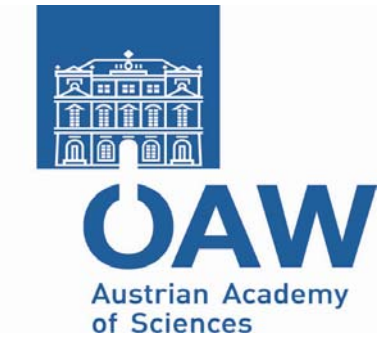

Austrian Academy of Sciences

Annual Report 2008

Johann Radon Institute for Computational and Applied Mathematics (RICAM)

REPORTING PERIOD:	1.1.2008 – 31.12.2008
DIRECTOR OF THE REPORTING RESEARCH INSTITUTION:	Prof. Heinz W. Engl RICAM
ADDRESS:	Altenbergerstraße 69 4040 Linz

This report reflects the situation and planning status at the end of 2008. Developments of 2009 will be reported in the next Annual Report.

Contents

Mission Statement

The Johann Radon Institute for Computational and Applied Mathematics (RICAM)

- does basic research in computational and applied mathematics according to highest international standards
- obtains the motivation for its research topics also from challenges in other scientific fields and industry
- emphasizes interdisciplinary cooperation between its workgroups and with institutions with similar scope and universities world-wide
- cooperates with other disciplines in the framework of special semesters on topics of major current interest
- wishes to attract gifted PostDocs from all over the world and to provide an environment preparing them for international careers in academia or industry
- cooperates with universities by involving PhD-students into its research projects
- promotes, through its work and reports about it, the role of mathematics in science, industry and society

1. Scientific Activity 2008

1.1. Zusammenfassung des wissenschaftlichen Berichts 2008 (Deutsch)

Das Institut verfügte 2008 über folgende Arbeitsgruppen:

- Arbeitsgruppe “Computational Methods for Direct Field Problems”, Gruppenleiter: Prof. Dr. Ulrich Langer
- Arbeitsgruppe “Inverse Problems”, Gruppenleiter: Prof. Dr. Heinz Engl
- Arbeitsgruppe „Symbolic Computation”, Gruppenleiter: Prof. Dr. Josef Schicho
- Arbeitsgruppe „Financial Mathematics”, Gruppenleiter: Prof. Dr. Hansjörg Albrecher
- Arbeitsgruppe „Analysis of Partial Differential Equations”, Gruppenleiter: Prof. Dr. Peter Markowich, Doz. Dr. Massimo Fornasier
- Arbeitsgruppe „Optimization and Optimal Control”, Gruppenleiter: Prof. Dr. Karl Kunisch
- Arbeitsgruppe „Mathematical Imaging”, Gruppenleiter: Prof. Dr. Otmar Scherzer

Im Jahr 2008 genehmigte das Präsidium der ÖAW die Errichtung einer zusätzlichen Arbeitsgruppe „Mathematical Methods in Systems and Molecular Biology“, die 2009 unter der Leitung von Dr. Philipp Kügler und Prof. Dr. Christian Schmeiser ihre Arbeit im BioCenter Wien aufnehmen wird.

Da Herr Prof. Albrecher inzwischen einen Ruf an die Universität Lausanne angenommen hat, wird die Arbeitsgruppe „Mathematical Finance“ im Jahr 2009 wieder umstrukturiert werden müssen.

Alle Arbeitsgruppen erzielten in ihren jeweiligen Gebieten zahlreiche wissenschaftliche Resultate, die unten detaillierter beschrieben sind, und die sich in zahlreichen Publikationen in internationalen Zeitschriften und Präsentationen auf Tagungen niederschlugen. Ein wesentliches Element der Arbeit des RICAM ist die interdisziplinäre Kooperation zwischen den Arbeitsgruppen; auch diese ist unten detailliert dargestellt. Zusätzlich fanden zahlreiche Kooperationen mit Wissenschaftern in aller Welt statt, das Institut hatte auch wieder ein reges Besuchsprogramm.

Seit Gründung des Instituts fand jedes Jahr ein Spezialsemester statt, im Jahr 2008 zum Thema „Stochastics with Emphasis on Finance“. Dieses Spezialsemester wurde von Prof. Dr. Hansjörg Albrecher und Prof. Dr. Wolfgang Runggaldier (Universität Padua) geleitet; 258 TeilnehmerInnen aus 34 Ländern, darunter 115 eingeladene Vortragende, nahmen teil. Wie bei früheren Spezialsemestern werden die Ergebnisse wieder in einem Buch in der „Radon Series for Computational and Applied Mathematics“, die vom Verlag DeGruyter in Berlin herausgegeben wird, dokumentiert werden.

Für 2009 war ein Spezialsemester „Inverse Problems“ von ähnlicher Dimension geplant. Wegen der Finanzkrise der ÖAW musste es in dieser Form abgesagt werden. Da mehrere ausländische Besucher ihre Freisemester bereits langfristig geplant hatten, um das Frühjahrssemester 2009 am RICAM zu verbringen, wird dieses Spezialsemester in stark reduzierter Form stattfinden und zur internationalen Konferenz „Applied Inverse Problems“ führen, die im Juli 2009 in Wien abgehalten wird.

1.2. Summary of the scientific report 2008 (English)

At the end of 2008, the Institute had the following group structure:

- Computational Methods for Direct Field Problems, group leader: Prof. Dr. Ulrich Langer
- Inverse Problems, group leader: Prof. Dr. Heinz Engl
- Symbolic Computation, group leader: Prof. Dr. Josef Schicho
- Financial Mathematics, group leader: Prof. Dr. Hansjörg Albrecher
- Analysis of Partial Differential Equations, group leaders: Prof. Dr. Peter Markowich, Doz. Dr. Massimo Fornasier
- Optimization and Optimal Control, group leader: Prof. Dr. Karl Kunisch
- Mathematical Imaging, group leader: Prof. Dr. Otmar Scherzer

During 2008, the Austrian Academy of Sciences approved the establishment of an additional working group in the field of Mathematical Methods in Systems and Molecular Biology under the leadership of Dr. Philipp Kügler and Prof. Dr. Christian Schmeiser, which will be located in the Vienna BioCenter.

Due to the fact that Prof. Albrecher accepted a call to the University of Lausanne, the Mathematical Finance group will have to be restructured again in 2009.

All groups achieved major scientific results in their fields as will be described in detail below and as is documented in a large number of publications. A key element of the work of the Institute is interdisciplinary cooperation between the groups; also these are documented in detail below. In addition, many cooperations with researchers all over the world took place. The Institute also had a very active visitors' program.

Since its foundation, the Institute held one Special Semester each year. In 2008, a Special Semester on Stochastics with Emphasis on Finance took place. It was jointly led by Prof. Hansjörg Albrecher and Prof. Wolfgang Runggaldier (University of Padova); during that semester, 258 participants from 34 countries visited; 115 of them were invited speakers. As earlier Special Semesters, also this one will have a lasting record in the form of a book in the Radon Series for Computational and Applied Mathematics, which is published by DeGruyter, Berlin.

For 2009, a Special Semester for Inverse Problems of a similar dimension had been planned. Due to a severe financial crisis in the Austrian Academy of Sciences, it had to be cancelled in this form. Since international visitors had already planned their sabbaticals in order to stay at RICAM during the spring of 2009, this Special Semester will be run in a reduced form and culminate in the international conference “Applied Inverse Problems” to take place in Vienna in July 2009.

1.3. Report on the scientific activity during 2008

Group "Computational Methods for Direct Field Problems"

Group Leader:

O.Univ.-Prof. Dipl.-Ing. Dr. Ulrich Langer

Researchers funded via ÖAW/Upper Austrian government funds:

PD Dr. Sven Beuchler (employed since September 1, 2008)
Dr. Chokri Chniti (employed until August 31, 2008)
Dr. Ivan Georgiev (employed since September 1, 2008)
Dr. Johannes Kraus
Dr. Satyendra Tomar

Visiting Scientist funded ÖAW/Upper Austrian government funds:

Prof. Dr. Ludmil Zikatanov (Oktober 3, 2008 –June 30, 2009)

Researchers funded via FWF:

Dipl.-Ing. Erwin Karer
Dipl.-Ing. Martin Purrucker (employed since November 1, 2008)
Dipl.-Ing. Astrid Sinwel (START-Project Y-192)

The "Computational Mathematics Group" (CMG) has focused on the development, analysis and implementation of novel fast computational methods for Partial Differential Equations (PDEs) or systems of PDEs arising in different fields of applications such as solid and fluid mechanics, electromagnetics, and others. In the following we present the main scientific activities and the most important achievements and results obtained in 2008:

1. *S. Beuchler* successfully completed his habilitation thesis on **"High Order FEM-Fast Solvers for Tensor Product Elements"** at the JKU in November 2008.

2. *J. Kraus* submitted his habilitation thesis on **"Algebraic multilevel methods for solving discretized finite element elliptic equations with symmetric positive definite matrices"** to the JKU in December 2008.

3. **FWF-project P20121-N18 "*Fast hp-solvers for elliptic and mixed problems"*** led by *S. Beuchler* (1 PhD-position: M. Purrucker): In cooperation with V. Pillwein (RISC+MathDK W1214, JKU Linz) and S. Zaglmayr (TU Graz) *S. Beuchler* is working on special higher-order shape functions for H(div) and H(curl) problems resulting in sparse element stiffness matrices.

4. *S. Beuchler* submitted the FWF-project ***"Numerical simulation of the proton transport along lipid bilayer membranes using adaptive finite elements"*** within the Doctoral Colleague "*Molecular bioanalytics" at the* JKU Linz. This project fits well into the new activities of RICAM in BioMath. A close cooperation with the Bio-Group is planed.

5. **FWF-Research Project P19170-N18 "*Algebraic Multigrid and Multilevel Methods for Vector Field Problems"*** led by *J. Kraus* (1 PhD position: E. Karer): E. Karer investigated Algebraic Multigrid (AMG) for problems in linear elasticity. The approach, which J. Kraus and E. Karer developed, exploits the special structure of the problem, i.e., the form of the stiffness matrices obtained by discretizing the equations of linear elasticity with linear finite elements. Thereby, a robust preconditioner for the arising discretized system of equations can be constructed. The method sets up so-called "edge matrices" that represent the dependence between certain degrees of freedom among each other. Those matrices are further used to determine the strength of nodal dependence, which is the basis for the selection of a coarse grid. Additionally, the edge matrices are used to set up the prolongation operator. E. karer implemented the special AMG approach in the finite element software package NGSolve developed by J. Schöberl (START Group). Several numerical tests were performed in order to verify the robustness of the preconditioner. The tests showed that the method is robust with respect to jumps in the material parameters, with respect to deformed geometries and with respect to orthotropic materials. Additionally, to the implementation, the two-level convergence of the approach was investigated. The numerical and theoretical results were summarized in the article "Algebraic multigrid for finite element elasticity equations: Determination of nodal dependence via edge matrices and two-level convergence", which appeared as a RICAM report and which was submitted to the International Journal for Numerical Methods in Engineering. Since the discretization using linear finite elements is not stable for almost incompressible materials such materials are not covered so fare. Therefore, we have started to study the discretization of the linear elasticity equations by discontinuous Galerkin (DG) methods. The aim is to construct a robust preconditioner in order to investigate the behavior of almost incompressible materials.

6. **Isogeometric method for numerical solution of partial differential equations**: *S. Tomar* submitted the project titled “Isogeometric method for numerical solution of partial differential equations” to FWF in September 2008. B. Jüttler (JKU Linz) and T.J.R. Hughes (Austin, USA) are national and international cooperation partners, respectively, The J.T. Oden Faculty research fellowship was awarded to *S. Tomar* in Oct 2008 on this topic.

7. **Functional-type a posteriori error estimates**: *S. Tomar* has continued his cooperation with. S. Repin (St. Petersburg) on functional-type a posteriori error estimates. They developed new estimates based on the Helmholtz type decomposition of the error for non-conforming approximation of elliptic problems. These estimates, while being qualitatively the same as our earlier work, are more general in application, e.g., they can work directly with discontinuous Galerkin approximation, can be used for mortar finite element methods, other non-conforming methods, or Trefftz methods. The related publications can be found in [Akademis, chapter 17].

8. There is a special Collarative Research Project **on “Robust Scientific Computing Methods and High Performance Algorithms”** of our RICAM group with the Institute for Parallel Processing (IPP) of the Bulgarian Academy of Sciences (BAS) at Sofia (Bulgaria). This projct is based on an agreement between RICAM and the IPP. There are numerous joint publications co-authored by *I. Georgiev*, *J. Kraus* and S. Margenov, see [Akademis, chapter 17], and other joint scientific activities like the organization of minisymposia and special sessions at international conferences, e.g., at the PMAA’08 in Switzerland. In particular, *J. Kraus* and S. Margenov are working on a monograph titled “Robust Algebraic Multilevel Methods and Algorithms” that will be published by Walter de Gruyter in 2009.

9. **Algebraic multilevel iterative (AMLI) methods:** *J. Kraus and S. Tomar* developed optimal order AMLI methods for systems of linear algebraic equations which arise from the finite element discretizations of variational problems posed in the Hilbert space H(div). Such a fast iterative solver is important not only for a variety of problems which has their variational formulation in H(div), e.g., in continuum mechanics, or in the mixed finite element discretization of a scalar second order elliptic problem, but also for functional-type a posteriori error estimates developed in the above-mentioned work. As a first step, they have developed a solver for lowest-order Raviart-Thomas (RT) elements. We are currently working on its extension to high-order RT elements. The related publications can be found in [Akademis, chapter 17].

10. **Domain Decomposition Methods:** *S. Beuchler* and *U. Langer* together with T. Eibner (TU Chemnitz, Germany) worked on primal and dual interface-concentrated Finite Element Methods. The results were published in the "SIAM Journal on Numerical Analysis" (see [Akademis, chapter 17] for the precise reference). The coupling of the interface-concentrated FETI method with data-sparse BETI methods were investigated by *U. Langer* and C. Pechstein (JKU Linz) and published in the journal "Computing and Visualization in Science" (see [Akademis, chapter 17] for the precise reference). *C. Chniti* was working on the so-called optimized Schwarz methods on the continuous level and the discrete (FEM) counterparts (see [Akademis, chapter 17] for his publications).

11. *L. Zikatanov* who joined our group at 1st of October 2008 and his collaborators *J. Kraus* and *I. Georgiev* from our staff have started and made progress on the development of **new discontinuous Galerkin discretizations for linear elasticity problems.** We have also worked on **design development of algebraic multigrid** (AMG) software with targeted applications in porous media and other multiscale models. The main goal is to use the theoretical background to design the components of adaptive AMG and also implement these on different parallel computer architectures.

