to analyze on such spaces existence and uniqueness of solutions of stochastic differential equations (SDEs) with non Gaussian noise, under local Lipshitz conditions for the drift term (preprint Bonn, SFB 611, Feb. 03, in collaboration with V. Mandrekar). An Ito formula is also established for such stochastic integrals and the solutions of the above SDEs (in preparation, in collaboration with G. Ziglio).

Section: Probability Theory, Statistics.

Generalisations of the Oloid

Otto Röschel
Technische Universität Graz

We study special developable surfaces through a given circle c (center M, radius r), which are determined by some additional properties. The so-called Oloid is gained, if Phi passes through a second congruent circle d with center N on c positioned in a plane orthogonal to that of c. This surface has the remarkable property, that its generators intersect c and d in points of constant distance .
We are looking for the following generalisation: Which curves k on the sphere (center N on the given circle c, radius equal to r) determine developable surfaces through c, such that its generators intersect c and k in points of constant distance $r\sqrt{3}$? The analytic approach shows, that the curves k on κ have to be solutions of a differential equation. Of course, the Oloid belongs to one of these solutions. The corresponding developable sufaces Φ are studied from a geometric point of view.

Section: Geometry.

On the period function of plane centers

Marco Sabatini
Università di Trento

Some recent results on the monotonicity of the period function of a plane center will be presented.

Section: Real and Complex Analysis, Ordinary Differential Equations.

Geometric properties of solutions to elliptic equations

Paolo Salani
Università di Firenze

We investigate conditions which force solutions to elliptic equations to inherit geometric properties (like convexity or starshapedness) of the domain.

Section: Geometry.

Tight affine frames of multivariate box splines

Maura Salvatori
Università di Milano

A simple and explicit construction of compactly supported tight affine frames, associated to box splines, with a small number of generators is given. As an application, we show that for a class of bivariate box splines on the four-directions mesh, only five generators are needed.

Section: Functional Analysis, Harmonic Analysis.

Portfolio Optimization under Partial Information: An HMM for the Stock Returns

Jörn Sass
Universität Linz

We consider a multi-stock market model where prices satisfy a stochastic differential equation with instantaneous rates of return (drift process) modeled as an unobserved continuous time, finite state Markov chain. The investor wishes to maximize the expected utility of terminal wealth but for his investment decisions only the prices are available to him.
Under this partial information we derive an explicit representation of the optimal trading strategy in terms of the unnormalized filter of the drift process, using HMM filtering results and Malliavin calculus.
Aspects of parameter estimation, simulation, and application to historical prices will be discussed. Further we show how stochastic interest rate and volatility models can be included.

Section: Financial and Industrial Mathematics.

On the characterization of canonical number systems

Klaus Scheicher
Universität Linz

Let $P(x) = b_n x^n + b_{n-1}x^{n-1} + ... + b_0 \in Z[x]$ be such that $n >= 1$ and $b_n = 1$. Let $N = \{0, 1, ..., |b_0| - 1\}$ and $R = Z[x]/P(x)Z[x]$. The pair $(P(x), N)$ is called a canonical number system (for short CNS) if each g in R admits a representation of the shape $g = d_0 + d_1 x + ... + d_h x^h$ with d_j in N. It is an open problem to characterize those $P(x)$ which form a canonical number system.
In this talk we give a characterization of canonical number systems for a large class of polynomials. This results are used to characterize cubic and quartic CNS under a certain condition.
Our tools are labeled directed graphs and finite automata.

Section: Number Theory.

Trialgebras and extended topological quantum field theories

Karl-Georg Schlesinger
Erwin-Schrödinger-Institut Wien

We explain how the question of a further generalization of (quasi-) Hopf algebras and the corresponding generalization of the Grothendieck-Teichmueller group which acts as a universal symmetry on them arises from the consideration of boundary conditions (D-branes) in open string theory. We consider a topological version of open strings with boundary conditions in the framework of the so called extended topological quantum field theories of Kerler and Lyubashenko. We show that trialgebras are the appropriate generalization of Hopf algebras relating to these theories by proving that there is a one to one correspondence between three dimensional extended topological quantum field theories and a certain class of trialgebras. We conclude by introducing a self-dual noncommutative and noncocommutative Hopf algebra which acts as a universal symmetry on trialgebras and show that a similar structure also arises in full (not necessarily topological) open string theory.

Section: Algebra.

Macroscopic limits of kinetic models for chemotaxis

Christian Schmeiser
Technische Universität Wien

Chemotaxis is the movement of cells influenced by chemical gradients. A class of kinetic transport models for chemotaxis and their macroscopic limits are presented. These limits are rigorously justified for nonlinear systems of kinetic and reaction-diffusion equations for the cells and the chemoattractant. Of particular interest are situations where the kinetic model has global solutions, whereas finite-time-blow-up occurs in the macroscopic model.

Section: Partial Differential Equations, Calculus of Variations.

Kachelungen: Mustermengen und ihre Species

Peter Schmitt
Universität Wien

Jede Menge von Kacheln bestimmt, eventuell zusammen mit Anlegeregeln, eine Species, nämlich die Familie der von ihr gestatteten Kachelungen. In meinem Vortrag möchte ich einen kurzen Überblick zu diesem Thema geben: Was läßt sich über die Struktur der Species aussagen? Wie kann sie durch Wahl der Kacheln und Anlegeregeln beeinflußt werden?
Tilings: protosets and their species
Each set of prototiles determines (possibly in combination with some matching rules) a species, i.e., the family of tilings which are admitted by it. I shall give a brief survey of this topic: What can be said of the structure of the species? How can it be influenced by choosing the tiles and the matching rules?

Section: Geometry.

Convexity methods for random tessellations

Rolf Schneider
Universität Freiburg

Methods from classical convex geometry (Minkowski's existence theorem, stability versions of geometric inequalities, mixed volumes) are applied to a question from stochastic geometry. Extending a problem of D.G. Kendall from the 1940s, we study the shape of large cells in random tessellations of n-dimensional Euclidean space generated by stationary Poisson processes of hyperplanes or points (Voronoi mosaics in the latter case). In particular, we determine the asymptotic shape of such cells under the condition that the volume (or some other suitable functional) is large.
(Joint work with Daniel Hug and Matthias Reitzner)

Minisymposium 3: Convex Geometry.

S-Expansions in Dimension two

Bernhard Schratzberger
Universität Salzburg

We demonstrate how the technique of Singularization can be transferred from one into two dimensions, i.e. we apply the method to the two-dimensional Algorithm of Brun. We discuss, how this technique (and related techniques, such as Insertion) can be used to transfer certain (statistical, approximation) properties from one algorithm to the other. In particular, we are interested in the transferability of the density of the invariant measure. Finally, we use this method to construct an algorithm with improved approximation properties, as opposed to the Algorithm of Brun.

Section: Number Theory.

Lyapunov exponents for multidimensional continued fractions

Fritz Schweiger
Universität Salzburg

The multiplicative ergodic theorem can be applied to the sequence of matrices which are generated by a multidimensional continued fraction. The quality of the Diophantine approximation is given by the first two Lyapunov exponents. However, an exact calculation is difficult. Some new results in this direction are presented.

Section: Number Theory.

Regularity of molecular wavefunctions and electron densities

Thomas Ostergaard Sorensen
Universität München

This is joint work with S. Fournais, M. Hoffmann-Ostenhof and T. Hoffmann-Ostenhof. We discuss recent results on the regularity and structure of atomic and molecular wavefunctions, and their associated electron densities. In particular, we characterize the singularities of the wavefunctions up to $C^{1,1}$ by means of a new abstract result on the regularity of solutions to the Poisson equation.