Further publications of the group can be found in chapter 17 in the Akademis report.

Group "Inverse Problems"

Group Leader:

o. Univ.-Prof. DI. Dr. Heinz W. Engl

Researchers funded via ÖAW/Upper Austrian government funds:

Dr. Stefan Müller
Dr. Trungh Thanh Nguyen
Prof. Sergei Pereverzyev
Dr. Sergei Pereverzyev (until Feb 29, 2008)
Dr. Hanna Pikkarainen
Dr. Ronny Ramlau (until Aug. 31, 2008)
Dr. Elena Resmerita (until May 31, 2008)
Dr. Mourad Sini

Researchers externally funded:

Stephan Anzengruber
Kattrin Arning
Dr. Hui Cao
Dr. Marcin Janicki (until Aug. 31, 2008)
Dr. Shuai Lu
Dr. James Lu
Dr. Esther Klann
Dr. Jenny Niebsch
Dr. Sivananthan Sampath
Dr. Eva Sincich (until Feb. 29, 2008)
Dr. Marie-Therese Wolfram (until Sept. 30, 2008)
Clemens Zarzer

In addition to the group leader, the group currently consists of 11 (senior) PostDocs and 3 doctoral students. Also, a member of the Industrial Mathematics Institute of JKU (Philipp Kügler) contributed to the scientific work of the institute in an advisory role within externally funded projects. Out of the 15 positions of the group, 5 were funded by the ÖAW. External funds come from

- the FWF in the framework of single projects and the Doctoral College "Molecular Bio-analytics"

- the Viennese fund WWTF for a project in systems biology jointly led by Christoph Flamm (University of Vienna) and the group leader.

The group was (and will continue to be) dealing with a wide variety of topics in inverse problems and related fields as can be seen in more detail from the individual reports below and in the previous annual reports. These can be grouped into methodological and applications-oriented topics, with close relations between both.

On the methodological side, the work concerned

- regularization methods, both variational and iterative ones, for nonlinear inverse problems with an emphasis on implementable parameter choice strategies with optimal convergence properties (like the “balancing principle”)
- theory of and use of sparsity in regularization methods
- regularization methods in a non-Hilbert space setting like Bregman iteration, maximum entropy and EM methods
- level set methods, BV and inverse scale space regularization, with close connections to imaging,
- a convergence theory (in distribution) for stochastic inverse problems including the first quantitative convergence results for Bayesian inversion, measured in the Prokhorov and Ky Fan metrics

Major application fields addressed were

- inverse problems in finance, where theory and numerics for identification in Levy models were developed in cooperation with the Finance Group
- inverse scattering
- parameter identification and inverse bifurcation problems in systems biology (where sparsity plays a major role)
- inverse problems for ion channels and biological membranes.

The last two points belong to the promising field of inverse problems in biology, which will be even by RICAM more emphasized in the future: Beginning in 2009, a group on Mathematical Methods in Molecular and Systems Biology will be set up in the Vienna BioCenter to initiate cooperations with life scientists there. This group emerged from efforts both of the Inverse Problems and of the Analysis of PDEs group and will be jointly led by Philipp Kügler and Christian Schmeiser.

The group has also been connected to all of the Special Semesters so far. In the Special Semester on Stochastics held in 2008, one important topic was stochastic methods for in-

verse and identification problem and their interplay with deterministic methods, which will also remain an important research topic for the group. Also, inverse problems in finance were treated. For the spring of 2009, we planned a Special Semester on Inverse Problems, which had to be cancelled due to a severe financial crisis. Since some international participants had planned their sabbatical accordingly and will nevertheless spend part of the spring of 2009 in Linz, a program in the form of a “Mini Special Semester” will be conducted, will lead into the international Applied Inverse Problems Conference (chaired by the group leader) to be held in Vienna in July 2009.

Contributions oft he individual group members

Trung Thanh Nguyen

Worked done in 2008 (2 months): studied forward and inverse acoustic and electromagnetic scattering theory

Future plans: we are investigating non-iterative methods for inverse obstacle scattering problems including the linear sampling method, factorization methods, probing methods, singular source methods, the stationary wave method. The main concentrations are: 1) asymptotic behavior of the so-called indicator functions in terms of geometrical and physical properties near the boundary of the obstacle, 2) Mathematical justification of the performance of the methods for different kinds of obstacle, 3) Numerical methods for forward scattering problems, 4) implementation of non-iterative algorithms and interpretation of numerical results, 5) Non-iterative methods with denoising the measured data using wavelets.

Sergei Pereveryzev (Hui Cao,Shua Lu, Sivananthan Sampath)

FWF Project P 20235-N18:

1)For the first time an order-optimal a posteriori regularization parameter choice strategy has been proposed for the classical quasi-reversibility method of solving ill-posed elliptic Cauchy problem (in cooperation with Dr. Hui Cao and Professor Michael Klibanov from University of North Carolina
(USA).)

2) First order-optimal error bounds have been obtained for multi-parameter Tikhonov regularization, which allows a control of the regularization performance in several spaces simultaneously (in cooperation with Dr. Shuai Lu and Professor Ulrich Tautenhahn from University of Applied Sciences Zittau/Görlitz (Germany)).

EU-Project EUP0139-20900:

New supervised learning scheme has been proposed, when not only a predictor, but also a space, where it is searched for, is constructed adaptively. This scheme has been used for predicting blood glucose concentration of diabetic patients. Experiments with data from the first clinical trial allows a conclusion that this new predicting algorithm outperforms existing ones in terms of a prediction horizon (1 hour versus half an hour), amount and frequency of measurements used for a prediction, and a period required for training of a prediction engine (4 hours versus several days). The research has been performed in cooperation with Dr. Sivananthan Sampath.

Hanna Pikkarainen

2008:

The mathematical theory of the Bayesian approach to inverse problems has been refined and applied to root computation

2009:

The development of Bayesian inversion theory in infinite dimensions will be continued in the direction of convergence rates and parameter choice rules

regularization of measures

Mourad Sini

1. There are several methods proposed to reconstruct interfaces from near or far field data. We can cite: MUSIC, LINEAR SAMPLING, FACTORISATION and PROBING methods. They are all build on indicator functions which depend on a special parameter. The main property of these indicator functions is that they change drastically when the parameter is near the interface.

In many of the published papers using those methods, the authors try to justify this property for different models and settings. However, in the numerical tests, it is clear that the quality of the reconstructions is heavily dependent on the way how the indicator functions blow up.

Sini intends to give more insight on this question. The geometry of the interface plays a great role. But other factors are also responsible of the quality of the reconstruction as the material (the coefficents of the PDE) distributed in or on the obstacles and the anisotropy of the background media..

In two papers written with Jijun Liu, Sini explained how the curvature of the interface affects the quality of the blowup of the indicator functions and then the quality of the reconstruction.

2.) A paper has been submitted with R. Potthast concerning the reconstruction of polygonal obstacles using few incident waves for the Maxwell model. It explained why one incident

wave and two linearly independ polarisations are enough to reconstruct convex polygons, and the no-response test as an algorithm for the reconstruction was justified.
3.) In collaboration with G. Nakamura and N. Honda, Sin finished a paper where they show how non-analytic obstacles can be reconstructed using few incident waves regardless of the size of the obstacles (as for Colton-Sleeman's results) nor the forms (as for polygonal obstacles by Alessandrini-Rondi, Yamamoto-Cheng, etc...). In 2008, Dr.Sini also submitted his habilitation to JKU.

Esther Klann

FWF-Project P19029-N18

2008 :

- Mumford-Shah Models for the Inversion of Tomography data
  * Implementation of an algorithm for the simultaneous inversion and segmentation of tomography data from an integrated SPECT/CT scanner (Prof. Ring, Graz; Prof. Ramlau)
  * Test calculations with synthetic data of different error levels
  * Works tarted: Regularization theory for linear operator equations by perimeter and norm constrainst (Prof. Ramlau) .
- Wavelet-based multilever methods for linear ill-posed problems (Prof. Reichel, Kent; Prof. Ramlau)

Jenny Niebsch

Developd imbalance reconstruction methods for high precision cutting machinery

Kattrin Arning

She developed an algorithm for the identification of ion channel properties based on current measurements, using a surrogate model approach.
Furthermore, the gating of channels has been investigated. For 2009 the application of the algorithm to real channel data is planned as well as addressing inverse problems with the gating model.

Ronny Ramlau

1. Regularization with sparsity constraints
i) Convergence rates results (with Resmerita)
ii) Minimization of TIkhonov functionals for p<1 (with Zarzer)
iii) Discrepancy principle for Tikhonov with sparsity constraint (with Anzengruber)
iv) Joint sparsity constraints (Fornasier, Teschke)
2. Simultaneous Reconstruction and Segmentation for Tomography data
i) Regularization results for the simultaneous reconstruction (with W. Ring)

ii) Optimization of a Mumford Shah like functional for simultaneously measured SPECT and CT data (with Klann and Ring)

3. Rotor Dynamics

i) Modelling of a ultra precision machine tool (w. J. Niebsch)

ii) Balancing of vacuum pumps

4. Adaptive iterative methods

i) Adaptive Landweber iteration (w. M. Zhariy)

ii) Multi - Level conjugate gradient method (w. E. Klann and L. Reichel)

Stefan Müller

software development for SOSlib, an open source library for systems biology problems developed by our cooperation partners at the University of Vienne:

- forward and adjoint sensitivity analysis
- compiler for the fast evaluation ofright-hand sides of the ODE.

Parameter identification

- in systems biology
- for the chlorite/iodide reaction

Analysis of simple biochemical systemssymbolic bifurcation analysis for gene regulatory networks

Clemens Zarzer

- study of literature on the Hypothalamic-Pituitary-Adrenals (HPA) axis in mammals
- development of a molecular biology model with a focus on the slow and fast feedback mechanism of cortisol in the pituitary gland
- design of a mathematical (ODE) model, based on the molecular biology model
- code development of an inverse (parameter identification) solver (MATLAB) specialized on molecular biology related ODE models
- first results on convergence analysis of variational regularization with a non-convex sparsity-enforcing regularization term. Together with R.Ramlau, a numerical algorithm was developed for this setup.

James Lu Inverse analysis for oscillatory potential in yeast metabolism; inverse bifurcation for inferring mechanisms underlying chronic stress conditions in hypothalamic-pituitary-adrenal axis; wavelet analaysis of chromosome positioning data; inferring diffusion mechanism in cell cytoplasm from fluorescence-correlation spectroscopy (FCS) data.

References see chapter 1.7, page 75-76.

Group "Symbolic Computation

Group Leader:

Univ.-Prof. DI. Dr. Josef Schicho

Researchers funded via ÖAW/Upper Austrian government funds:

Dr. Georg Regensburger

Dr. Markus Rosenkranz

Dr. David Sevilla

Researchers externally funded:

Madalina Hodorog

Niels Lubbes

Brian Moore

The group of symbolic computation consists of group leader J. Schicho, postdoctoral researchers G. Regensburger, M. Rosenkranz and D. Sevilla, and PhD students M. Hodorog, N. Lubbes and B. Moore (externally funded). Until February, T. Beck was working as a postdoctoral researcher. The special research area "Numeric and Symbolic Scientific Computation" ended as planned in September 2008; two PhD researchers of the SFB, namely Lubbes and Moore, are now still working in the symbolic computation group at RICAM, in the project "Solving Algebraic Equations"; the two postdoctoral researchers M. Kapl and X. Song and the PhD researcher S. Bela work now in other projects at the University of Linz.

In the first two months, T. Beck and J. Schicho completed the development of an algorithm for the resolution of surface singularities and, based upon this, an algorithm for adjoint computation ([1], [2]). Before this achievement, the singularity analysis and the adjoint computation was the most expensive step for the problem of parametrizing algebraic surfaces by rational functions. With the new algorithm, this step is now very fast; the most expensive step is somewhere else, and more complex instances can be treated. - T. Beck started a career in industry, he is now working in a company producing software for CAD/CAM.

Together with H. K. Pikkarainen from the RICAM group "Inverse problems", Schicho computed the posterior probabilities of the multiplicity patterns for the roots of a univariate polynomials with noisy coefficients. It is intended to apply Bayesian methods also for other ill-posed problems in computer algebra.

The theory of integro-differential operators has been extended, both on the theoretical and on the practical level. When the ring of differential operators is specialized to the important case of polynomials, one obtains the well-known Weyl algebra. Since the latter can be described as a skew polynomial ring, it is very attractive both for algebraic analysis and for algorithmic purposes. G. Regensburger and M. Rosenkranz have found a skew polynomial formulation for the ring of integro-differential operators that can be regarded as an integro-differential analog of the classical Weyl algebra. In [12] they have also set up an integro-differential analog of the well-known differential polynomials. These so-called integro-differential polynomials allow describing adjuctions in arbitrary integro-differential algebra.

The symbolic machinery of boundary value problems has been applied to an important problem in actuarial mathematics, which is concerned with estimating the risk of an insurance company to go bankrupt. Mathematically, the model reduces to a boundary value problem of arbitrarily high order. Together with H.-J. Alberecher, C. Constantinescu, and G. Pirsic, Regensburger and Rosenkranz factored this boundary value problem into first-order problems, which they then solved by suitable Green's operators. Unlike in earlier applications, one has to cope here with a boundary value problem on an unbounded domain, which necessitated some refined analysis on the function spaces to be involved. The final outcome of this treatment is a new explicit formula for the desired Gerber-Shiu function [13].

Regensburger and Rosenkranz also organized a special session on algebraic and algorithmic aspects of differential and integral operators at the ACA 2008 in Hagenberg.

Together with C. Gosselin from the University of Quebec, Schicho and Moore solved the balancing problem for planar and spherical 4-bar linkages. A linkage is statically balanced if the sum of all forces caused by its moves exerted to the base is equal to zero, and it is called dynamically balanced if the sum of all torques is zero. It has been known for some time that it is possible to balance planar mechanisms statically, and in 1997 Gosselin came up with a dynamically balanced planar mechanism. We gave now the complete classification of statically and dynamically balanced planar mechanisms [3,4]; it turned out that spherical mechanisms can only be statically balanced. A report on spherical mechanisms is in progress.

Together with B. Jüttler from the University of Linz, M. Kapl developed a method for hierarchical analysis of implicitly defined curves, based on wavelets [6]. Approximations of planar curves by circular arcs have been studied by X. Song and S. Bela [7,8]. In cooperation with Jüttler, M. Aigner from the University of Linz, and L. Gonzalez-Vega from the University of Cantabria, Schicho computed rational parametrizations for a special class of algebraic surfaces that arises in the context of geometric modelling [9].

In the FWF project “Solving Algebraic Equations”, which is a joined project together with H. Hauser from the University of Vienna, we studied families of curves on algebraic surfaces. More precisely, N. Lubbes and J. Schicho developed an algorithm for finding all families of rational curves of minimal degree on a given rational surface. The method is based on the adjoint computation method by Beck/Schicho. The method has been presented in [5]; a report and an implementation is in progress.

A byproduct of the joint seminars of the symbolic group at RICAM and the group of Hauser in Vienna was a result on algebraic varieties that can be covered by Zariski-open subsets of affine spaces. We called these varieties “plain varieties”; and the result is that the blowing up of a plain variety along a nonsingular subvariety is again plain [14].

D. Sevilla González has worked on the problem of parametrizing algebraic curves by roots. An algorithm based on quotients of algebraic curves by their automorphisms has been devised and partially implemented in the mathematical software systems Magma and Maple. As a result of the theoretical investigation, a joint paper has been submitted by publication. Another approach is that of the detection and computation of the trigonality character of an algebraic curve, since a trigonal curve for which a 3:1 map to the line is known can be easily parametrized by radicals (analogously to solving a cubic polynomial in one variable). A report on this method is in progress. - In other fields, Sevilla has published an article [10] on Monstrous Moonshine, as a result of a collaboration with J. McKay of Concordia University (Montreal). In it, the poset of replicable functions with respect to functional decomposition is explicitly calculated. The result [11] on common factors of resultants modulo p has is a joint collaboration within the AMAC research group in the University of Cantabria.

Following up the SFB, the doctoral college “Computational Mathematics” started in October. M. Hodorog and J. Schicho have started to work in the subproject “Symbolic-Numeric Techniques for Parametrizing Algebraic Varieties”. A promising idea for a symbolic/numeric analysis of the singularity type of an algebraic curve is to compute the knot of the singularity by subdivision methods.

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Further publications of the group can be found in chapter 17 in the Akademis report.

Group "Financial Mathematics"

Group Leaders:

Univ.-Prof. Dr. Hansjörg Albrecher

o.Univ.-Prof. Dr. Walter Schachermayer

Researchers funded via ÖAW/Upper Austrian government funds:

Dr. Corina Constantinescu

Dr. Markus Hahn (part-time until August 2008, full-time starting September 2008)

Dr. Ronnie Loeffen (starting September 2008)

Dr. Philipp Mayer (March 2008 until May 2008)

Dr. Wolfgang Putschögl (part-time until March 2008)

Dr. Jean-Francois Renaud (until March 2008)

Dr. Jörn Sass (until July 2008)

Dr. Stefan Thonhauser (starting in July 2008)

Univ.-Doz. Dr. Arne Winterhof

Researchers externally funded:

Dr. Nina Brandstätter (until November 2008)

Dr. Dominik Kortschak

DI Philip Ngare

Dr. Gottlieb Pirsic (starting in October 2008)

DI Stefan Thonhauser (until June 2008)

From September to December 2008, the group coorganized the Special Semester on Stochastics with Emphasis on Finance at RICAM with more than 250 participants from 34 countries and six high-level workshops on various topics in this research field (details on those events are given in the corresponding section of this report). In addition, a one-week tutorial on general topics of mathematical finance was held for the younger participants of the special semester before the start of the semester.

From August 27-29, Prof. Albrecher and Dr. Constantinescu organized the 2nd Int. Workshop on Gerber-Shiu Functions at RICAM with more than 40 international participants discussing recent advances in ruin theory. A special issue of the journal Insurance: Mathematics & Economics will appear that is dedicated to this event at RICAM.

In addition to the extensive above activities, the regular research activities on the development, calibration and analysis of stochastic models for insurance and finance, questions of optimal choice of control parameters in order to reach a given risk or profitability target and related computational issues were continued, and both internal and external collaborations were continued and intensified. A more detailed description of some significant results will be given in the following:

In collaboration with the Symbolic Computation group, algebraic techniques and methods were developed that are applicable for the analysis of risk measures in non-life insurance models. In [1], an algebraic operator approach for deriving explicit expressions of the expected discounted penalty function of a surplus process was introduced for generic penalty functions and in a renewal setting for interclaim time and claim size distributions with rational Laplace transform. The key ingredient of this approach is the transformation of certain integro-(differential) equations to boundary value problems and the factorization of the involved differential operator, leading to an algorithm of iteratively solving first-order boundary value problems. This approach circumvents the traditional Laplace transformation and has the advantage of relaxing some of the usually required analytical conditions. The method permits extensions to risk models perturbed by diffusions and risk models with investments and/or taxes. In [2], the asymptotic analysis of functions of the risk processes for renewal models under risky investments was continued. Specifically, in addition to the asymptotic analysis of ruin probabilities, the Laplace transform of the time to ruin and the expected discounted penalty (Gerber-Shiu) functions are investigated, in the case of generalized Erlang inter-arrival times, for both exponentially bounded and regularly varying claim size distributions.
In [3], extensions of the tax identity of Albrecher and Hipp to renewal models were analyzed. By excising negative excursions of the risk process, a transparent matrix-version of the tax identity could be established. An extension of the tax identity to general spectrally negative Lévy insurance risk models was worked out in [8]. A new and independent proof of the tax identity in the classical model was obtained in [30] by exploiting certain dualities with queueing models. This approach also enabled a generalization of the identity to surplus-dependent tax rates and triggered some further research activities for the analysis of stochastic process refracted at their running maximum.

In another research activity the efficient evaluation and asymptotic expansion of ruin probabilities in the Cramér-Lundberg model with subexponential claim sizes and more generally asymptotic expansions of compound sums were investigated, a classical topic of risk theory that still lacks a complete treatment up to now. In [4], an asymptotically correct integral representation of the ruin probability for Pareto claim sizes is derived, which can be used to de-

rive asymptotic expansions for the ruin probability. In [5], new results on the asymptotic evaluation of compound distributions of subexponential distributions were derived. Among those it was clarified to what extent a shifting of the argument in the expansion can increase the accuracy of a finite truncation of such expansions and it turned out that appropriate shifting can lead to a substantial improvement in accuracy.

As an extension of the classical de Finetti dividend problem, in [6] optimal dividend payout strategies for a risk reserve process under a force of interest were identified. It turned out that viscosity solutions to the corresponding Hamilton-Jacobi-Bellman equations provide an appropriate framework for a rigorous soloution of the stochastic control problem. In a related but different and more complicated model setup, a proper formulation and solution of the stochastic control problem of identifying optimal dividend strategies in the presence of proportional and fixed transaction costs for a compound Poisson model was started in [7]. The solution to the associated impulse control problem could be fully characterized and several situations admitting an explicit solution were identified. An alternative analytic approach to this problem was provided for general spectrally negative Lévy processes in [9]. Under an easy-to-check condition on the Lévy measure, the optimal dividend strategy in the presence of a penalty term in the objective function, representing solvency constraints, was identified in [10]. Threshold dividend strategies for spectrally negative Lévy processes were investigated in [11], including an existence and uniqueness proof for a solution of a certain stochastic differential equation with non-Lipschitz coefficients.

In cooperation with the Inverse Problems group, it was shown in [19] that for the originally ill-posed inverse problem of calibrating a local Lévy process to given option price data, Tikhonov regularization can be used to get a well-posed optimization problem. Stability as well as convergence of the regularized parameters were proven, using the forward partial integro-differential equation associated to the European call price. A precise link between these parameters and the corresponding market models also enabled the extension of the results to the associated market models and hence to the model prices of exotic derivatives. Furthermore, in [20] a particular subclass of local Lévy market models was identified for which the calibration algorithms are considerably easier to implement.

In [12] optimal consumption under quite general conditions on the drift and with partial information (where only the stock prices are observed) was considered. In [13] convex dynamic constraints on the strategy are discussed in a similar model. Based on former work on static risk constraints, [14] deals with the computation and an updating procedure for the utility maximization problem under a shortfall risk constraint, and [15] derives a solution for a spe-

cial risk constraint. [16,17] deal with parameter estimation in Markov switching models, the first provides a moment based method using regression type arguments which leads to good estimates for large sample sizes. [17] investigates a correction procedure for fragmented observations as they are typical in finance, and introduces a general two-step approach, which combines arbitrary standard methods for the estimation of one coherent series with a subsequent correction of the bias that comes from ignoring the special structure of the fragmented data. This method applies to a variety of models both in discrete and continuous time. In [18] a more accurate method based on the exact distribution of the discrete time observations is derived and studied, using a Bayesian approach. The method also proves to be suitable for extreme parameter values, then at higher computational cost.

The research on sequence design for cryptography, quasi-Monte Carlo methods and algorithmic and additive number theory has also been continued within the group. The complexity of possible interpolation functions of the double discrete logarithm, a frequently used cryptographic function, in the finite field case and in the elliptic curve case has been studied in [24] (for this achievement Doz. Winterhof received the Best Paper Award of WAIFI 2008). In sequence design, several quality measures including linear complexity and discrepancy for certain nonlinear and binary sequences have been analyzed using number theoretic techniques (see e.g. [23,25,28]). A generalization of the randomness measure of linear complexity has been investigated that yields low values not only for linear generators but also for (simple) inversive generators. Efforts to adapt the well-known Massey-Berlekamp algorithm to this new measure were made. The classical concept of binary Sidelnikov sequences of period q-1 was extended to nonbinary sequences and periods dividing q-1 and linear complexity and correlation using character sum techniques and cyclotomy was investigated. It could be shown that these new sequences are suitable for applications in both cryptography and wireless communication.
Furthermore a new lattice test was studied which is much finer than his predecessors and thus harder to analyze. Moreover, results on the distribution of power residues and primitive elements in nonlinear sequences were established which provides an important step towards an efficient deterministic algorithm for finding primitive elements. Linear programs were used to analyze the Waring problem in finite fields, providing several exact values for the Waring number. These results have applications to the covering radii of certain cylic codes.
Exponential sum techniques have been used to study modular hyperbolas from a purely number theoretic point of view. Here the number of points which are visible form the origin were estimated [26,27]. Previously, only bounds for all points on the curve were known.
For generalized Hammersley point sets, theoretical bounds on their L_2-distribution as well as numerical searches for parameters improving the hitherto best known sequences of this

kind have been established. The distribution behavior of sequences that are Q-additive (similar to the digit sum) with respect to a mixed-base representation have been investigated [21]. Further work includes results on low-discrepancy sequences with respect to hyperplane nets [22].

Parts of the mentioned research activities were financed by two FWF projects within the group: “Mathematical Models for Insurance Risk” (led by Prof. Albrecher) and “Pseudo-Random Sequences” (led by Doz. Winterhof).

In addition, several members of the research group serve on editorial boards of journals and wrote various reports for peer-reviewed journals, book proposals and research grant proposals.

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Further publications of the group can be found in chapter 17 in the Akademis report.

Group "Analysis of Partial Differential Equations"

Group Leaders:

o.Univ.-Prof. DI. Dr. Peter Markowich

o.Univ.-Prof. DI. Dr. Christian Schmeiser

Researchers funded via ÖAW/Upper Austrian government funds:

Dr. Keith Anguige

Dr. Renjun Duan

Dr. Arjan Kuijper (until Oct. 31, 2008)

Dr. Massimo Fonte

Dr. Massimo Fornasier

Dr. Francesco Vecil

Researchers externally funded:

Andreas Langer

In 2008, the members of the group have worked in rather diverse fields, determining the structure of this report.

Macroscopic modelling of cell-cell adhesion

In 2008, there has been a continuing collaboration between Keith Anguige and Christian Schmeiser on a class of adhesion-diffusion problems in the general area of cell-motility modelling. The aim here has been to develop and analyse continuum models for the motion of a system of particles which can to some extent move randomly, but whose movements arerestricted by volume filling and cell-to-cell adhesion - the motivation for the modelling is to gain an understanding of structure formation in biological processes such as gastrulation and vasculogenesis in the early embryo.

The basic 1-d adhesion/diffusion model we have been considering is a forward-backward parabolic equation in the high-adhesion regime [17], and one way to get around the resulting ill posedness is to consider a kind of multi-phase Stefan problem for the cell density. In 2008, analytical work on this Stefan problem was continued, thus resulting in a (partial) existence-and-stability theory. The analysis was also complemented numerically, and the results submitted to EJAM [18].

The model can also be extended to account for chemotactic effects, resulting in a forward-backward-parabolic generalisation of the Keller-Segel model. Existence and long-time-stability results for this system have been extended, and they have been complemented with numerical simulations which depict a transition from smooth aggregation in a low density population to Stefan-problem-like behaviour. A paper describing these results is in preparation [19].

Image analysis and PDEs

This work, which has been carried out by Arjan Kuijper, can be subdivided into properties of PDEs based on image geometry [2], segmentation using such PDEs [3,5,6,7], and use [4] and topological properties [8,12,14,15] of Gaussian scale space. Furthermore, within the WWTF project “Mathematical Methods for Image Analysis and Processing in the Visual Arts”, A. Kuijper studied the use of PDEs and image analysis tools for the visual arts [9,10,11]. He continued his work on shape analysis using symmetry sets [13]. In October he submitted his habilitation thesis at the TU Graz [16].

Kinetic transport equations

Renjun Duan's current research is focused on the following three issues: the first issue, suggested by P. Markowich, is about the existence and stability of solutions and blow-up phenomena for the chemotaxis equations coupled with the classical fluid dynamical system such as the Navier-Stokes or Stokes equations. The second issue, led by M. Fornasier, is on the study of the kinetic flocking equation arising from the Cucker-Smale model. The third one, which is a continuation of previous work during R. Duan's PhD study, is to prove the stability and convergence rates of solutions to the existing non-trivial steady state for the Boltzmann equation and related kinetic equations [20]. So far, the new progress is made as follows: In joint work between R. Duan, A. Lorz, and P. Markowich about the first issue, the asymptotic stability of the constant state for small, smooth initial perturbations has been proved and also the global existence of weak solutions with finite mass, first-order spatial moment and entropy under some additional conditions [21]. In the second issue, jointly with Professor Fornasier, we are trying to understand the large-time behavior of solutions to modified kinetic equations with diffusion. For the third issue, R. Duan proved the stability of symmetric solutions to the Boltzmann equation with potential forces on torus, under smooth, symmetric initial perturbations which preserve the total mass, momentum and mechanical energy, and also trying to study the time-decay estimates of the linearized kinetic equation with Boltzmann collision terms on the basis of the Fourier energy method [22], [23].