Section: Partial Differential Equations, Calculus of Variations.

Four-manifolds with special homotopy

Fulvia Spaggiari
Università di Modena e Reggio Emilia

The first step to classify manifolds is the determination of their homotopy type. A classification of the homotopy type of 4-manifolds having finite fundamental groups with periodic homology of period four was given by Baues, Hambleton and Kreck. Results are known for the case where π_1 is cyclic. The homotopy classification of 4-manifolds with free fundamental group was given by Cavicchioli and Hegenbarth. The aim of this talk is to present some results on the homotopy type of closed orientable topological 4-manifolds M with Λ-free second homotopy group, where Λ is the integral group ring of $\pi_1(M)$. This study is related to a problem settled by Kirby, and extends some results obtained for closed 4-manifolds with free fundamental group. Then we illustrate other applications on certain classes of closed topological 4-manifolds with special homotopy.

Section: Topology, Differential Geometry.

Räumliche Verzahnungen, von Disteli bis Phillips

Hellmuth Stachel
Technische Universität Wien

Räumliche Verzahnungen dienen dazu, Drehungen um eine Antriebsachse p_{10} derart auf eine Abtriebsachse p_{20} zu übertragen, dass das Verhältnis ω_{20}/ω_{10} der Winkelgeschwindigkeiten konstant bleibt. Die Bewegungsübertragung erfolgt dabei mittels berührender Flankenflächen Φ_1 und Φ_2, wobei zwischen Punkt- und Linienberührung zu unterscheiden ist. Es wird ein Überblick geboten über die von Disteli entwickelten Verzahnungen, die die duale Fortsetzung der sphärischen Zykloidenverzahnung darstellen mit Regelflächen als Flankenflächen, wobei die Eingriffslinie stets geradlinig ist. Insbesondere wird Distelis räumliches Analogon zur sphärischen Evolventenverzahnung mittels dualer Speerkoordinaten behandelt. Ferner wird die Geometrie der kürzlich von J. Phillips entwickelten 'räumlichen Evolventenverzahnung' vorgestellt. Dies ist eine Punktverzahnung, wobei als Flankenflächen Schraubtorsen auftreten. Diese Verzahnung hat so wie die ebene Evolventenverzahnung den Vorteil, unempfindlich zu sein gegenüber geringfügigen Fehljustierungen.

Section: Geometry.

Tempered irreducible unitary representations of the free group

Tim Joshua Steger
Università di Sassari

Let Γ be a noncommutative free group on finitely many generators. We consider unitary representations of Γ which are weakly contained in the regular representations. Equivalently, these are the "tempered" representations, those whose matrix coefficients are almost in ℓ^2. Let Ω be the natural boundary of Γ. A representation which acts in a certain well-defined natural way on some L^2-space on Ω is called a *boundary representation*. All boundary representations are tempered. Conversely, if π is any tempered representation, there is an inclusion of π into some boundary representation. Such an inclusion is a *boundary realization* of π.

Consideration of examples leads to the *duplicity conjecture*: a given irreducible tempered representation has at most two inequivalent, irreducible boundary realizations. We give the details of this conjecture.

There are lots of representations of Γ, and one's intuition is that a "generic" representation is irreducibile. However, proving the irreducibility of a specific representation is usually difficult. In many cases, an analysis going by way of boundary realizations works. In certain cases one can prove simultaneously that a representation is irreducible and that it has exactly two inequivalent, irreducible boundary realizations; in others that it has exactly one boundary realization.

Minisymposium 1: Harmonic Analysis.

Generalized flows and singular ODEs on differentiable manifolds

Roland Steinbauer
Universität Wien

Based on the concept of manifold valued generalized functions [3,4] in the sense of J. F. Colombeau's special construction [1,2] we initiate a study of nonlinear ordinary differential equations with singular (in particular: distributional) right hand sides in a global setting. After establishing several existence and uniqueness results for solutions of such equations and flows of singular vector fields we compare the solution concept employed here with the purely distributional setting due to J. Marsden [6]. Finally, we derive criteria securing that a sequence of smooth flows corresponding to a regularization of a given singular vector field converges to a measurable limiting flow.

[1] J. F. Colombeau, *Elementary Introduction to New Generalized Functions*, North Holland, Amsterdam, 1985.

[2] M. Grosser, M. Kunzinger, M. Oberguggenberger, R. Steinbauer, *Geometric Theory of Generalized Functions*, volume 537 of Mathematics and its Applications 537. Kluwer Academic Publishers, Dordrecht, 2001.

[3] M. Kunzinger, *Generalized functions valued in a smooth manifold*, Monatsh. Math. 137, 31–49 (2002).

[4] M. Kunzinger, R. Steinbauer, J. Vickers, *Intrinsic characterization of manifold-valued generalized functions*, Proc. London Math. Soc., to appear (2003).

[5] M. Kunzinger, R. Steinbauer, M. Oberguggenberger, J. Vickers, *Generalized flows and singular ODEs on differentiable manifolds*, Preprint, math. FA/0304131 (2003).

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Section: Functional Analysis, Harmonic Analysis.

The relativistic Vlasov-Klein-Gordon System I: Local classical solutions

Roland Steinbauer
Universität Wien
Co-authors: M. Kunzinger, M. Oberguggenberger, J. Vickers

We investigate an ensemble of collissionless classical particles coupled to a Klein-Gordon field. The resulting nonlinear system of PDEs – the relativistic Vlasov-Klein-Gordon System – formally resembles the relativistic Vlasov-Maxwell System which still constitutes a main challenge in existence theory in kinetic equations.
In this first talk of a series of two we prove the existence of unique classical local-in-time solutions of the system together with a continuation criterion. The latter one guarantees the solution to be global-in-time provided the momentum support of the distribution function is a-priori bounded.

[1] R. J. DiPerna, P.-L. Lions, *Global weak solutions of Vlasov-Maxwell systems.* Comm. Pure Appl. Math., 42 (6), 729–757 (1989).

[2] R. Glassey, W. Strauss, *Singularity formation in a collissionless plasma could occur only at high velocities,* Arch. Rat. Mech. Anal., 92, 56–90 (1986).

[3] M. Kunzinger, G. Rein, R. Steinbauer, G. Teschl, *Global weak solutions of the relativistic Vlasov-Klein-Gordon System*, Commun. Math. Phys., to appear (2003); (also available as math. AP/0209303 from `http://www.arxiv.org/`.)

[4] M. Kunzinger, G. Rein, R. Steinbauer, G. Teschl, *Local classical solutions of the relativistic Vlasov-Klein-Gordon System*, Preprint (2003).

[5] K. Kruse, G. Rein, *A stability result for the relativistic Vlasov-Maxwell system.* Arch. Rat. Mech. Anal., 121 (2), 187–203 (1992).

Section: Partial Differential Equations, Calculus of Variations.

Is the "Skytower" stable?

Alois Steindl
Technische Universität Wien

Skytowers are old futuristic concepts of space elevation where a space station on a geo-stationary orbit is connected by a tether with the surface of the earth. Nowadays due to carbon strings, sufficiently light and strong tethers should allow a practical realization. However, the stability of the relative equilibrium of the system is an open question. Using amended potentials we investigate the orbital stability of the straight configuration for stress-optimized tapered tethers.

Section: Real and Complex Analysis, Ordinary Differential Equations.

On m-ary search trees generated by van der Corput sequences

Wolfgang Steiner
Technische Universität Wien

We study the structure of binary and, more generally, m-ary search trees which are constructed by successively storing the elements of the van der Corput sequence to some base q. We calculate the height of the tree, the mean value and the distribution of the depths of the nodes. (The distribution is asymptotically normal.)