Nonlinear hyperbolic PDEs

Massimo Fonte studies nonlinear models arising from mathematical physics and, in particular, the issue of blow-up for a nonlinear shallow water wave equation in 1-d. He mainly devoted his research to the construction of a semi-group of solutions which are stable with respect to a Wasserstein-like metric [24]. M. Fonte also focused part of his work in 2008 on the so called Burgers-Poisson equation. In collaboration with K. Fellner (Univ. of Cambridge) a linear stability result for the solutions in presence of a shock for both the solution itself and in its gradient has been proved. A weighted L^1- norm is defined in order to get asymptotic stability in the time variable.

The second part of M. Fonte's work is done in collaboration with F. Priuli (SISSA, Italy). The problem of discontinuous fluxes for Traffic Flow on Networks has been studied. Admissible, entropic solutions for the Riemann Problem have been constructed, without any assumption on convexity/concavity of the fluxes, as already done in the literature.

Sparse approximation, optimization, and nonlinear PDEs for image processing

Massimo Fornasier returned to RICAM from a 1 year leave at Princeton University on October 2007. He concluded the Marie Curie Outgoing International Fellowship (contract MOIF-CT-2006-039438, 18 months) of the European Commission (6th Framework Programme) project “Sparse Approximation for Blind Source Separation” at the end of March 2008. In January 8, 2008 he submitted his Habilitationsschrift at the Faculty of Mathematics of the University of Vienna. His habilitation has been approved on June 4, 2008. On February 22, 2008 he submitted at FWF the project “Sparse Approximation and Optimization in High-Dimensions” for a **START-prize** which has been awarded to him on November, 10, 2008. M. Fornasier has been nominated for a **Prix de Boelpaepe** of the Acad*é*mie Royale de Belgique - Classe des Sciences (to be decided), and he is principal investigator of a proposal for an ERC-Starting Grant (European Research Council, 5 years, under evaluation).

M. Fornasier focussed his research on the formulation and the analysis of iterative methods for the solution of inverse problems with sparsity constraints and their connections with free-discontinuity problems and nonlinear PDEs for image processing [28,29,31,32,34]. He continued his investigations in adaptive numerical methods for solving PDEs by means for frame discretizations [30,33,35]. He recently started a new research program concerning the analysis and the numerical solution of kinetic equations which are modeling social interactions, starting from bird flocking and fish school modeling [26,27].

Andreas Langer (a PhD student of M. Fornasier, employed in the framework of the WWTF “Five Senses - Call 2006” Project “Mathematical Methods for Image Analysis and Processing in Visual Arts”) works on variational methods, gradient flow and higher order partial differential equations for image processing. He focused on image restoration, where he was inter-

ested in the task of how an image looks like outside of its boundaries. It is clear that the further one goes away from the known image the less one can say how it should look like there. But in a small surrounding of the boundary of the image it should be possible to find a very good approximation of the "real" image. A. Langer looked at the problem as an initial-value problem with the flux field given by Chan *et al*, who proposed an algorithm for inpainting problems, where the Euler-Lagrange equation of a functionalized Euler's elastica energy was used. This leads to an algorithm, which calculates approximations of the continuation but does not work satisfying.

In collaborations with C. Schönlieb (Univ. of Cambridge), M. Fornasier and A. Langer started to work on domain-decomposition algorithms for sequential and parallel minimization of functionals formed by a discrepancy term with respect to data and total-variation constrained. A sequential and parallel overlapping domain-decomposition algorithm was introduced, which can be used for the restoration of 1D and 2D signals in interpolation/inpainting problems and for recovering piecewise constant medical-type images from partial Fourier ensembles. Additionally, the convergence properties have been analyzed.

Numerical methods for hyperbolic equations

During 2008, Francesco Vecil has been working on numerical methods for the solution of hyperbolic equations in the field of applied mathematics. His main research line is the simulation of semiconductor physics through a mesoscopic description of the carrier transport/collisions (Boltzmann equation) [25], coupled with a Poisson or Schrödinger-Poisson equation to self-consistently compute the force field by taking into account also the quantum effects in case of nanoscaled devices. The interest of this is the development of new technologies for both energy saving (better performance) and material saving in terms of silicon. Recently F. Vecil has started implementing solvers for behaviour simulations at kinetic level: the swarming models have been initially thought for the description of bird behaviour (flocking and milling), but also apply to marketing models and models for linguistic evolution.

As for the technical aspects, the main instruments used until now for the solution of such systems are splitting schemes and Runge-Kutta Finite Difference schemes: the first ones allow larger time steps and are not constrained by the CFL condition, the drawback being that they are only second order in time and have problems in properly stabilizing at the asymptotic equilibrium. The second ones are better established, have proven robust but are often very time-consuming. In order to solve the transport, semi-Lagrangian schemes based on characteristics have been tested, both direct and mass-preserving, coupled with Weighted Essentially Non Oscillatory interpolations for the reconstruction of the probability distribution function outside the grid points. Another relevant technique exploited in the simulations is

Newton-Raphson iterations for the solution of the force field in nanoMOSFETs, which improves Gummel iterations by providing much faster convergence towards the equilibrium.

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Further publications of the group can be found in chapter 17 in the Akademis report.

Group "Optimization and Optimal Control"

Group Leader:

o.Univ.-Prof. DI. Dr. Karl Kunisch

Researchers funded via ÖAW/Upper Austrian government funds:

Dr. Roland Griesse, until Feb., 08

Dr. Xiliang Lu

Dr. Boris Vexler, until Feb., 08

Dr. Daniel Wachsmuth, since Aug., 08

Researchers externally funded:

Dipl.Ing. Martin Bernauer, until July, 08

Dipl. Math. Techn. Olaf Benedix, until April 08

Mag. Nataliya Metla, until Oct.., 08

The work of the group focused on optimal control governed by partial differential equations.

For *optimal control subject to variational inequalities* (Wachsmuth-Kunisch) sufficient second-order optimality conditions were analyzed [1]. Moreover, due to lack of differentiability, the problem cannot be solved with Newton's method. Here, regularized problems were studied, and the convergence of semi-smooth Newton method was proved. Efficient techniques to choose the regularization parameter are currently under investigation.

*Numerical verification of optimality (*Wachsmuth*)*: For many applications, the optimization criterion is not a convex function, and the underlying partial differential equation is non-linear, which makes the optimal control problem non-convex. Then the convergence analysis of fast optimization methods as well as of approximation techniques is based on sufficient optimality conditions. Hence, it is desirable to check whether these conditions are satisfied for a given solution candidate. If one has computed a solution of discretized approximation of the original problem, the question arises, whether this solution approximates a local or even a global optimum of the original problem. For a special class of optimal control problems, techniques to answer this question were developed [2]. In particular, it could be proven numerically that a computed solution was near a local minimum.

Optimal control problem for the two phases fluids (Lu-Kunisch) were investigated. Due to the nonlinearity and non-uniqueness of the underlying system, and the lack of the regularity for the adjoint equation, an artificial diffusion term for the transport equation was introduced. The first order optimality system for the regularized optimal control problem was well defined by carefully choosing appropriate function spaces. The asymptotic properties of the regularization procedure were analysed as well [3].

For *optimal control problems with pointwise polygonal state constraints* (Lu) the Lagrange multipliers are only measures. A regularized problem was studied. The convergence of the regularized optimal solution was given and super-linear convergence of semi-smooth Newton method for the regularized problem was proven.

Special emphasis was put on *stability and sensitivity analysis* in the context of optimal control of partial differential equations, with a particular emphasis on, algorithmic aspects, and applications (Griesse, Wachsmuth) [3-8]. Griesse had joined RICAM in July 2004 and left on February 29, 2008, moving to Chemnitz University of Technology, Germany, where he had accepted an offer for a professorship in numerical mathematics for partial differential equations. He continued to supervise the third-party funded PhD students Nataliya Metla (jointly with Arnd Rösch) [9,10] and Martin Bernauer (jointly with Kunisch) [11]. The work on elliptic equations with gradient constraints is published in [12,13].

For *optimal control problems governed by the wave equation (*Vexler-Kunisch-Kröner*)*, a functional analytic setting was developed. Moreover, super-linear convergence of semi-smooth Newton methods for dealing with inequality constraints as well as proper discretization using space-time finite element methods were investigated.

A priori error analysis for FE-discretization of Dirichlet boundary control problems (Vexler). For optimal control problems governed by elliptic equations with the control variable entering as Dirichlet boundary condition, optimal order error estimates were developed using proper duality techniques and estimates in negative Sobolev norms. The resulting estimates for the error in the state and the adjoint variables improve the results known from the literature and explain the behavior observed from numerical examples [14-23] .

FEM error analysis for state-constrained optimal control of the Stokes equations (Vexler). For optimal control problems governed by the Stokes equations with state constraints a large class of finite element discretizations was considered. An a priori error analysis was devel-

oped using suitable estimates with respect to the supremum norm and special quasi-interpolation operators [24].

Simulation and optimal control of thermo-mechanic properties of concrete during hydration. (Vexler –Apel – Benedix - Flaig). A class of models for hydration of young concrete was investigated. For the resulting nonlinear parabolic equations the existence, uniqueness and stability of solutions were ensured. For simulation and optimal control, the underlying equations were discretized using space-time finite element methods.

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Further publications of the group can be found in chapter 17 in the Akademis report.

Group "Mathematical Imaging"

Group Leader:

Univ.-Prof. Dr. Otmar Scherzer

Researchers funded via ÖAW/Upper Austrian government funds:

Dr. Jérôme Boulanger

Dr. Peter Elbau

The group "Mathematical Imaging" consists of Dr. Boulanger who joined from the Curie Institute Paris on June 1, 2008 and Dr. Elbau who was formerly at the ETH Zurich working in the group of Prof. G. Felder and joined on October 1, 2006. The research shares joint scientific interests with other working groups at RICAM, especially with the groups for Inverse Problems, for Analysis of Partial Differential Equations, and for Computational Methods for Direct Field Problems.

We derive novel image analysis techniques based on non-convex variational optimization problems and morphological evolutionary partial differential equations for higher dimensional data [I-3]. An application for such models is image analysis of color image data and diffusion tensor imaging data [I-10]. One research goal is to develop existence theory and numerics for such variational problems and evolutionary equations.

In the ongoing research [I-3], when analyzing higher dimensional data, we are confronted with a paradox, that the variational optimization problems are know to attain a generalized solution but cannot be minimized efficiently, while the evolution equations can be solved relatively easily with explicit or semi implicit methods, but there is no solution theory available. To close the gap between non-convex variational problems and associated partial differential equations, we developed a concept of non-convex semigroups. The approach generalizes convex (linear and nonlinear) semigroup theory. We constructed a non-convex energy formulation for the mean curvature motion and showed exemplary for rotationally invariant initial data that the non-convex semigroup solution converges to the solution of the mean curvature equation. Extremely tedious calculations were necessary to give this proof of concept.

Another research topic is the stable approximation of sparse solutions to nonlinear operator equations by means of Tikhonov regularization with a subquadratic penalty term [I-9]. Imposing certain assumptions, which for a linear operator are equivalent to the standard range condition, we derive the usual convergence rate of the regularized solutions in dependence

of the noise level. Particular emphasis lies on the case, where the true solution is known to have a sparse representation in a given basis. In this case, if the differential of the operator satisfies a certain injectivity condition, we can show that the actual convergence rate can be improved significantly in comparison with existing results.

For the acquisition of medical images new tomography techniques have the potential of being less harmful for the patient and of showing a better contrast in soft tissue. In thermoacoustic tomography a body is illuminated by a short electromagnetic pulse. This leads to the emission of a sound wave, which is then measured to gain information on the interior of the body. The group leader has initialized an Austrian network on this topic founded by the Austrian Science Foundation. Several novel mathematical problems have been formulated already [I-7], [I-8], and were also considered by our former coworker Dr. Bastian Gebauer who left in 2008 to the University of Mainz, Germany. In this context, Dr. Gebauer suggested a new hybrid imaging technique that combines electrical impedance tomography with acoustic tomography. This novel technique makes use of the fact that the absorbed electrical energy inside the body raises its temperature, thus leading to expansion effects. The expansion then induces an acoustic wave which can be recorded outside the body and consequently be used to calculate the absorbed energy inside the body from which the electrical conductivity can be reconstructed. A patent has been submitted for Electrical Impedance Acoustic Imaging. Currently, we are trying to derive causal mathematical models for wave propagation with attenuation in nonviscous fluids.

For fluorescence microscopy, we have developed a non-parametric regression method [I-1][I-2] for denoising 3D image sequences. The proposed method exploits 3D+time information to improve the signal-to-noise ratio of images corrupted by mixed Poisson-Gaussian noise. A variance stabilization transform is first applied to the image-data to introduce independence between the mean and variance. This pre-processing requires the knowledge of parameters related to the acquisition system, also estimated in our approach. In a second step, we have proposed an original statistical patch-based framework for noise reduction and preservation of space-time discontinuities. In our study, discontinuities are related to small moving spots with high velocity observed in fluorescence video-microscopy. The idea is to minimize an objective nonlocal energy functional involving spatio-temporal image patches. The minimizer has a simple form and is defined as the weighted average of input data taken in varying neighborhoods. The size of each neighborhood is optimized to improve the performance of the pointwise estimator using the bias-variance trade-off.

In collaboration with biologists and bio-physicists of the University of California-San Francisco, we have initiated a deep experimental evaluation of our proposed denoising method.

This work should bring new insights on the capacity of wide-field microscopy as a tool for the investigation of the photo-sensitive living cells on periods exceeding a cell cycle. The combination of the restoration method with the state of the art microscope would then break known limits and offer new opportunities to biologists.

Together with INRIA-Rennes and Curie Institute-Paris, we aim at proposing a solution to the problem of detecting events in total internal reflection fluorescence microscopy. Endocytosis-recycling is an essential cellular trafficking process regulating the proper distribution and function of a large set of molecules, such as lipids, receptors, or adhesion transmembrane proteins. This dynamic process also participates to the homeostasis of intracellular membrane compartments. Progresses in imaging dynamics behaviors of molecules including fast video microscopy and the application of evanescent wave microscopy have allowed to image intracellular vesicular movements, exocytosis and endocytosis of fluorescent-tagged proteins. However, spatio-temporal analysis of transient events occurring at different sites of the cell has not been systematically performed. In addition, more formal tests are required in testing biological hypotheses, rather than visual inspection combined with more or less manual statistical analysis. For an unbiased quantification of repetitive and transient events, such as those observed during the trafficking of molecules traveling through the endosomal-recycling network of cells, their automatic detection becomes necessary. While requiring particular adjustments, the proposed approach is versatile enough, to be applicable to diverse although complementary modes of microscopy. Moreover, while focusing on one particular Lectin receptor that constitutively recycles from internal compartments to the plasma membrane, it could be translated to many other studies of membrane trafficking in health and diseases such as diabetes, neurological, pigmentation or lysosomal defects. The quantification of these rare events requires an adaptation of existing works to the desired very low level of false alarm.