Section: Discrete Mathematics, Algorithms.

Simple Random Walk on Special Fractal Trees

Bertran Steinsky
Technische Universität Graz

We analyse the return probabilities to the origin on special fractal trees with methods of asymptotic combinatorics and functional iterations.

Section: Discrete Mathematics, Algorithms.

Geometric Analysis of Delayed Hopf Bifurcations

Peter Szmolyan
Technische Univesität Wien

Differential equations with slowly varying parameters can behave quite different from the corresponding static bifurcation problems. In the case of Hopf bifurcations the phenomenon of bifurcation delay occurs in analytic systems. It is shown that the delay is due to the exponentially small separation of stable and unstable slow manifolds. The main ideas of the proof are to choose a suitable integration path in complex time and to use the recently developed blow-up method for singularly perturbed differential equations.

Section: Real and Complex Analysis, Ordinary Differential Equations.

The relativistic Vlasov-Klein-Gordon System II: Global weak solutions

Gerald Teschl
Universität Wien

We investigate an ensemble of collisionless classical particles coupled to a Klein-Gordon field. The resulting nonlinear system of PDEs – the relativistic Vlasov-Klein-Gordon System – formally resembles the relativistic Vlasov-Maxwell System which still constitutes a main challenge in existence theory in kinetic equations.
In this second talk in a series of two we establish existence of global-in-time weak solutions of the relativistic Vlasov-Klein-Gordon system using energy conservation. Since the energy of the system is indefinite, we have to impose a size restriction on the initial data which ensures that the coupling energy is dominated by the kinetic and field energy. This then yields the necessary a-priori bounds on the solutions.

Section: Partial DifferentialEquations, Calculus of Variations.

Asymptotic problems related to iterative functional equations

Elmar Teufl
Technische Universität Graz

In this talk we will investigate the asymptotic behaviour of holomorphic solutions of linear iterative functional equations in repelling fixed points. Furthermore we will present some applications to combinatorics and probability theory.

Section: Real and Complex Analysis, Ordinary Differential Equations.

A limit theorem for iterated maps preserving an infinite measure

Maximilian Thaler
Universität Salzburg

In recent years several distributional limit theorems for processes generated by infinite-measure preserving transformations have been proved. The purpose of the talk is to present a further result of this type. We shall mainly concentrate on a specific class of interval maps.
A basic problem in the probabilistic theory of iterated maps is to study the distributional behaviour of the iterates (assuming that the initial value is a random variable). Our starting point is the question whether well-known results for uniformly expanding maps, such as Gauss' distributional limit theorem for the continued fraction map, have parallels in the infinite invariant measure case.
(2000 MSC : 37 A 40, 37 E 05, 60 F 05)

Section: Probability Theory, Statistics.

Variable stepsize linear multistep discretizations of singular perturbation problems

Mechthild Maria Thalhammer
Universität Innsbruck

In this talk, we investigate the stability and convergence behaviour of variable stepsize linear multistep methods applied to singularly perturbed problems of the form

$$y' = f(y,z), \qquad \varepsilon z' = g(y,z)$$

involving a small parameter $0 < \varepsilon \ll 1$. Following [3], we extend the convergence estimate given in [1] for linear multistep methods with constant stepsizes to variable stepsizes. Besides, we specify a refined estimate for the widely used class of backward differentiation formulas. Important ingredients in our convergence analysis are stability bounds for non-autonomous linear problems. For the derivation of such stability results, we employ techniques that are similar to those used in [2].

[1] Ch. Lubich, *On the convergence of multistep methods for nonlinear stiff differential equations,* Numer. Math., 58, 839–853 (1991).

[2] A. Ostermann, M. Thalhammer and G. Kirlinger, *Stability of linear multistep methods and applications to nonlinear parabolic problems,* Preprint 2-2003, Universität Innsbruck. Submitted to Appl. Numer. Math.

[3] M. Thalhammer, *On the convergence behaviour of variable stepsize multistep methods for singularly perturbed problems,* in preparation.

Section: Numerical Mathematics, Scientific Computing.

Number systems and fractals

Jörg Maximilian Thuswaldner
Montanuniversität Leoben

Let α be an algebraic integer (denote its norm by $N(\alpha)$) and set $\mathcal{N} = \{0, 1, \ldots, |N(\alpha)-1|\}$. Then the pair $(\alpha, \mathcal{N})$ is called a canonical number system if each $\gamma \in \mathbb{Z}[\alpha]$ admits a unique representation of the form

$$\gamma = c_0 + c_1\alpha + \cdots + c_h\alpha^h$$

with $c_j \in \mathcal{N}$ and $h \geq 0$. It is a very difficult problem to characterize all algebraic numbers that give rise to a canonical number system. In my talk I want to discuss some partial solutions to this problem. Furthermore, I will speak about properties of self-affine fractal sets which are related to these number systems.

Award-Winner of the Austrian Mathematical Society.

Littlewood-Paley decompositions on nilpotent Lie groups

Alessandro Veneruso
Università di Genova

I will present a joint work with Giulia Furioli and Camillo Melzi. We characterize the L^p spaces ($1 < p < \infty$) on a nilpotent Lie group G by means of a Littlewood–Paley decomposition on G associated to a sub-Laplacian $L = -(X_1^2 + \ldots + X_k^2)$ where $\{X_1, \ldots, X_k\}$ is a Hörmander system on G. We also prove that the kernel of the operator $m(L)$ is a Schwartz function on G if m is a Schwartz function on R.

Section: Functional Analysis, Harmonic Analysis.

A dynamical Model for the Monetary Circuit

Ezio Venturino
Università di Torino

A permanent feature of modern economies is given by business cycles [2], leading to economic fluctuations which are a serious problem for policy makers. While several theories exist to explain their causes, new recent literature [3], [4], [6], emphasizes the fact that the decisions jointly taken by entrepreneurs and banks determine the level of employment. However banks are generally seen just as passive agents in the money supply process for the whole economy.
The purpose of this investigation is to highlight the relationship among banks and entrepreneurs, looking at the process of money creation. Our model draws also on Minsky's model of corporate financial [5] and its further developments, [1], [7], [8]. In contrast to the current economic literature, where money is mainly considered as an exogenous disturbance, our system explicitly models the money supply process, and looks at its consequences for the evolution of the economic system.
The two-dimensional dynamical system contains several parameters and therefore is quite complex, but a complete analysis of all possible $\omega-$limit sets is possible. Under our assumptions, limit cycles cannot arise.

[1] S. Dow, *Horizontalism: a critique*, Cambridge Journal of Economics, 20, 497–508 (1996).

[2] J. Eatwell, M. Milgate, P. Newman, (Editors), *The new Palgrave: a dictionary of economics*, Macmillan, London, 1975.

[3] G. Fontana, *Essay on money, uncertainty and time in the post Keynesian tradition*, PhD Thesis, University of Leeds, UK, 1999.

[4] G. Fontana, *Post Keynesians and circuitists on money and uncertainty: an attempt at generality*, Journal of Post Keynesian Economics, 23, 27–48 (2000).

[5] H. P. Minsky, *John Maynard Keynes*, Macmillan, London, 1975.

[6] L. P. Rochon, S. Rossi, *Modern Theories of Money: The Nature and the Role of Money in Capitalist Economies*, Edward Elgar, Cheltenham (UK), 2003.

[7] R. Wray, *Money and credit in capitalist economies: the endogenous money approach*, Edward Elgar, Aldershot, UK, 1990.

[8] R. Wray, *Understanding modern money: the key to full employment and price stability*, Edward Elgar, Cheltenham, UK, 1999.

Section: Financial and Industrial Mathematics.