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Further publications of the group can be found in chapter 17 in the Akademis report.

1.4. Congruence/deviations from medium-term research program 2008-2012

In general, the research program has been performed as originally planned. However, there are two major exceptions:

- Mathematical Finance: The development in this area was characterized by two changes in the group leadership. Originally, the group leader was Prof. Gerhard Larcher (Johannes Kepler Universität Linz), who had (due to his number theoretic routes) developed the group into the direction of Quasi-Monte-Carlo-Methods. This topic is still addressed at RICAM by Doz. Dr. Arne Winterhof at high scientific level. However, it is not any more the main emphasis of the Finance group since Prof. Larcher quit his position in 2005. We succeeded in attracting Doz. Dr. Hansjörg Albrecher (then TU Graz) as new group leader. After originally having been employed at RICAM half-time, a joint appointment with the Johannes Kepler University was arranged, which will hopefully serve also as future model for similar arragnements: Prof. Albrecher was employed 80% by RICAM and 20% as a professor at the Johannes Kepler University. The group developed into the direction of mathematical methods in insurance mathematics. However, Doz. Albrecher received several outside offers and finally accepted a chair at the University of Lausanne (Switzerland). At about the same time, also Doz. Jörn Sass from the same group accepted a professorship in Kaiserslautern. Thus, we had to look for a new group leader again. The basis for this search was laid by the special semester on “Stochastics with Emphasis on Finance”, which was conducted in 2008 and jointly led by Prof. Wolfgang Runggaldier (Padova) and Hansjörg Albrecher. From the presentations of this semester, the idea emerged that the group should be not only focus on Mathematical Finance, but be oriented broader into the direction of stochastics with an emphasis on finance. We could attract Dr. Peter Friz (Cambridge University) for building up this group, which is now on the way.
- Analysis of Partial Differential Equations: Due to the influence of Doz. Massimo Fornasier, who also received a START-Prize in 2008 and obtained his habilitation at the University of Vienna, the group moved also into the direction of partial differential equation methods in imaging. Thus, Mathematical Imaging is now a cross-cutting topic at three groups in RICAM: Analysis of Partial Differential Equations (Prof. Markowich, co-leader Doz. Massimo Fornasier), Inverse Problems (Heinz Engl) and Mathematical Imaging (Otmar Scherzer). The synergies between these groups will be emphasized even more in coming years.

- Mathematical Methods in Molecular and Systems Biology: The establishment of this group, which was approved by the Academy in 2008 and which was finally established in Vienna in March 2009, was the consequence of work done mainly in the Inverse Problems group together with biologists, especially with the group of Peter Schuster (University of Vienna). We hope to be able to make the group fully functional in 2009 in spite of the current financial restrictions.

Special Semesters

The following special semesters were conducted according to the original plans:

- Special Semester on Computational Mechanics, October 3 - December 16, 2005
- Special Semester on Gröbner Bases and Related Methods, February 1 - July 31, 2006
- Special Semester on Quantitative Biology analyzed by Mathematical Methods, October 1, 2007 - January 27, 2008
- Special Semester on Stochastics with Emphasis on Finance, September 1 – December 15, 2008

Due to the financial crisis which was already visible at the end of 2008, we had to cancel a full special semester on Inverse Problems planned for 2009 and replaced it by a „mini special semester“ on a smaller scale. We will report on this in the next annual report.

Institute structure

As of the end of 2008, the structure of the institute is as follows:

Director: Heinz Engl

Deputy Directors: Ulrich Langer, Karl Kunisch

Groups:

- Computational Mathematics for Direct Field Problems (Prof. Ulrich Langer)
- Inverse Problems (Prof. Heinz W. Engl)
- Symbolic Computation (Prof. Josef Schicho)
- Financial Mathematics (Dr. Peter Friz, Prof. Walter Schachermayer)
- Analysis of Partial Differential Equations (Prof. Peter Markowich, Doz. Massimo Fornasier)
- Optimization and Optimal Control (Prof. Karl Kunisch)
- Mathematical Imaging (Prof. Otmar Scherzer)
- Mathematical Methods in Molecular and Systems Biology (Dr. Philipp Kügler, Prof. Christian Schmeiser)

1.5. Current version of the medium-term research program for 2009-2013

The main directions of the research program are:

A Developing new mathematical methods in the areas:

1. **Computational Methods for Direct Field Problems** with the following priorities: Development, analysis and implementation of new numerical methods for multi-field problems modeled by Partial Differential Equations with special emphasis of parallel computing, e.g.: Fast domain decomposition based solvers for the discretization of elliptic and mixed problems by means of high order finite elements in three space dimensions, extension to Navier-Stokes;
Subspace correction methods for discontinuous Galerkin approximations of linear elasticity problems; Multilevel preconditioners for indefinite problems based on Augmented Lagrangian method; Algebraic multigrid/multilevel for elasticity systems; Numerical models in complex fluids.

2. **Inverse Problems:** Developing fast and stable methods for nonlinear inverse problems based on a thorough convergence analysis; special emphasis will be laid on iterative methods and on sparsity-enforcing techniques. Applications include inverse scattering problems, (medical) imaging and industrial applications. Also, there will be a close cooperation with the group Mathematical Methods in Molecular and Systems Biology on inverse problems techniques in models from life science.

3. **Symbolic Computation:** Developing/extending symbolic and symbolic-numerical methods for the solution of systems of polynomial equations or differential equations. In the next years, the group will focus on parametrization of algebraic curves by radicals, parametrization of algebraic surfaces by rational functions, manipulating integral operators in connection with differential and integral equations, solution in terms of power series and approximate solution of polynomial systems, analysis of singularities of polynomial systems. Existing and foreseen applications include robot kinematics, robot dynamics, and computer aided geometric design.

4. **Stochastic Analysis and Quantitative Finance:** Main topics will be:

- Stochastic differential equations and stochastic flows.

This includes SDEs with jumps, Malliavin calculus and rough path theory; as well as a certain emphasis on (new) numerical schemes such as

- Higher order Euler schemes derived from rough path theory
- Cubature on Wiener space
- Multi-level Monte Carlo

- Stochastic partial differential equations.

A first focus will be on stochastic PDEs in viscosity sense, building on the seminal results of Crandall-Lions. A corresponding stochastic theory was recently suggested, together with many applications, by P.L.Lions and T. Souganidis.

- Quantitative Finance

Option pricing via cubature methods. Asymptotic analysis for calibration of complex stochastic financial models and numerical aspects.

5. **Analysis of Partial Differential Equations:** The group will address three following main directions 1. nonlinear kinetic equations for modeling social interactions and biological processes 2. nonlinear hyperbolic equations for nonlinear water wave modeling and traffic flow on networks 3. variational methods for free-discontinuity and free-boundary problems for image processing. Both analytical studies and numerical methods will be investigated. We would like to list below a few problems which will be addressed for each of the aforementioned research directions.

1. Kinetic models for bird flocking and school fishing will be derived from particle description, and the emergence of social behavior will be investigated in terms of convergence to stable patterns; hydrodynamic limits will be derived and analyzed either theoretically or numerically; Chemotaxis equations and kinetic equations coupled with the fluid dynamical equations for bio-fluid modeling and simulation; numerical methods for kinetic and hydrodynamic equations; 2. Linear stability results for Burgers-Poisson equation in presence of a shock for both the solution itself and in its gradient; asymptotic stability in the time variable; analysis of equations modeling traffic flow on networks with discontinuous fluxes; construction of entropic solutions for the Riemann Problem, without any assumption on convexity/concavity of the fluxes; numerical methods for hyperbolic equations; 3.Existence of minimizers of Mumford-Shah type functionals when data are given as the result of an application of a singular operator; characterization of discontinuity sets of such solutions; analysis of the discrete to continuous limit via Gamma-convergence methods; analysis of free-boundary problems involving p-Laplacian, in particular in case of the 1-Laplacian, when the equation is interpreted as the limit of a linearization by means of a re-weighted nonisotropic diffusion. Numerical methods for the solution of free-discontinuity and free-boundary problems with emphasis for image processing applications.

6. **Optimization and Optimal Control:** The group will concentrate on optimization with partial differential equations as constraints, with the aim of contributing to theory and numerical realsation alike. Complete first and second order optimality conditions will be derived for optimal control problems associated to variational inequalities. This class of problems will analysed also within the context of multi-level complementarity problems in function spaces. For efficient numerical realization path following techniques will be developed. Methods will be

constructed for a rather general class of optimal control problems which allow to evaluate and validate second order optimality conditions numerically. Further we shall focus on the model function technique as a general purpose method for choosing regularization parameters in ill-posed problems.

7. **Mathematical Imaging:** Aiming for image analysis of stationary and dynamic data with derivative free regularization methods, such as neighborhood filters. Thereby, developing of a novel mathematical framework within the Calculus of Variations. In particular, aiming for equivalence relations to lower semi-continuity of the functional to be minimized. Applications include medical imaging and microscopy. There are already strong collaborations with the Inverse Problems Group.

8. **Mathematical Methods in Systems and Molecular Biology:**

The principal goal of the group is the application of existing and the development of new mathematical techniques from the areas of inverse problems and differential equations to/for the solution of questions in the field of the systems and molecular biology. Apart from the advancement of the mathematical competence of the group, reaching these goals requires to raise the lasting interest of the relevant Viennese research groups in the life sciences in interdisciplinary co-operations with RICAM. In a series of seminars during the starting period of the group potential partners are to be convinced of the advantages of the employment of mathematical techniques for the evaluation and interpretation of experimental data and for modeling their systems. In addition, the purpose of this seminar series should be to gain a deeper view of the activities in systems and molecular biology at the Vienna BioCenter and at the Viennese universities. As interface to the Viennese bio cluster, it is the intention of the group to prepare and transfer research questions, that fall into the core competencies of the RICAM groups already established, to Linz in order to exploit the full range of competence of RICAM.

Closer statements about the thematic orientation of the group are not possible at the current time. At the beginning, however, existing co-operations - among them also in the form of projects funded by WWTF - in the fields the cellular mechanics, hormone regulation and ion channel activation will be intensified.

It will be the key for the success of the group that the infrastructure necessary can be provided. Office space with the Vienna BioCenter has been made available by the University of Vienna; we hope that in spite of the financial crisis that the Academy takes this opportunity and actually rents this space. Obviously, without office space, the group cannot function, and office space at different locations in Vienna would be sub-optimal for reaching the goal of close cooperations with biologists.

B Application of the mathematical methods developed in cooperation projects:

Main emphasis will be in cooperations with life scientists (mainly in Vienna, conducted by the new group “Mathematical Methods in Systems and Molecular Biology”) and in cooperation with industry as partner of the Industrial Mathematics Competence Center (IMCC).

C Running further special semesters according to the successful model developed:

After an interruption of the series in 2009 due to budgetary reasons, we hope to be able to organize one special semester each in the following years.

1.6. Publications/scientific talks/poster presentations 2008

Data from the Akademis Report.

Publications: chapter 17;

Scientific talks & Poster presentations: chapter 18

17. Wissenschaftliche Publikationen	gesamt
A) Bücher / Monographien oder **Editionen**	5
A) Peer-reviewte Beiträge in Fachzeitschriften oder Sammelwerken	113
· davon in indizierten Fachzeitschriften	53
B) Herausgeberschaften	12
B) längere Beiträge ohne Peer-Review in Fachzeitschriften oder Sammelwerken	0
C) Sonstige wissenschaftliche Publikationen	27
Veröffentlichungen von Nachwuchswissenschafter(inne)n/Habilitationen	
(diese Publikationen wurden z.T. bereits in oben angeführten Kennzahlen miterfasst)	
· Diplomarbeiten	0
· Dissertationen	3
· Habilitationen	2
Lexikonartikel	0
Kurze Lexikonbeiträge, summarisch	0

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Thonhauser, Stefan (2008) Stochastic Control and Analysis of Dividend Problems in Risk Theory. Doktorarbeit, Technisch-Naturwissenschaftliche Fakultät, TU Graz, Graz University of Technology, Graz. [Thonhauser, Stefan: Alleinautorln];

C) Sonstige wissenschaftliche Publikationen

Wolfram, Marie-Therese (2008) Forward and inverse solvers for electro-diffusion systems. [Wolfram, Marie-Therese: Hauptautorln];

Z. Chen, D. Gomez, A. Winterhof (2008) Distribution of Inversive Pseudorandom Numbers. [Winterhof, Arne: Hauptautorln];

(2008) Passive transport across bilayer lipid membranes: Overton continues to rule. [Kügler, Philipp: Koautorln]; peer-rev. lang

(2008) Some remarks on an impulse control problem in insurance. [Thonhauser, Stefan: Hauptautorln];

Dissertationen (z.T. bereits oben gelistet)

Kortschak, Dominik (2008) Asymptotic properties of compound distribution tails and dependence. Doktorarbeit, Technisch-Naturwissenschaftliche Fakultät, TU Graz, Graz University of Technology, Graz. [Kortschak, Dominik: Hauptautorln];

Thonhauser, Stefan (2008) Stochastic Control and Analysis of Dividend Problems in Risk Theory. Doktorarbeit, Technisch-Naturwissenschaftliche Fakultät, TU Graz, Graz University of Technology, Graz. [Thonhauser, Stefan: Alleinautorln];

Wolfram, Marie-Therese (2008) Forward and inverse solvers for electro-diffusion systems. [Wolfram, Marie-Therese: Hauptautorln];

Habilitationen (z.T. bereits oben gelistet)

Fornasier, Massimo (2008) Compressive Algorithms. Adaptive Solutions of PDE's and Variational Problems. Habilitationsschrift, Fakultät für Mathematik, Vienna, Vienna. [Fornasier, Massimo: Alleinautorln];

Kuijper, Arjan (2008) Deep Structure, Singularities, and Computer Vision. Habilitationsschrift, Institute for Computer Graphics and Vision, Technical University Graz, Graz. [Kuijper, Arjan: Alleinautorln];

18. Wissenschaftliche Vorträge und Präsentationen

	gesamt
Eingeladene wissenschaftliche Vorträge	134
· davon auf internationalen Veranstaltungen	104
· davon Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpt	5
· davon Keynotes und Named Lectures	63
Sonstige wissenschaftliche Vorträge	71
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Wissenschaftliche Posterpräsentationen	8
· davon auf internationalen Veranstaltungen	7
· davon Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpt	1

Eingeladene wissenschaftliche Vorträge

Beuchler, Sven (05.11.2008) High order FEM-fast solvers for tensor product elements. Vortrag: Kolliqiumsvortrag Uni Wuppertal/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Beuchler, Sven (25.09.2008) High order FEM-fast solvers for tensor product elements. Vortrag: Kolloqiumsvortrag Uni Duesseldorf/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Beuchler, Sven (26.11.2008) High order FEM-fast solvers for tensor product elements. Vortrag: Kolloqiumsvortrag Uni Bielefeld/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Constantinescu, Corina (02.12.2008) Erlang(n) risk models with risky investments. Vortrag: Special Semester on Stochastics with Emphasis on Finance, Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Constantinescu, Corina (05.06.2008) Renewal risk processes with stochastic returns on investments. Vortrag: LMU & TU München Oberseminar Finanz- und Versicherungsmathematik (LMU & TU München), München/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Constantinescu, Corina (27.05.2008) Risk processes with stochastic returns on investments. Vortrag: FAM@TU Seminar on mathematical finance and actuarial mathematics, Vienna/AUSTRIA <http://www.fam.tuwien.ac.at/events/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Fornasier, Massimo (01.10.2008) Variational principles and compressive algorithms. Vortrag: Seminar, Regensburg/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Fornasier, Massimo (03.05.2008) Iteratively re-weighted least square algorithms for compressed sensing. Vortrag: Colloquium, Edinburgh/UNITED KINGDOM.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (04.06.2008) Compressive Algorithms. Adaptive Solutions of PDE's and Variational Problems. Vortrag: Habilitationskolloquium, Vienna/AUSTRIA <http://plone.mat.univie.ac.at/events/2008/compressive-algorithms-adaptive-solutions-of-pdes-and-variational-problem>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Fornasier, Massimo (06.03.2008) Compressive Algorithms. Vortrag: Colloquium: numerical analysis seminar, Cambridge/UNITED KINGDOM <http://www.damtp.cam.ac.uk/user/na/seminars.html>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (11.12.2008) Kinetic models for flocking. Vortrag: Seminar (City Unviersity of Hong Kong), Hong Kong/HONG KONG.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Fornasier, Massimo (13.05.2008) Domain decomposition methods for singular PDEs and applications in image processing. Vortrag: invited lecture, Paris/FRANCE.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (16.05.2008) Compressive Algorithms. Adaptive Solutions of PDE's and Variational Problems. Vortrag: Colloquium, Bonn/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (17.12.2008) Compressive Algorithms. Adaptive Solutions of PDEs and Variational Problems. Vortrag: Seminar, Zuerich/SWITZERLAND.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Fornasier, Massimo (18.06.2008) Compressive Algorithms. Adaptive Solutions of PDE's and Variational Problems. Vortrag: invited seminar, Rostock/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

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Fornasier, Massimo (19.06.2008) Compressive Algorithms. Adaptive Solutions of PDE's and Variational Problems. Vortrag: invited seminar, Leeds/UNITED KINGDOM.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Fornasier, Massimo (20.05.2008) L'applicazione architetto della matematica. La matematica architetto di nuove applicazioni. Vortrag: invited lecture, Bologna/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (19.06.2008) Compressive Algorithms. Adaptive Solutions of PDE's and Variational Problems. Vortrag: invited seminar, Leeds/UNITED KINGDOM.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

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Fornasier, Massimo (22.04.2008) l1-minimization in compressive algorithms for PDE's and variational problems. Vortrag: invited lecture, Milano/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (22.05.2008) l1-minimization in compressive algorithms for PDE's and variational problems. Vortrag: invited seminar, Pavia/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (23.09.2008) Compressive algorithms, variational principles, and free-discontinuity problems. Vortrag: Seminar, Rome/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (25.01.2008) Compressive algorithms: beyond adaptive wavelet methods in PDE's. Vortrag: Workshop on "Adaptive Numerical Methods for PDE's", Vienna/AUSTRIA <http://www.wpi.ac.at/event_view.php?id_activity=95>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (25.01.2008) Subspace correction methods in sparse optimization,. Vortrag: Obergurgl Workshop on Hybrid Imaging, Sparsity Constraints, and Mathematics in Biology, Obergurgl/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (25.04.2008) Iterative thresholding algorithms and acceleration methods. Vortrag: invited lecture, Marburg/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (29.02.2008) Compressive Algorithms. Vortrag: Colloquium, York/UNITED KINGDOM.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Gebauer, Bastian (24.01.2008) Detecting inclusions of mixed type in optical tomography. Vortrag: Culminating Workshop of the RICAM Special Semester on Quantitative Biology analyzed by Mathematical Methods, Obergurgl/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Hahn, M. (08.01.2008) Introduction to Markov Chain Monte Carlo Methods. Vortrag: Seminar Finanzmathematik, JKU Linz (JKU Linz), Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Hahn, Markus (02.12.2008) Estimating Models Based on Markov Jump Processes Given Fragmented Observation Series. Vortrag: Special Semester on Stochastics with Emphasis on Finance, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/specsem/sef>.; Typ: Sonstiger eingeladener

Hahn, Markus (08.12.2008) Calibrating Markov Switching Models to Stock Data. Vortrag: Forschungsseminar (TU Kaiserslautern, Fachbereich Mathematik / Fraunhofer ITWM), Kaiserslautern/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Kindermann, Stefan; Sini, Mourad; Wolfram, Marie-Therese (26.07.2008) Project 1308: Computational Inverse Problems and Applications. Vortrag: 4th International Conference on Symbolic and Numerical Scientific Computing (SNSC'08)/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Klann, E. (28.05.2008) A Mumford-Shah level-set approach for the simultaneous reconstruction and segmentation of tomography data. Vortrag: The Fourt International Conference; Inverse Problems: Modeling and Simulation ("Inverse Problems", "Inverse and Ill-Posed Problems" and "Inverse Problems in Science and Engineering"), Fethiye/TURKEY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Kortschak, Dominik (10.01.2008) Approximation von Tail–Wahrscheinlichkeiten für zusammengesetzte Zufallsvariablen und Ruinwahrscheinlichkeiten. Vortrag: Vesicherungsmathematisches Kolloquium/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Kortschak, Dominik (19.09.2008) Asymptotic results for the sum of dependent non-identically distributed random variables. Vortrag: First Summer School on Copulas, Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Kraus, Johannes (21.06.2008) Hierarchical splittings of discontinuous Galerkin finite elementspaces for elliptic problems with highly varying coefficients. Vortrag: Parallel Matrix Algorithms and Applications, Neuchâtel/SWITZERLAND <http://www.dcs.bbk.ac.uk/pmaa08/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Langer, Prof. Ulrich (14.01.2008) Parallel Interface Concentrated Finite Element Tearing and Interconnecting Methods. Vortrag: 18th International Conference on Domain Decomposition Methods/ISRAEL <http://www.cs.huji.ac.il/conferences/dd18/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Loeffen, Ronnie (04.12.2008) Refracted Lévy processes. Vortrag: Concluding Workshop of the Special Semester on Stochastics with Emphasis on Finance, RICAM, Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Loeffen, Ronnie (28.08.2008) Refracted Lévy processes. Vortrag: 2nd International Workshop on Gerber-Shiu functions, RICAM, Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Lu, James (02.07.2008) Some inverse problems in systems biology. Vortrag: CSBE Seminar Series, Edinburgh/UNITED KINGDOM <http://www.bioinformatics.ed.ac.uk/twiki/bin/view.pl/SysBioClub/PastTalks#July_2008>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Lu, James (07.04.2008) Inverse eigenvalue and bifurcation analysis for inferring mechanisms underlying the dynamics of gene networks . Vortrag: Center for Computational Engineering Science Seminar Series , Aachen/GERMANY <http://www.aices.rwth-aachen.de/events/cces-seminar-series-ss-2008>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Marie-Therese, Wolfram (16.04.2008) Mixed Finite Element Methods for Non-Linear Fokker-Planck Equations. Vortrag: Workshop II: Numerics and Dynamics for Optimal Transport /UNITED STATES.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Markowich, Peter (08.01.2008) Reaction-Diffusion (Convection) Equations and Entropies. Vortrag: Workshop on Pattern Formation and Functional Morphology, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/specsem/ssqbm>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Pereverzyev Jr., Sergiy (10.01.2008) Algebraic Modeling of Pattern Formation in Plants. Vortrag: RICAM Special Semester 2007/2008: Workshop on Pattern Formation and Functional Morphology, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/specsem/ssqbm/events/pf_fm/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Pereverzyev, Sergei V (18.04.2008) Adaptive Learning via the Balancing Principle. Vortrag: Symposium on Nonlinear Evolution Equations, Bangalore/INDIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Pikkarainen, Hanna Katriina (02.07.2008) Convergence results for the Bayesian inversion theory. Vortrag: 5th European Congress on Computational Mathods in Applied Sciences and Engineering ECCOMAS 2008, Venice/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Regensburger, G.; Rosenkranz, M. (21.10.2008) A Symbolic Computation Approach to the Analysis of Gerber-Shiu Functions. Vortrag: RICAM Group Seminar, Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Regensburger, G.; Rosenkranz, M. (27.08.2008) A Symbolic Computation Approach to the Analysis of Gerber-Shiu Functions. Vortrag: Second International Workshop on Gerber-Shiu Functions, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/workshops/gs08/schedule/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Resmerita, E. (08.01.2008) The expectation-maximization algorithm for ill-posed integral equation. Vortrag: Colloquium of the Institute for Numerical and Applied Mathematics, G.A. University of Goettingen/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Resmerita, E. (10.01.2008) Error estimation for iterative/variational regularization by means of Bregman distances. Vortrag: GRADUIERTENKOLLEG - Seminarldentifikation in mathematischen Modellen:Synergie stochastischer und numerischer Methoden/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Rosenkranz, M. (26.06.2008) Integro-Differential Polynomials and Boundary Problems. Vortrag: Foundations of Computational Mathematics (FoCM '08), Hong Kong, Hong Kong/CHINA <http://www-sop.inria.fr/cafe/SA08/SA08talks/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Sass, Jörn (16.07.2008) Optimal investment under dynamic risk constraints and partial information. Vortrag: Bachelier Finance Society 5th World Congress, London/UNITED KINGDOM.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sass, Jörn (31.01.2008) Handelsbereiche unter Transaktionskosten. Vortrag: Mathematisches Kolloquium, Frankfurt/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Scherzer, Otmar (07.08.2008) Thermoacustic Tomography with Integrating Transducers. Vortrag: SIAM Conference on Life Science, Montreal/ CANADA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Scherzer, Otmar (12.06.2008) Regularized Reconstruction of Shapes with Statistical A Priori Knowledge. Vortrag: Geometry and Statistics of Shapes, Bonn/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Scherzer, Otmar (27.05.2008) Some convex and nonconvex variational principles for image processing. Vortrag: Oberseminar Max-Planck-Institut für Mathematik, Leipzig/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Scherzer, Otmar (28.04.2008) Reconstruction of Shapes with A Priori Knowledge based on M-Reps. Vortrag: Shape and Size in Medicine, Biotechnology and Materials Science, Milano/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Schicho, J. (15.05.2008) A fast algorithm for rational normal curves. Vortrag: Rhine Workshop for Computer Algebra, Levico Terme/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Dr. Mourad (10.04.2008) Reconstruction of complex obstacles from few measurements. Vortrag: Institute of Acoustics Spring Conference 2008, Reading/UNITED KINGDOM.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Mourad (12.05.2008) Reconstruction of complex interfaces from exterior measurements. Vortrag: Department of Mathematics research seminar, Univeristy of Annaba. (University of Annaba), Annaba/ALGERIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Mourad (15.01.2008) How to make interfaces appear more (or less) visible from exterior measurements. Vortrag: Hokkaido Mathematical Department's seminar, Sapporo/JAPAN.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Sini, Mourad (18.06.2008) How to make obstacles appear more (or less) visible from exterior measurements. Vortrag: European Congress on Computational Methods in Engineering (ECCOMAS 2008), Venice/ITALY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Mourad (20.06.2008) Reconstruction of complex cracks from exterior meausurements. Vortrag: International Conference on Inverse Problems and Engineering: Theory and Practice., Dourdan/FRANCE.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Mourad (25.07.2008) Detection of complex obstacles using few far field measurements. Vortrag: 4th International Conference on Symbolic and Numerical Scientific Computing (SNSC'08), Hagenberg/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Mourad (27.10.2008) Reconstruction of complex interfaces from exterior measurements. Vortrag: Nanjing, Nanjing/CHINA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Sinwel, Astrid (14.10.2008) New mixed finite elements for elasticity. Vortrag: LCM Seminar, Linz/AUSTRIA.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Tomar, Dr. Satyendra (15.08.2008) Efficient a posteriori error estimates for nonconforming approximation of elliptic problems based on Helmholtz type decomposition of error. Vortrag: Worms 2008, Jyvaskyla/FINLAND <http://www.mit.jyu.fi/scoma/Worms2008/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Tomar, Dr. Satyendra (30.10.2008) Cost effective guaranteed a posteriori error estimates using optimal order multilevel method. Vortrag: University of Zurich, Numerical Analysis Seminar, Zurich/SWITZERLAND.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Tomar, Satyendra (13.12.2008) Cost effective guaranteed a posteriori error estimates for discontinuous Galerkin approximations. Vortrag: ICCPDE, Mumbai (Bombay)/INDIA <http://www.math.iitb.ac.in/~cpde/iccpde-2008/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Tomar, Satyendra (30.12.2008) Cost effective guaranteed a posteriori error estimates for discontinuous Galerkin approximations. Vortrag: IISER visit, Mohali (Chandigarh)/INDIA <http://www.iisermohali.ac.in/colloq.html>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Tomar, Satyendra (31.12.2008) Guaranteed error estimation with optimal cost. Vortrag: PUC visit, Chandigarh/INDIA <http://maths.puchd.ac.in/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag

Tomar, S.K. (21.06.2008) Multilevel preconditioning in H(div) and applications to a posteriori error estimates. Vortrag: Parallel Matrix Algorithms and Applications, Neuchâtel/SWITZERLAND <http://www.dcs.bbk.ac.uk/pmaa08/>.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Wachsmuth, Daniel (10.06.2008) Wie kann man Optimalitaet von Naeherungsloesungen ueberpruefen?. Vortrag: Kolloquium (TU Darmstadt, Graduiertenschule Computational Engineering), Darmstadt/GERMANY.; Typ: Sonstiger eingeladener Veranstaltungsbeitrag (internationale Veranstaltung)