Unscharfe Wahrscheinlichkeitsverteilungen

Reinhard Viertl
Technische Universität Wien
Co-author: D. Hareter, TU Wien

Da Messwerte kontinuierlicher Größen stets mehr oder weniger unscharf sind (dies ist eine andere Unsicherheit als Fehler), pflanzt sich diese Unschärfe auch in relativen Häufigkeiten und Histogrammen fort. Daher ist es notwendig, auch Wahrscheinlichkeiten im Sinne von Grenzwerten relativer Häufigkeiten zu adaptieren. Dies führt zum Begriff unscharfer Wahrscheinlichkeiten. Die Eigenschaften von solchen verallgemeinerten Wahrscheinlichkeiten leiten sich aus denen unscharfer relativer Häufigkeiten ab. Daneben ergeben auch A-posteriori-Dichten auf der Grundlage unscharfer Daten verallgemeinerte Wahrscheinlichkeitsdichten.
Obige Tatsachen erfordern einen allgemeineren Wahrscheinlichkeitsbegriff. Kritik an Wahrscheinlichkeiten als exakte Zahlen haben schon viel früher Keynes und andere Wissenschaftler formuliert. Diese allgemeineren Wahrscheinlichkeitsverteilungen, genannt unscharfe Wahrscheinlichkeitsverteilungen, haben zudem den Vorteil, dass sie als allgemeinere Form von A-priori-Verteilungen in der Bayesschen Statistik breitere Akzeptanz finden können.
Eigenschaften unscharfer Wahrscheinlichkeitsverteilungen und eine Adaption des Bayesschen Theorems für die Situation unscharfer Information werden in dem Vortrag gezeigt.

R. Viertl, D. Hareter, *A generalization of Bayes theorem for non-precise a-priori distributions*, erscheint in Metrika.

K. Weichselberger, *Alternative probabilistic systems, Encyclopedia of Life Support Systems*, published online by UNESCO und EOLSS, www.eolss.net.

Section: Probability Theory, Statistics.

Periodic solutions of a forced differential equation in presence of a separatrix

Gabriele Villari
Università di Firenze

The problem of the existence of periodic solutions for a periodically forced planar dynamical system is considered. A new approach, which combines the topological methods with some geometrical features of the trajectories of some associated autonomous differential system, and focus the attention on those autonomous systems which possess a separatrix, will be presented.

Section: Real and Complex Analysis, Ordinary Differential Equations.

An inequality for dual mixed volumes of bounded Borel sets

Aljosa Volcic
Università di Trieste

Let C be a bounded Borel set in $\mathbb{R}^n$, and let $i > 0$. We define the i-chord symmetral $\widetilde{\nabla}_i C$ of C by defining its radial function with the equality

$$\rho_{\widetilde{\nabla}_i C}(u)^i = \int_{\mathbb{R}} \chi_C(tu)|t|^{i-1}\, dt\,,$$

for u in the unit sphere S^{n-1}, and its dual mixed volume by

$$\widetilde{V}_i(C) = \frac{1}{n}\int_{S^{n-1}} \rho_{\widetilde{\nabla}_i C}(u)^i\, du\,.$$

Here χ_C denotes the characteristic function of C.
These definitions generalize those given in Gardner's book "Geometric Tomography"

Section: Geometry.

Explicit Calculation of Fundamental Solutions

Peter Wagner
Universität Innsbruck

I intend to give a survey on the recent explicit calculation of fundamental solutions for cubic and quartic operators in 3 variables as well as the structure of their singular support.

P. Wagner, *Fundamental solutions of real homogeneous cubic operators of principal type in three dimensions*, Acta Math. 182, 283–300 (1999).

P. Wagner, *On the fundamental solutions of a class of elliptic quartic operators in dimension 3*, J. Math. Pures Appl., 81, 1191–1206 (2002). (Available at
`http://techmath.uibk.ac.at/mathematik/wagner/publwagner.html`)

Minisymposium 4: Microlocal Analysis.

Error propagation in geometric constructions

Johannes Wallner
Technische Universität Wien

The propagation of errors through geometric constructions is a topic which is rather elementary on the one hand, but offers computational difficulties on the other. This lecture will give an overview.

Section: Geometry.

Über das Lösen von Differentialgleichungen

Gerhard Wanner
Université de Genève

Eines der Gebiete, das Gröbner in seinen Forschungen und seinen Büchern besonders pflegte, war das Lösen von gewöhnlichen und partiellen Differentialgleichungen. Als einer seiner Schüler habe ich mich seitdem auf diesem Gebiet spezialisiert.
Am Beispiel der Berechnung eines Brückenbogens wollen wir die Problematik der analytischen und der numerischen Lösung auseinandersetzen. Weitere Beispiele aus Physik, Chemie und Biologie werden uns immer weitere Rätsel über numerische Phänomene und deren Behandlung bescheren.

Teachers' Meeting.

Tschirnhausen revisited

Gunter Weiss
Technische Universität Dresden

Der Universalgelehrte Ehrenfried Walther von TSCHIRNHAUS (1651-1708) verwendet in seinem philosophischen Hauptwerk, "Medicina Mentis" (1695) vor allem geometrische und physikalische Beispiele zur Erläuterung seiner erkenntnistheoretischen Thesen. Wenngleich er in Bezug auf die Weiterentwicklung der Mathematik wohl weit hinter seine Freunde, W. LEIBNIZ und C. HUYGENS gestellt werden muss, ist seine herausragende Bedeutung als Förderer des damals noch rudimentären Mathematikunterrichts in Deutschland unbestritten. Seine durchwegs geometrischen Schlussweisen, insbesondere aber auch seine Trugschlüsse, sind auch heute noch interessant und könnten, geeignet didaktisch aufbereitet, Gymnasiasten und Studienanfänger bei einigen mathematische Schlüsselstellen zu tieferem Verständnis verhelfen. TSCHIRNHAUS wagt sich u.a. an ein (unzureichendes) Axiomensystem à la Euklid heran, mit dem er eine "Kreisgeometrie" aufbauen möchte. Er behauptet, mit elementar konstruierbaren Kurven die Tangenten in "jedem" Kurvenpunkt "jeder Kurve" ohne den LEIBNIZ'schen Differentialkalkül bestimmen zu können. Er sammelt die aktuellen mathematischen und naturwissenschaftlichen Forschungsergebnisse seiner Zeit in ganz Europa und verbreitet sie in seiner kursächsischen Heimat. TSCHIRNHAUS und LEIBNIZ waren die ersten auswär-tigen Mitglieder der Pariser Academie des Sciences. TSCHIRNHAUS war Hofwissenschaftler am sächsisch-polnischen Königshof, wo er nachweislich als erster in Europa das Porzellan nacherfand. Seine Brennspiegel und -linsen machten ihn zu seiner Zeit weltberühmt. Er ist heute zu Unrecht vergessen! Dem Vortrag liegt die deutsche Ausgabe der 2. Auflage der "Medicina Mentis" (Hrsgb. R. ZAUNICK, 1963) zugrunde.

Section: Geometry.

On finite p-rings with small radical

Johann Wiesenbauer
Technische Universität Wien

When trying to classify all finite p-rings R with certain properties, usually the most natural approach is to fix their (Jacobson-)radical $J(R)$ and the semisimple factor ring $R/J(R)$ and to solve the corresponding ring extension problem. This is done here for some quite general classes of finite p-rings under the assumption that the radical is still small, i.e. of order p or p^2.

Section: Algebra.

Abelsche Gruppenaktionen auf der geordneten Zahlengeraden

Reinhard Winkler
Technische Universität Wien

Interessiert man sich für vertauschbare Abbildungen (das tut man z.B. in der Kryptographie), so stößt man in natürlicher Weise auf die Frage nach maximalen abelschen Untergruppen gewisser Permutationsgruppen. Im Vortrag wird die Automorphismengruppe der Zahlengeraden als geordneter Menge betrachtet. Hauptergebnis ist ein Klassifikationssatz modulo Konjugiertheit.

Section: Algebra.

Harmonic functions on lamplighter graphs

Wolfgang Woess
Technische Universität Graz

The Cayley graphs of the basic lamplighter groups over $\mathbb{Z}$ (wreath products $\mathbb{Z}_q \wr \mathbb{Z}$) can be obtained as the horocyclic products of two homogeneous trees with the same degrees. Thus, they are specific examples of Diestel-Leader graphs (for the latter, the two homogenenous trees do not necessarily have the same degrees). For a class of random walks on the Diestel-Leader graphs, we can give a complete description of the cone of positive harmonic functions, and in particular, of the minimal positive harmonic functions. This includes the typical "switch-walk-switch" random walks on the lamplighter groups.

Section: Functional Analysis, Harmonic Analysis.

On the dynamics of some planar maps associated to nonlinear Hill's equations with an indefinite weight

Fabio Zanolin
Università di Udine

We discuss some properties of twist and expansion type for continuous mappings of the plane which are related to the Poincare' map associated to the nonlinear ODE x" + w(t) g(x) = 0, with a sign-changing weight w(t). Applications are given to various boundary value problems, including the periodic one. The presence of a chaotic-like behavior of coin-tossing type for the solutions is considered as well.

Section: Real and Complex Analysis, Ordinary Differential Equations.

List of participants

Olusegun Ebenezer Adeboye
Bakoteh Upper Basics
PMB 413 Serekunda Post Office
Serekunda
adeboye@myself.com

Erhard Aichinger
Johannes Kepler Universität Linz
Altenberger Straße 69
A-4040 Linz
erai@jku.at

Lucia Alessandrini
Università di Parma
Via D'Azeglio 85
I-43100 Parma
lucia.alessandrini@unipr.it

Giorgio T. Bagni
Università di Roma
Dipartimento di Matematica
Piazzale Aldo Moro 2
I-00185 Roma
bagni@mat.uniroma1.it

Elena Barbieri
Università di Modena e Reggio Emilia
Dipartimento di Matematica
Via Campi 213/B
I-41100 Modena
barbieri.elena@unimo.it

Joachim Bauer
Universität Duisburg
Fachbereich Mathematik
Lotharstraße 63/65
D-47048 Duisburg
bauer@math.uni-duisburg.de

Peter Berglez
Technische Universität Graz
Institut für Mathematik
Steyrergasse 30
A-8010 Graz
berglez@weyl.math.tu-graz.ac.at

Christa Binder
Technische Universität Wien
Institut für Analysis u. Techn. Mathematik
Wiedner Hauptstraße 8-10/1141
A-1040 Wien
christa.binder@tuwien.ac.at

Paolo Boggiatto
Università di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
I-10123 Torino
boggiatto@dm.unito.it

Enrico Bombieri
Institute for Advanced Study,
Princeton
1 Einstein Drive
08540 Princeton, New Jersey
USA
eb@ias.edu

Rada Maria Bombosi
Universität Wien
Institut für Mathematik
Sensengasse 8/Mezz.
A-1090 Wien
rada.maria.bombosi@univie.ac.at

Immanuel Bomze
Telekom Austria AG, Wien
Lassallestraße 9
A-1020 Wien
immanuel.bomze@telekom.at

Iacopo Borsi
Università di Firenze
Dipartimento di Matematica
Via Morgagni 67/A
I-50134 Firenze
borsi@math.unifi.it

Hannelore Brandt
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
1090 Wien
Austria
hannelore.brandt@univie.ac.at

Johann Brauchart
Technische Universität Graz
Institut für Mathematik A
Steyrergasse 30
A-8010 Graz
brauchart@finanz.math.tu-graz.ac.at

Alberto Bressan
S.I.S.S.A.
Via Beirut 4
I-34014 Trieste
bressan@sissa.it

Thomas Breuer
Fachhochschule Vorarlberg
Achstraße 1
A-6850 Dornbirn
thomas.breuer@fh-vorarlberg.ac.at

Sara Brofferio
Technische Universität Graz
Steyrergasse 30
A-8010 Graz
brofferio@finanz.math.tu-graz.ac.at

Katrin Brunnthaler
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/1
A-6020 Innsbruck
katrin.brunnthaler@uibk.ac.at

Bruno Buchberger
Universität Linz und FH
Hagenberg
Research Institute for Symbolic
Computation
A-4232 Schloss Hagenberg
bruno.buchberger@risc.uni-
linz.ac.at

Christian Buchta
Universität Salzburg
Institut für Mathematik
Hellbrunner Straße 34
A-5020 Salzburg
christian.buchta@sbg.ac.at

Bernhard Burgstaller
Universität Linz
Institut für Analysis, Abtlg.:
Finanzmathematik
Altenbergerstraße 69
A-4040 Linz
bernhardburgstaller@yahoo.de

Ernesto Buzano
Università di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
I-10123 Torino
ernesto.buzano@unito.it

Stefano Campi
Università di Modena e Reggio
Emilia
Dipartimento di Matematica
Via Campi 213/b
I-41100 Modena
campi@unimo.it

Andreas Cap
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
Andreas.Cap@univie.ac.at

Ingrid Carbone
Università della Calabria
Dipartimento di Matematica
Ponte P. Bucci, Cubo 30 B
I-87036 Arcavacata di Rende (CS)
i.carbone@unical.it

Alberto Cavicchioli
Università di Modena e Reggio
Emilia
Dipartimento di Matematica
Via Campi 213/B
I-41100 Modena
cavicchioli.alberto@unimo.it

Andrea Colesanti
Università di Firenze
Dipartimento di Matematica
Viale Morgagni 67/a
I-50134 Firenze
colesant@math.unifi.it

Maria Contessa
Università di Palermo
Via Emanuele Filiberto 217
I-00185 Roma
contessa@math.unipa.it

James Bell Cooper
Universität Linz
Institut für Analysis
Altenbergerstr. 69A
A-4040 Linz
cooper@bayou.uni-linz.ac.at

Ligia-Loretta Cristea
Technische Universität Graz
Institut für Mathematik C
Steyrergasse 30/III
A-8010 Graz
cristea@finanz.math.tu-graz.ac.at

Carlota Cuesta
Technische Universität Wien
Institut für Angewandte Mathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
carlota@aurora.anum.tuwien.ac.at

Paola Cuoghi
Università di Modena e Reggio Emilia
Dipartimento di Matematica
Via Campi 213/b
I-41100 Modena
pcuoghi@unimo.it

Leonede De Michele
Università di Milano-Bicocca
Dipartimento di Matematica e Applicazioni
Via Bicocca degli Arcimboldi 8
I-20126 Milano
Demichele@matapp.unimib.it

Lucia Del Chicca
Universität Linz
Institut für Analysis und Numerik
Altenbergerstraße 69A
A-4040 Linz
lucia.delchicca@jku.at

Vittoria Demichelis
Università di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
I-10123 Torino
vittoria.demichelis@unito.it

Yasmin Dolak
Technische Universität Wien
Wiedner Hauptstraße 8-10
A-1040 Wien
yasmin.dolak@tuwien.ac.at

Gerhard Dorfer
Technische Universität Wien
Institut für Algebra und Computermathematik
Wiedner Hauptstraße 8-10/118
A-1040 Wien
g.dorfer@tuwien.ac.at