Eingeladene wissenschaftliche Vorträge: Keynotes and Named Lectures

Albrecher, Hansjörg (03.07.2008) The effect of tax payments in ruin theory. Vortrag: International Symposium on Business and Industrial Statistics, Prague/CZECH REPUBLIC.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (03.09.2008) Risk modelling in insurance. Vortrag: Special Semester on Stochastics with Emphasis on Finance (RICAM), Linz/AUSTRIA.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (05.11.2008) Tax payments in collective risk theory. Vortrag: Invited Lecture at Department of Statistics and Decision Support Systems, University of Vienna, Wien/AUSTRIA.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (09.05.2008) Finanzmathematische Methoden zur Quantifizierung von Wetterrisiken. Vortrag: Eingeladener Vortrag am Wegener Zentrum Graz, Graz/AUSTRIA.; Typ: Keynote

Albrecher, Hansjörg (10.06.2008) Mathematical Modelling of Reinsurance. Vortrag: Int. Workshop on Evaluating and Covering Extreme Risks, Paris/FRANCE.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (10.07.2008) Tax Identities in Risk Theory. Vortrag: Patrick Poon Actuarial Science Workshop, Hongkong/HONG KONG.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (10.12.2008) Tax and divident payments in collective risk theory. Vortrag: Invited Lecture at Vienna Graduate School of Finance, Wien/AUSTRIA.; Typ: Keynote

Albrecher, Hansjörg (11.11.2008) On refracted stochastic process and the analysis of insurance risk. Vortrag: Probability Seminar, Cambridge/UNITED KINGDOM.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (13.03.2008) Steuer- und Dividendenzahlungen in der Risikotheorie. Vortrag: Stochastisches Kolloquium, Universität Karlsruhe, Karlsruhe/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (13.03.2008) Tax and Dividend Payments in Risk Theory. Vortrag: Int. Cologne Workshop on Actuarial Mathematics, Köln/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (16.07.2008) Tax identities in risk theory. Vortrag: 12th Int. Congress on Insurance: Mathematics & Economics in Dalian, Dalian/CHINA.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (17.01.2008) Tax and divident payments in collective risk theory. Vortrag: Seminaire ISA, University of Lausanne (University of Lausanne), Lausanne/SWITZERLAND.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (20.07.2008) On computational aspects of determining Gerber-Shiu functions. Vortrag: Int. Workshop on Actuarial Science: Developments and Future (Tsinghua University, Beijing), Beijing/CHINA.; Typ: Keynote (internationale Veranstaltung)

Albrecher, Hansjörg (29.04.2008) Short Course on "Advanced Ruin Theory". Vortrag: Department of Actuarial Science, University of Louvain-la-Neuve: Short Course on "Advanced Ruin Theory", Louvain-la-Neuve/BELGIUM.; Typ: Keynote (internationale Veranstaltung)

Elbau, Peter (08.07.2008) Semi-Group Theory for Non-convex Energy functionals. Vortrag: SIAM Conference on Imaging Science, San Diego, CA/UNITED STATES <http://www.siam.org/meetings/is08>.; Typ: Named Lecture (internationale Veranstaltung)

Engl, Heinz W. (09.12.2008) Regularization of Inverse Problems: Convergence Analysis, Applications in Systems Biology. Vortrag: The Third International Conference on Scientific Computing and Partial Differential Equations (Hong Kong Baptist University), Hong Kong/HONG KONG.; Typ: Keynote (internationale Veranstaltung)

Engl, Heinz W. (10.05.2008) Regularization of Inverse Problems: Convergence Analysis, New Applications. Vortrag: Seminars in Applied and Computational Analysis (University of Cambridge), Cambridge/UNITED KINGDOM.; Typ: Keynote (internationale Veranstaltung)

Engl, Heinz W. (10.12.2008) International Forum on Computational Mathematics. Vortrag: The Third International Conference on Scientific Computing and Partial Differential Equations (Hong Kong Baptist University), Hong Kong/HONG KONG.; Typ: Keynote (internationale Veranstaltung)

Engl, Heinz W. (18.11.2008) Regularization of Inverse Problems: Convergence Analysis, New Applications and Challenges. Vortrag: BIRS Workshop "Inverse Problems: Recent Progress and New Challenges", Banff/CANADA.; Typ: Keynote (internationale Veranstaltung)

Engl, Heinz W. (30.10.2008) Regularization of Inverse Problems: Convergence analysis, New Application Challenges. Vortrag: Colloquium (Universität Halle), Halle/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Engl, H.W. (27.08.2008) Regularization of Inverse Problems: Convergence analysis, New Application Challenges. Vortrag: Annual Meeting of China Society of Industrial and Applied Mathematics, Zheng Zhou/CHINA.; Typ: Keynote (internationale Veranstaltung)

Fonte, Massimo (19.07.2008) Shock stability for the Burgers-Poisson equation. Vortrag: Sixth meeting on Hyperbolic Conservation Laws: Recent results and Research perspectives, L'Aquila/ITALY <http://www.math.unipd.it/~marson/L%27Aquila08/>.; Typ: Named Lecture (internationale Veranstaltung)

Fornasier, Massimo (01.04.2008) Inverse problems and sparsity measures. Vortrag: Minisymposium Inverse Problems with Sparsity Constraints, GAMM, Bremen/GERMANY.; Typ: Named Lecture (internationale Veranstaltung)

Fornasier, Massimo (02.12.2008) Subspace decomposition method for very large scale sparse optimizations. Vortrag: Structured Decompositions and Efficient Algorithms, Dagstuhl/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Fornasier, Massimo (05.09.2008) Modern harmonic analysis and PDEs methods for visual art restoration. Vortrag: Modelling and Numerics for Monuments Conservation, Orleans/FRANCE.; Typ: Keynote (internationale Veranstaltung)

Fornasier, Massimo (10.12.2008) Domain decomposition methods for total variation minimization. Vortrag: The Third International Conference on Scientific Computing and Partial Differential Equations, Hong Kong/HONG KONG.; Typ: Named Lecture (internationale Veranstaltung)

Fornasier, Massimo (23.05.2008) Modern methods of harmonic analysis and PDEs in mathematical imaging. Vortrag: Mathknow08 - Mathematics, Applied Sciences, and Real Life, Milano/ITALY <http://mox.polimi.it/mathknow08/>.; Typ: Named Lecture (internationale Veranstaltung)

Fornasier, Massimo (26.06.2008) Iteratively re-weighted least squares for sparse recovery. Vortrag: Int. Conf. Foundations of Computational Mathematics 2008 (FoCM08), Hong Kong/HONG KONG <http://www.damtp.cam.ac.uk/user/na/FoCM/FoCM08/>.; Typ: Named Lecture (internationale Veranstaltung)

Fornasier, Massimo (27.11.2008) Kinetic models for flocking. Vortrag: Kinetic modelling for socio-economic and related problems, Vigevano/ITALY.; Typ: Keynote (internationale Veranstaltung)

Fornasier, Massimo (30.06.2008) Variational principles and compressive algorithms. Vortrag: Int. Conf. "Mathematical Methods for Curves and Surfaces", Toensberg/NORWAY <http://heim.ifi.uio.no/~cagd/speakers.html>.; Typ: Keynote (internationale Veranstaltung)

Griesse, Roland (25.01.2008) A Semismooth Newton Method for Tikhonov Functionals with Sparsity Constraints. Vortrag: Workshop on "Hybrid Imaging, Regularization, and Mathematics in Biology", Obergurgl/AUSTRIA.; Typ: Named Lecture (internationale Veranstaltung)

Janicki, Marcin (17.06.2008) Estimation of local temperature dependent heat transfer coefficient for dynamic thermal analysis of electronic circuits. Vortrag: 6th International Conference on Inverse Problems in Engineering: Theory and Practice, Dourdan/FRANCE.; Typ: Named Lecture (internationale Veranstaltung)

Janicki, Marcin (20.03.2008) Determining Thermal Simulation Data from Transient Measurements. Vortrag: 24th Semiconductor Thermal Measurement, Modelling, and Management Symposium (IEEE), San Jose, CA/UNITED STATES <http://www.semi-therm.org/>.; Typ: Named Lecture (internationale Veranstaltung)

Janicki, Marcin (21.06.2008) INVESTIGATION OF CIRCUIT THERMAL MODELS BASED THE TRANSIENT THERMAL RESPONSE SPECTRA. Vortrag: 15th International Conference on Mixed Design of Integrated Circuits and Systems/POLAND.; Typ: Named Lecture (internationale Veranstaltung)

Kuegler, Philipp (12.01.2008) Reverse Engineering of Chemical and Biological Reaction Networks Using Sparsity Constraints. Vortrag: First International Conference of Gwalior Academy of Mathematical Sciences (GAMS) with Symposium on Mathematical Modeling in Engineering and Biosciences/INDIA.; Typ: Keynote (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Kuegler, Philipp (14.03.2008) Inverse Analysis of Biochemical Reaction Networks Using SparsityConstraints. Vortrag: Workshop on Modeling and identification of distributed parameter systems for cell population dynamics/BELGIUM.; Typ: Keynote (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Kuijper, A (24.01.2008) Clustered Cell Segmentation - Based on Iterative Voting and the Level Set Method. Vortrag: 3rd International Conference on Computer Vision Theory and Applications (VISAPP, Funchal, Portugal, 22 - 25 January 2008), Funchal/PORTUGAL.; Typ: Named Lecture (internationale Veranstaltung)

Kunisch, Prof. Karl (24.10.2008) Soptimal Control of Parabolic Variational Inequalities on Bounded and Unbounded Domains. Vortrag: "Phase Transitions and Optimal Control" (WIAS Berlin)/GERMANY.; Typ: Named Lecture (internationale Veranstaltung)

Kunisch, Prof. Karl (26.03.2008) Some Considerations for Numerical Realization of Closed Loop Optimal Control. Vortrag: PDE Constrained Optimization - recent challenges and future developments, Hamburg/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Kunisch, Prof. Karl (31.03.2008) Proper Orthogonal Decomposition in PDE-Constrained Optimization. Vortrag: Workshop on "Industrial Applications of Low Order Models Based on POD",, Bordeaux/FRANCE.; Typ: Keynote (internationale Veranstaltung)

Langer, Prof. Ulrich (14.04.2008) From the Boundary Element DDM to new local Trefftz Finite Element Methods on Arbitrary Polyhedral Meshes. Vortrag: Oberwolfach workshop on Analysis of Boundary Element Methods/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Langer, Prof. Ulrich (19.09.2008) Coupled Data-Sparse Boundary and Interface-Concentrated Finite Element Tearing and Interconnecting Methods. Vortrag: Fast Algorithms for Scientific Computing, New York/UNITED STATES.; Typ: Keynote (internationale Veranstaltung)

Langer, Prof. Ulrich (30.09.2008) From the Boundary Element DDM to Trefftz Finite Element Methods on Arbitrary Polyhedral Meshes. Vortrag: 7th International Conference on ``Scientific Computing in Electrical Engineering", Espoo/FINLAND.; Typ: Keynote (internationale Veranstaltung)

Ramlau, Dr. Ronny (29.01.2008) Effitiente Methoden zur Regularisierung von schlecht gestellten Problemen: Analysis und Anwendungen. Vortrag: Universität der Bundeswehr München (Universität der Bundeswehr München), München/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Ramlau, Ronny (02.07.2008) Imbalance Determination in Rotating Systems - Theory and Industrial Applications. Vortrag: ECMI Tagung (ECMI), London/UNITED KINGDOM.; Typ: Keynote (internationale Veranstaltung)

Ramlau, Ronny (03.07.2008) Minisymposium "Inverse Problems and Signal Processing in Industrial Applications". Vortrag: ECMI Tagung (ECMI), London/UNITED KINGDOM.; Typ: Keynote (internationale Veranstaltung)

Ramlau, Ronny (16.12.2008) Tikhonov Regularisation of Sparsity Constraints, Analysis and Applications. Vortrag: Inverse Days (University of Kuopio), Kuopio/FINLAND.; Typ: Keynote (internationale Veranstaltung)

Ramlau, Ronny (20.06.2008) Regularization of Inverse Problems with Sparsity Constraints. Vortrag: FoCM (Fondation of Computational Mathematics) Conference, Hongkong/HONG KONG.; Typ: Keynote (internationale Veranstaltung)

Ramlau, Ronny (28.05.2008) Inverse Problems Modelling and Simulation . Vortrag: The Fourth International Conference Inverse Problems, Fethiye/TURKEY.; Typ: Keynote (internationale Veranstaltung)

Regensburger, Georg; Rosenkranz, Markus (22.05.2008) The Algebra of Integro-Differential Polynomials. Vortrag: AAA76, 76th Workshop on General Algebra, Linz/AUSTRIA <http://www.algebra.uni-linz.ac.at/AAA76/>.; Typ: Named Lecture (internationale Veranstaltung)

Regensburger, Georg (03.05.2008) Max-Plus Linear Algebra in Maple and Generalized Solutions for First-Order Ordinary BVPs via Max-Plus Interpolation. Vortrag: Milestones in Computer Algebra, MICA 2008, Stonehaven Bay, Trinidad and Tobago/TRINIDAD AND TOBAGO <http://www.orcca.on.ca/conferences/mica2008/>.; Typ: Named Lecture (internationale Veranstaltung)

Scherzer, Otmar (31.03.2008) Mathematische Bildverarbeitung. Vortrag: GAMM 2008, Bremen/GERMANY.; Typ: Keynote (internationale Veranstaltung)

Schicho, J. (15.11.2008) Minimal degree families of rational curves. Vortrag: SAGA 2008, Castro Urdiales/SPAIN.; Typ: Keynote (internationale Veranstaltung)

Wachsmuth, Daniel (02.07.2008) Computable Error Bounds for Elliptic Optimal Control Problems. Vortrag: IACM/ECCOMAS Congress 2008, Venice /ITALY.; Typ: Named Lecture (internationale Veranstaltung)

Wachsmuth, Daniel (10.09.2008) Optimal boundary control of Navier-Stokes equations with state constraint. Vortrag: EDRFCM 08 (ERCOFTAC), St. Marienthal/GERMANY.; Typ: Named Lecture (internationale Veranstaltung)

Wachsmuth, Daniel (12.12.2008) How to check numerically optimality conditions for infinite-dimensional optimization problems. Vortrag: OPTPDE 2008, Warsaw/POLAND.; Typ: Named Lecture (internationale Veranstaltung)