Dietmar Dorninger
Technische Universität Wien
Institut für Algebra und
Computermathematik
Wiedner Hauptstraße 8-10/118
A-1040 Wien
d.dorninger@tuwien.ac.at

Michael Drmota
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10
A-1040 Wien
michael.drmota@tuwien.ac.at

Mirjam Duer
Technische Universität Darmstadt
Fachbereich Mathematik
Schlossgartenstraße 7
D-64289 Darmstadt
duer@mathematik.tu-darmstadt.de

Peter Dörfler
Montanuniversität Leoben
Institut für Mathematik
Franz-Josef-Straße 18
A-8700 Leoben
Peter.Doerfler@unileoben.ac.at

Günther Eigenthaler
Technische Universität Wien
Institut für Algebra und
Computermathematik
Wiedner Hauptstraße 8-10/1181
A-1040 Wien
g.eigenthaler@tuwien.ac.at

Michela Eleuteri
Università di Trento
Dipartimento di Matematica
Via Sommarive 14
I-38050 Povo Trento
eleuteri@science.unitn.it

Karen Elsner
Max-Planck-Institut für Physik,
München
Werner-Heisenberg-Institut
Föhringer Ring 6
D-80805 München
elsner@mppmu.mpg.de

Franz Embacher
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
franz.embacher@univie.ac.at

Heinz W. Engl
Universität Linz /
Österr.Akademie der
Wissenschaften / UCLA
Institut für Industriemathematik
Altenbergerstraße 69
A-4040 Linz
heinz.engl@oeaw.ac.at

Josef Eschgfaeller
Università di Ferrara
Dipartimento di Matematico
Via Germoglio 76
I-44100 Ferrara
esg@unife.it

Klemens Fellner
Technische Universität Wien
Institut für Angewandte und
Numerische Mathematik
Wiedner Hauptsrasse 8/115
A-1040 Wien
Klemens.Fellner@tuwien.ac.at

Thomas Fetz
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/6
A-6020 Innsbruck
fetz@mat1.uibk.ac.at

Ilse Fischer
Universität Klagenfurt
Institut für Mathematik
Universitätsstraße 65 - 67
A-9020 Klagenfurt
ilse.fischer@uni-klu.ac.at

Peter Flor
Universität Graz
Institut für Mathematik
Heinrichstraße 36/IV
A-8010 Graz
peter.flor@kfunigraz.ac.at

August Florian
Universität Salzburg
Institut für Mathematik
Hellbrunnerstraße 34
A-5020 Salzburg
august.florian@sbg.ac.at

Karl Josef Fuchs
Universität Salzburg
Institut für Didaktik der
Naturwissenschaften
Hellbrunnerstraße 34
A-5020 Salzburg
karl.fuchs@sbg.ac.at

Clemens Fuchs
Technische Universität Graz
Institut für Mathematik A
Steyrergasse 30/II
A-8010 Graz
clemens.fuchs@tugraz.at

Lorenzo Fusi
Università di Firenze
Dipartimento di Matematica
Viale Morgagni 67/a
I-50134 Firenze
fusi@math.unifi.it

Claudia Garetto
Università di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
I-10123 Torino
garettoc@dm.unito.it

Ingenuin Gasser
Universität Hamburg
Fachbereich Mathematik
Bundesstraße 55d
D-20146 Hamburg
gasser@math.uni-hamburg.de

Riccardo Ghiloni
Università di Trento
Dipartimento di Matematica
Via Sommarive 14
I-38050 Povo Trento
ghiloni@science.unitn.it

Hans-Joachim Girlich
Universität Leipzig
Mathematisches Institut
Augustusplatz 10-12
D-04109 Leipzig
girlich@mathematik.uni-leipzig.de

Bernhard Gittenberger
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10/113
A-1040 Wien
gittenberger@geometrie.tuwien.ac.at

Peter Grabner
Technische Universität Graz
Institut für Mathematik A
Steyrergasse 30
A-8010 Graz
peter.grabner@tugraz.at

Todor Gramchev
Università di Cagliari
Dipartimento di Matematica
Via Ospedale 72
I-09124 Cagliari
todor@unica.it

Helmut Groemer
University of Arizona
6820 E. Rosewood Circle
AZ 85710 Tucson
groemer@email.arizona.edu

Michael Grosser
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
michael.grosser@univie.ac.at

Franz Halter-Koch
Universität Graz
Mathematisches Institut
Heinrichstraße 36
A-8010 Graz
franz.halterkoch@uni-graz.at

Hans Havlicek
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10
A-1040 Wien
havlicek@geometrie.tuwien.ac.at

Lothar Heinrich
Universität Augsburg
Institut für Mathematik
Universitätsstraße 14
D-86135 Augsburg
heinrich@math.uni-augsburg.de

Gilbert Helmberg
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13
A-6020 Innsbruck
gilbert.helmberg@telering.at

Wolfgang Herfort
Technische Universität Wien
Institut für Angewandte und
Numerische Mathematik
Wiedner Haupstraße 8-10/1151
A-1040 Wien
herfort@tuwien.ac.at

Clemens Heuberger
Technische Universität Graz
Institut für Mathematik
Steyrergasse 30
A-8010 Graz
clemens.heuberger@tugraz.at

Maria Hoffmann-Ostenhof
Universität Wien
Mathematisches Institut
Strudlhofgasse 4
A-1090 Wien
Maria.Hoffmann-Ostenhof@univie.ac.at

Manfred Husty
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/1
A-6020 Innbruck
manfred.hutsy@uibk.ac.at

Günther Hörmann
Universität Innsbruck und
Universität Wien
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/6
A-6020 Innsbruck
guenther.hoermann@univie.ac.at

Wilfried Imrich
Montanuniversität Leoben
Institut für Mathematik und
Angewandte Geometrie
Franz-Josef-Straße 18
A-8700 Leoben
imrich@unileoben.ac.at

Hans Jarchow
Universität Zürich
Institut für Mathematik
Winterthurerstraße 190
CH-8057 Zürich
jarchow@math.unizh.ch

Russell Johnson
Università di Firenze
Dipartimento di Sistemi e
Informatica
Via di S. Marta 3
I-50139 Firenze
johnson@dsi.unifi.it

Günther Karigl
Technische Universität Wien
Institut für Algebra
Wiedner Hauptstraße 8-10
A-1040 Wien
g.karigl@tuwien.ac.at

Hermann Kautschitsch
Universität Klagenfurt
Institut für Mathematik
Universitätsstraße 65-67
A-9020 Klagenfurt
hermann.kautschitsch@uni-klu.ac.at

Gerhard Kirchner
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/4
A-6020 Innsbruck
Gerhard.Kirchner@uibk.ac.at

Manfred Kronfellner
Technische Universität Wien
Institut für Algebra
Wiedner Hauptstraße 8-10
A-1040 Wien
m.kronfellner@tuwien.ac.at

Arnold Richard Kräuter
Montanuniversität Leoben
Institut für Mathematik und
Angewandte Geometrie
Franz-Josef-Straße 18
A-8700 Leoben
kraeuter@unileoben.ac.at

Bernhard Krön
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
bernhard.kroen@univie.ac.at

Maria Gabriella Kuhn
Università di Milano-Bicocca
Dipartimento di Matematica
Via Bicocca degli Arcimboldi 8
I-20126 Milano
kuhn@matapp.unimib.it

Michael Kunzinger
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
michael.kunzinger@univie.ac.at

Andrea Laforgia
Università di Roma
Dipartimento di Matematica
Largo San Leonardo Murialdo 1
I-00146 Roma
laforgia@mat.uniroma3.it

Mario Lamberger
Technische Universität Graz
Institut für Mathematik C
Steyrergasse 30
A-8010 Graz
mario.lamberger@tugraz.at

Gerhard Larcher
Universität Linz
Abteilung für Finanzmathematik
Altenbergerstraße 69
A-4040 Linz
Gerhard.Larcher@jku.at

Jérôme Le Rousseau
Université Aix-Marseille I
39, Rue Joliot-Curie
F-13453 Marseille
jlerous@cmi.univ-mrs.fr

Franz Lehner
Technische Universität Graz
Institut für Mathematik C
Steyrergasse 30
A-8010 Graz
lehner@finanz.math.tu-graz.ac.at

Günter Lettl
Universität Graz
Institut für Mathematik
Heinrichstraße 36
A-8010 Graz
guenter.lettl@uni-graz.at

Viktor Losert
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
losert@ap.univie.ac.at

Christian Lubich
Universität Tübingen
Mathematisches Institut
Auf der Morgenstelle 10
D-72076 Tübingen
lubich@na.uni-tuebingen.de

Friedrich Manhart
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10
A-1040 Wien
manhart@geometrie.tuwien.ac.at

Mauro Marini
Università di Firenze
Dipartimento di Elettronica e
Telecomunicazione
Via A. da Settimello 8
I-50135 Firenze
marini@ing.unifi.it

Werner Mark
Cesare Battististraße 46
I-39100 Bozen

Daniel C. Mayer
Daimler Chrysler Consult
Naglergasse 53
A-8010 Graz
daniel.mayer@algebra.at

Sokol Memetaj
University of Vlora
Mathematics and Computer
Science Department
L. Pavaresia
Vlore
m_sokol@hotmail.com

Johanna Michor
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
Johanna.Michor@esi.ac.at

Aart Middeldorp
Universität Innsbruck
Institut für Informatik
Technikerstraße 25/7
A-6020 Innsbruck
aart.middeldorp@uibk.ac.at

Vera Miljanovic
Technische Universität Wien
Wiedner Hauptstraße 8-10
A-1040 Wien
vera@deana.math.tuwien.ac.at

Rainer Mlitz
Technische Universität Wien
Institut für Angewandte und
Numerische Mathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
r.mlitz@tuwien.ac.at

Pierpaolo Montana
Università di Roma I
Dipartimento di Matematica per le Decisioni Economiche, Finanziarie ed Assicurative
Via del Castro Laurenziano 9
I-00161 Roma
pierpaolo.montana@uniroma1.it

Willi More
Universität Klagenfurt
Institut für Mathematik
Universitätsstraße 65-67
A-9020 Klagenfurt
willi.more@uni-klu.ac.at

Markus Moschner
Universität Wien
Institut für Statistik und Decision Support Systems
Universitätsstraße 5/3
A-1010 Wien
moschm@logic.at

Walther Neuper
Technische Universität Graz
Institut für Softwaretechnologie
Wielandgasse 19
A-8010 Graz
neuper@ist.tugraz.at

Andreas Obereder
Universität Linz
Institut für Industriemathematik
Altenbergerstraße 69A
A-4040 Linz
obereder@indmath.uni-linz.ac.at

Michael Oberguggenberger
Universität Innsbruck
Technische Mathematik, Geometrie und Bauinformatik
Technikerstraße 13/6
A-6020 Innsbruck
michael@mat1.uibk.ac.at

Pierpaolo Omari
Università di Trieste
Dipartimento di Science Matematiche
Via Valerio 12
I-34127 Trieste
omari@units.it

Alexander Ostermann
Universität Innsbruck
Technische Mathematik, Geometrie und Bauinformatik
Technikerstraße 13/6
A-6020 Innsbruck
alexander.ostermann@uibk.ac.at

Alois Panholzer
Technische Universität Wien
Institut für Algebra und Computermathematik
Wiedner Hauptstraße 8-10/118
A-1040 Wien
Alois.Panholzer@tuwien.ac.at

Franz Pauer
Universität Innsbruck
Institut für Mathematik
Technikerstraße 25/7
A-6020 Innsbruck
franz.pauer@uibk.ac.at

Carla Peri
Università Cattolica S.C.
Largo Gemelli 1
I-20123 Milano
carla.peri@unicatt.it

Oliver Pfeiffer
Montanuniversität Leoben
Institut für Mathematik und
Angewandte Geometrie
Franz-Josef-Straße 18
A-8700 Leoben Austria
oliver.pfeiffer@unileoben.ac.at

Martin Pfurner
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/1
A-6020 Innsbruck
martin.pfurner@uibk.ac.at

Friedrich Pillichshammer
Universität Linz
Institut für Analysis, Abtlg.:
Finanzmathematik
Altenberger Straße 69
A-4040 Linz
friedrich.pillichshammer@jku.at

Nikola Popovic
Technische Universität Wien
Institut für Angewandte und
Numerische Mathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
nikola.popovic@tuwien.ac.at

Helmut Pottmann
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10
A-1040 Wien
pottmann@geometrie.tuwien.ac.at

Claudio Procesi
Università di Roma
Dipartimento Matematico G.
Castelnuovo
Piazzale A. Moro
I-00185 Roma
procesi@mat.uniroma1.it

Helmut Prodinger
University of the Witwatersrand
School of Mathematics
P. O. Wits
2050 Johannesburg
South Africa
helmut@maths.wits.ac.za

Georg Propst
Universität Graz
Institut für Mathematik
Heinrichstraße 36
A-8010 Graz
georg.propst@uni-graz.at

Bernhard Quatember
Universität Innsbruck
Institut für Informatik
Technikerstraße 25
A-6020 Innsbruck
Bernhard.Quatember@uibk.ac.at

Armin Rainer
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
armin_rainer@gmx.net

Ludwig P. Reich
Universität Graz
Institut für Mathematik
Heinrichstraße 36
A-8010 Graz
ludwig.reich@kfunigraz.ac.at

Heinrich Reitberger
Universität Innsbruck
Institut für Mathematik
Technikerstraße 25
A-6020 Innsbruck
Heinrich.Reitberger@uibk.ac.at

Matthias Reitzner
Technische Universität Wien
Institut für Analysis und
Technische Mathematik 1142
Wiedner Hauptstraße 8-10
A-1040 Wien
mreitzne@mail.zserv.tuwien.ac.at

Fulvio Ricci
Scuola Normale Superiore
Piazza dei Cavalieri 7
I-56126 Pisa
fricci@sns.it

Luigi Rodino
Università di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
I-10123 Torino
rodino@dm.unito.it

Wolfgang Runggaldier
Università di Padova
Dipartimento di Matematica Pura
ed Applicata
7 Via Belzoni
I-35131 Padova
runggal@math.unipd.it

Barbara Rüdiger
Universität Bonn
Institut für Angewandte
Mathematik, Abtlg.:
Wahrscheinlichkeitstheorie
Wegelerstraße 6
D-53115 Bonn
ruediger@wiener.iam.uni-bonn.de

Otto Röschel
Technische Universität Graz
Institut für Geometrie
Kopernikusgasse 24/IV
A-8010 Graz
roeschel@tugraz.at

Marco Sabatini
Università di Trento
Dipartimento di Matematica
Via Sommarive 14
I-38050 Povo (TN)
sabatini@science.unitn.it

Paolo Salani
Università di Firenze
Dipartimento di Matematica
Viale Morgagni 67a
I-50134 Firenze
salani@math.unifi.it

Maura Salvatori
Università di Milano
Dipartimento di Matematica
Via Saldini 50
I-20133 Milano
maura.salvatori@mat.unimi.it

Jörn Sass
Universität Linz
Johann Radon Institute for
Computational and Applied
Mathematics (RICAM)
Altenbergerstraße 69a
A-4040 Linz
joern.sass@oeaw.ac.at

Walter Schachermayer
Technische Universität Wien
Institut für Finanz- und
Versicherungsmathematik,
Wiedner Hauptstraße 8-10/105
A-1040 Wien
wschach@fam.tuwien.ac.at

Klaus Scheicher
Universität Linz
Institut für Analysis, Abtlg.:
Finanzmathematik
Altenbergerstraße 69
A-4020 Linz
klaus.scheicher@jku.at

Karl-Georg Schlesinger
Erwin-Schrödinger-Institut Wien
Boltzmanngasse 9
A-1090 Wien
kgschles@esi.ac.at

Christian Schmeiser
Technische Universität Wien
Institut für Angewandte und
Numerische Mathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
christian.schmeiser@tuwien.ac.at

Peter Schmitt
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
peter.schmitt@univie.ac.at

Rolf Schneider
Universität Freiburg
Mathematisches Institut, Abtlg.:
Reine Mathematik
Eckerstraße 1
D-79104 Freiburg
rolf.schneider@math.uni-
freiburg.de

Georg Schneider
Universität Wien
Institut für
Betriebswirtschaftslehre
Brünnerstraße 72
A-1210 Wien
Georg.Schneider@univie.ac.at

Johannes Schoissengeier
Universität Klagenfurt
Institut für Mathematik
Universitätsstraße 65-67
A-9020 Klagenfurt
johannes.schoissengeier@uni-klu.ac.at

Bernhard Schratzberger
Universität Salzburg
Institut für Mathematik
Hellbrunnerstraße 34
A-5020 Salzburg
bernhard.schratzberger@sbg.ac.at

Fritz Schweiger
Universität Salzburg
Institut für Mathematik
Hellbrunnerstraße 34
A-5020 Salzburg
fritz.schweiger@sbg.ac.at

Gunther Schweitzer
Technische Universität Graz
Institut für Mathematik A
Steyrergasse 30/II
A-8010 Graz
schweitzer@finanz.math.tu-graz.ac.at

Thomas Ostergaard Sorensen
Universität München
Mathematisches Institut
Theresienstraße 39
D-80222 München
sorensen@math.auc.dk

Fulvia Spaggiari
Università di Modena e Reggio Emilia
Dipartimento di Matematica
Via Campi 213/B
I-41100 Modena
spaggiari.fulvia@unimo.it

Hellmuth Stachel
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10/113
A-1040 Wien
stachel@geometrie.tuwien.ac.at

Tim Joshua Steger
Università di Sassari
Struttura di Matematica e Fisica
Via Vienna 2
I-07100 Sassari (SS)
steger@ssmain.uniss.it

Roland Steinbauer
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1090 Wien
roland.steinbauer@univie.ac.at

Alois Steindl
Technische Universität Wien
Institut für Mechanik
Wiedner Hauptstraße 8-10
A-1040 Wien
Alois.Steindl@tuwien.ac.at

Wolfgang Steiner
Technische Universität Wien
Institut für Geometrie
Wiedner Hauptstraße 8-10
A-1040 Wien
steiner@geometrie.tuwien.ac.at

Bertran Steinsky
Technische Universität Graz
Institut für Mathematik A
Steyrergasse 30/II
A-8010 Graz
steinsky@finanz.math.tu-graz.ac.at

Peter Szmolyan
Technische Univesität Wien
Institut für Angewandte und
Numerische Mathematik
Wiedner Hauptstraße 6-10
A-1040 Wien
szmolyan@tuwien.ac.at

Susanne Teschl
Technikum Wien
Fachhochschule-Studiengang
Informations-u.
Kommunikationssysteme
Höchstädtplatz 5
A-1200 Wien
susanne.teschl@technikum-wien.at

Gerald Teschl
Universität Wien
Institut für Mathematik
Strudlhofgasse 4
A-1190 Wien
Gerald.Teschl@univie.ac.at

Elmar Teufl
Technische Universität Graz
Institut für Mathematik
Steyrergasse 30
A-8010 Graz
teufl@finanz.math.tu-graz.ac.at

Maximilian Thaler
Universität Salzburg
Institut für Mathematik
Hellbrunnerstraße 34
A-5020 Salzburg
Maximilian.Thaler@sbg.ac.at

Mechthild Maria Thalhammer
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13
A-6020 Innsbruck
Mechthild.Thalhammer@uibk.ac.at

Jörg Maximilian Thuswaldner
Montanuniversität Leoben
Institut für Mathematik und
Statistik
Franz-Josef-Straße 18
A-8700 Leoben
joerg.thuswaldner@unileoben.ac.at

Robert Tichy
Technische Universität Graz
Institut für Mathematik A
Steyrergasse 30/II
A-8010 Graz
tichy@tugraz.at

Karl Unterkofler
Fachhochschule Vorarlberg
Achstraße 1
A-6850 Dornbirn
karl.unterkofler@fh-vorarlberg.ac.at

Giuseppe Valla
Università di Genova
Dipartimento di Matematica
Via Dodecaneso 35
I-16146 Genova
valla@dima.unige.it

Alessandro Veneruso
Università di Genova
Dipartimento di Matematica
Via Dodecaneso 35
I-16146 Genova
veneruso@dima.unige.it

Ezio Venturino
Università di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
I-10123 Torino
ezio.venturino@unito.it

Reinhard Viertl
Technische Universität Wien
Institut für Statistik und
Wahrscheinlkichkeitstheorie
Wiedner Hauptstraße 8/107
A-1040 Wien
R.Viertl@tuwien.ac.at

Gabriele Villari
Università di Firenze
Dipartimento die Matematica
Ulisse Dini
Viale Morgagni 67A
I-50134 Firenze
villari@math.unifi.it

Aljosa Volcic
Università di Trieste
Dipartimento di Science
Matematiche
Via Alfonso Valerio 12/1
I-34100 Trieste
volcic@univ.trieste.it

Michael von Renteln
Universität Karlsruhe
Mathematisches Institut
Kaiserstraße 12
D-76128 Karlsruhe
michael.vonrenteln@math.uni-karlsruhe.de

Peter Wagner
Universität Innsbruck
Technische Mathematik,
Geometrie und Bauinformatik
Technikerstraße 13/4
A-6020 Innsbruck
wagner@mat1.uibk.ac.at

Johannes Wallner
Technische Universität Wien
Abteilung für Geometrie im
Maschinenwesen und Kinematik
Wiedner Hauptstraße 8-10/113
A-1040 Wien
wallner@geometrie.tuwien.ac.at

Gerhard Wanner
Université de Genève
Section de mathématiques
C.P. 240
CH-1211 Genéve 24
Gerhard.Wanner@math.unige.ch

Gunter Weiss
Technische Universität Dresden
Institut für Geometrie
Zellescher Weg 12-14
D-01069 Dresden
weiss@math.tu-dresden.de

Johann Wiesenbauer
Technische Universität Wien
Institut für Algebra und
Computermathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
j.wiesenbauer@tuwien.ac.at

Reinhard Winkler
Technische Universität Wien
Institut für Algebra und
Computermathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
reinhard.winkler@tuwien.ac.at

Wolfgang Woess
Technische Universität Graz
Institut für Mathematik C
Steyrergasse 30
A-8010 Graz
woess@weyl.math.tu-graz.ac.at

Fabio Zanolin
Università di Udine
Dipartimento di Matematica e
Informatica
Via delle Scienze 206
I-33100 Udine
zanolin@dimi.uniud.it

Redaktion: M. Oberguggenberger, Th. Fetz
Universität Innsbruck, Technikerstr. 13, 6020 Innsbruck
E–mail: oemg2003@uibk.ac.at
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