Wachsmuth, Daniel (26.11.2008) Wie kann man Optimalitaet von Naeherungsloesungen ueberpruefen?. Vortrag: Institutskolloquium (Universitaet Duisburg-Essen), Duisburg/GERMANY.; Typ: Named Lecture (internationale Veranstaltung)

Winterhof, A. (13.05.2008) Pseudorandom Numbers and Number Theory. Vortrag: Mathematical Seminar University of Luminy/FRANCE.; Typ: Named Lecture

Winterhof, A. (21.02.2008) Constructions of Approximately Mutually Unbiased Bases. Vortrag: Seminar of the Institute of Quantumphysics - University Ulm/GERMANY.; Typ: Named Lecture

Winterhof, A. (22.12.2008) Waring's problem in finite fields. Vortrag: Mathematical Seminar Sabanci University, Istanbul/TURKEY.; Typ: Named Lecture

Winterhof, A. (23.12.2008) Lattice tests. Vortrag: Workshop on Sequences, Cryptography and Coding, Istanbul/TURKEY.; Typ: Named Lecture

Winterhof, A. (24.10.2008) Sidelnikov (Sub-)Sequences. Vortrag: Workshop on Mathematical Cryptography/SPAIN.; Typ: Named Lecture (internationale Veranstaltung)

Winterhof, A. (28.05.2008) Number Theory and Pseudorandom Numbers. Vortrag: Mathematical Seminar University of Newcastle/AUSTRALIA.; Typ: Named Lecture (internationale Veranstaltung)

Sonstige wissenschaftliche Vorträge

Anguige, Dr. K. (11.02.2008) A one-dimensional model of cell diffusion and aggregation, incorporating volume filling and cell-to-cell adhesion. Vortrag: RICAM PDE-Group Seminar/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Arning, Kattrin (14.09.2008) Modelling, Simulation and Inverse Problems in Ion Channels. Vortrag: Molecular Bioanalytics Summer school 2008, St. Wolfgang/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Arning, Kattrin (31.03.2008) Optimal Design of Ion Channels and Nanopores II. Vortrag: 79th Meeting of the International Association of Applied Mathematics ans Mechanics, Bremen/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Béla, Szilvia (01.07.2008) Approximating implicitly defined curves by fat arcs. Vortrag: 7th International Conference on Mathematical Methods for Curves and Surfaces, Tønsberg/NORWAY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Béla, Szilvia (26.07.2008) Approximating implicitly defined curves by fat arcs. Vortrag: 4th International Conference on Symbolic and Numeric Scientific Computing, Hagenberg/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Béla, Szilvia (28.03.2008) Approximating implicitly defined curves by fat arcs. Vortrag: 5th FSP S092 Workshop, Strobl/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Beuchler, Sven (22.09.2008) Wavelet solvers for p-fem discretizations in 3d using hexahedral elements. Vortrag: Chemnitz FEM-Symposium/ GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Constantinescu, Corina (05.03.2008) Asymptotic results for the probability of ruin in renewal jump-diffusion risk processes. Vortrag: 8th German Open Conference on Probability and Statistics, Aachen/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Constantinescu, Corina (16.07.2008) On the time value of ruin in renewal jump-diffusion risk models. Vortrag: 12th International Congrss on Insurance:Mathematics and Economics, Dalian/CHINA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Erwin, Karer (24.04.2008) Measures for the Strength of Nodal Dependence in AMG for Vector-Field Problems. Vortrag: 4th Austrian Numerical Analysis Day, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/workshops/anaday08/>.; Typ: Sonstiger Veranstaltungsbeitrag

Fornasier, Massimo (15.05.2008) A comparison of joint sparsity and total variation minimization algorithms in image processing. Vortrag: seminar of the Centre de Mathématiques et de Leurs Applications, Cachan - Paris/FRANCE <http://www.cmla.ens-cachan.fr/manifestations/seminaire/ 20072008/20080515.html>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Hahn, M. (06.03.2008) Estimating continuous-time Markov processes based on merged time series. Vortrag: German Open Conference on Probability and Statistics 2008 (Deutsche Mathematikervereinigung - Fachgruppe Stochastik), Aachen/GERMANY <http://gocps2008.rwth-aachen.de>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Kapl, Mario (01.07.2008) Weighted semiorthogonal spline wavelets and applications. Vortrag: 7th International Conference on Mathematical Methods for Curves and Surfaces, Tønsberg/NORWAY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Kapl, Mario (26.07.2008) Weighted spline wavelets and applications. Vortrag: 4th International Conference on Symbolic and Numeric Scientific Computing, Hagenberg/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Karer, Erwin (20.06.2008) On the strength of nodal dependence in AMG for vector-field problems. Vortrag: Parallel Matrix Algorithms and Applications, Neuchatel/SWITZERLAND <www.dcs.bbk.ac.uk/pmaa08/>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Karer, Erwin (20.10.2008) On the strength of nodal dependence in AMG for problems in linear elasticity. Vortrag: Ninth European MultiGrid Conference EMG 2008, Bad Herrenalb/GERMANY <http://www.techsim.org/EMG08/>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Klann, E. (03.10.2008) DK Opening - Project 8: Nonlinear regularization methods for the solution of linear ill-posed problems. Vortrag: DK Computational Mathematics -- Opening (RICAM; JKU), Linz/AUSTRIA <http://www.dk-compmath.jku.at/>.; Typ: Sonstiger Veranstaltungsbeitrag

Kortschak, Dominik (04.12.2008) Asymptotic properties of compound distribution tails. Vortrag: Special Semester on Stochastics with Emphasis on Finance: Concluding Workshop/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Kortschak, Dominik (07.07.2008) Asymptotic expansion of the ruin probability for Pareto claim size distributions. Vortrag: International Workshop on Applied Probability 2008, Compiegne/FRANCE.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Kortschak, Dominik (16.07.2008) Asymptotic expansion of the ruin probability for Pareto claim size distributions. Vortrag: The 12th International Congress on Insurance: Mathematics and Economics, Dalian/CHINA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Kraus, Johannes (20.10.2008) Multilevel preconditioning in H(div) and applications to a posteriori error estimates. Vortrag: Ninth European Multigrid Conference, Bad Herrenalb/GERMANY <http://www.techsim.org/EMG08/>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Lubbes, M.Sc. Niels (15.04.2008) Constructive Minimal Model Programming. Vortrag: RICAM Group Seminar - Symbolic Computation, RICAM, Altenbergerstrasse 50, 4040 Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Lubbes, Niels (03.07.2008) Application of mmp-ing: minimal families of curves on surfaces. Vortrag: Algebraic Geometry Workshop Linz-Wien in Spitz [3-4.07.2008], Hotel Mariandl, Kremser Straße 2, 3620 Spitz an der Donau/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (03.04.2008) Dynamic balancing of planar mechanisms using toric geometry. Vortrag: 79th Annual Meeting of the International Association of Applied Mathematics and Mechanics, Bremen/GERMANY <http://www.zarm.uni-bremen.de/gamm2008>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (03.07.2008) Balancing of linkages. Vortrag: Algebraic Geometry Workshop Linz-Wien/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (10.06.2008) On the ability of a cable-driven robot to generate a prescribed set of wrenches. Vortrag: GROUP SEMINAR - Symbolic Computation, Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (11.11.2008) Teaching balancing to humanoid robots. Vortrag: GROUP SEMINAR - Symbolic Computation, Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (22.01.2008) Static balancing of planar four-bar mechanisms . Vortrag: RICAM Group Seminar - Symbolic Computation, RICAM, Altenbergerstrasse 50, 4040 Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (22.10.2008) Application of symbolic computation to robotics: from design of dynamically balanced mechanisms to the real-time simulation of complex mechanical systems. Vortrag: Scientific visit to ATR, Kyoto/JAPAN.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (25.07.2008) Balancing of parallel mechanisms. Vortrag: SFB 4th International Conference on Symbolic and Numerical Scientific Computing, Hagenberg im Muehlreis/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (22.10.2008) Application of symbolic computation to robotics: from design of dynamically balanced mechanisms to the real-time simulation of complex mechanical systems. Vortrag: Scientific visit to ATR, Kyoto/JAPAN.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (25.07.2008) Balancing of parallel mechanisms. Vortrag: SFB 4th International Conference on Symbolic and Numerical Scientific Computing, Hagenberg im Muehlreis/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Moore, Brian (29.07.2008) Balancing of parallel mechanisms. Vortrag: Applications of Computer Algebra, Hagenberg im Muehlreis/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Müller, Stefan (02.08.2008) Model identification from noisy data: solving ill-posed inverse problems using regularization. Vortrag: Society for Mathematical Biology Conference, Toronto/CANADA <http://www.fields.utoronto.ca/programs/scientific/CMM/08-09/SMB/index.html>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Niels Lubbes, David Sevilla (22.04.2008) Divisors, rational maps, and all that. Vortrag: RICAM Group Seminar - Symbolic Computation: Divisors, rational maps, and all that, RICAM, Altenbergerstrasse 50, 4040 Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Pikkarainen, Hanna Katriina (11.12.2008) Convergence results for the Bayesian inversion theory. Vortrag: Seminar, University of Reading, Reading/UNITED KINGDOM.; Typ: Sonstiger Veranstaltungsbeitrag

Pikkarainen, Hanna Katriina (28.05.2008) State estimation approach to nonstationary inverse problems: one-dimensional model case. Vortrag: International Conference "Inverse Problems: Modeling and Simulation", Fethiye/TURKEY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Pikkarainen, Hanna Katriina (28.10.2008) Convergence results for the Bayesian inversion theory. Vortrag: Workshop on Inverse and Partial Information Problems: Methodology and Applications (RICAM), Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Ramlau, Prof. Dr. Ronny (25.01.2008) Workshop "Recent Advances in Regularization Techniques". Vortrag: Workshop "Recent Advances in Regularization Techniques", Obergurgl/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Regensburger, G.; Rosenkranz, M. (01.12.2008) Integro-Differential Algebras and the Monoid of Boundary Problems. Vortrag: Theorie de Galois Differentielle, Lille/FRANCE.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Regensburger, G.; Rosenkranz, M. (05.02.2008) Integro-Differential Algebras for Boundary Problems. Vortrag: RICAM Group Seminar, Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Regensburger, G.; Rosenkranz, M. (26.07.2008) Integro-Differential Polynomials. Vortrag: SNSC'08 (Fourth International Conference on Symbolic and Numerical Scientific Computing), Hagenberg/AUSTRIA <http://www.sfb013.uni-linz.ac.at/index.php?id=snsc08>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Regensburger, G.; Rosenkranz, M. (28.07.2008) Integro-Differential Algebras as a Natural Setting for Boundary Problems. Vortrag: ACA'08 (Applications of Computer Algebra), Session on Groebner Bases and their Applications, Hagenberg/AUSTRIA <http://www.ricam.oeaw.ac.at/people/page/rosenkranz/aca08/aadios.html>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Regensburger, Georg (04.07.2008) Integro-Differential Polynomials. Vortrag: Algebraic Geometry Workshop Linz-Wien in Spitz [3-4.07.2008], Hotel Mariandl, Kremser Straße 2, 3620 Spitz an der Donau/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Rosenkranz, M.; Regensburger, G. (22.07.2008) Integro-Differential Polynomials and Operators. Vortrag: International Symposium on Symbolic and Algebraic Computation (ISSAC), Hagenberg/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Rosenkranz, M.; Regensburger, G. (26.02.2008) Canonical Forms for Integro-Differential Polynomials. Vortrag: RICAM Group Seminar, Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Rosenkranz, M.; Regensburger, G. (26.07.2008) Integro-Differential Algebras for Solving/Factoring Boundary Problems. Vortrag: SNSC'08 (Fourth International Conference on Symbolic and Numerical Scientific Computing), Hagenberg/AUSTRIA <http://www.sfb013.uni-linz.ac.at/index.php?id=snsc08>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Rosenkranz, M.; Regensburger, G. (28.07.2008) Groebner Bases for Boundary Value Problems. Vortrag: ACA'08 (Applications of Computer Algebra), Session on Groebner Bases and their Applications, Hagenberg/AUSTRIA <http://www.wlu.ca/science/physcomp/kotsireas/ACA2008GB.html>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Rosenkranz, Markus (03.07.2008) Integro-Differential Algebras and Boundary Problems. Vortrag: Algebraic Geometry Workshop Linz-Wien in Spitz [3-4.07.2008], Hotel Mariandl, Kremser Straße 2, 3620 Spitz an der Donau/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sass, Jörn (04.09.2008) The numeraire portfolio under transaction costs. Vortrag: Operations Research 2008, Augsburg/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sass, Jörn (05.03.2008) The numeraire portfolio under transaction costs. Vortrag: GOCPS 2008, Aachen/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Scherzer, Otmar (08.07.2008) Inverse Scale Spaces versus Bregman Flow. Vortrag: SIAM Conferecne on Imaging Science 2008, San Diego/UNITED STATES.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Scherzer, Otmar (08.07.2008) Regularized Reconstruction of Shapes with Statisctical A Priori Knowledge. Vortrag: SIAM Conference on Imaging Science 2008, San Diego/UNITED STATES.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Schicho, Dr. Josef (25.11.2008) Numerical Statistics and zeros of polynomials. Vortrag: Algebraic Geometry Seminar Linz-Wien, RICAM, Altenbergerstrasse 50, 4040 Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sevilla, David (04.03.2008) The Tschirnhaus-Weierstrass form of a curve. Vortrag: RICAM Group Seminar - Symbolic Computation, RICAM, Altenbergerstrasse 50, 4040 Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sevilla, David (04.07.2008) Root parametrizations and TW curves. Vortrag: Algebraic Geometry Workshop Linz-Wien in Spitz [3-4.07.2008], Hotel Mariandl, Kremser Straße 2, 3620 Spitz an der Donau/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sevilla, David (10.03.2008) The Tschirnhaus-Weierstrass form of a curve. Vortrag: Algebraic Geometry Seminar Linz-Wien, Faculty of Mathematics, Nordbergstraße 15, 1090 Wien/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag

Sevilla, David (11.03.2008) The Tschirnhaus-Weierstrass form of a curve (II). Vortrag: RICAM Group Seminar - Symbolic Computation, RICAM, Altenbergerstrasse 50, 4040 Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sevilla, David (29.10.2008) Tschirnhaus-Weierstrass curves and computation of automorphisms of algebraic curves. Vortrag: Local group seminar, E.T.S.I.I.T., University of Cantabria, E-39071 Santander, Spain /SPAIN.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sini, Mourad (25.09.2008) How to make an obstacle appear more (or less) visible from exterior measurements?. Vortrag: Chemnitz Symposium on Inverse Problems, Chemnitz/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sinwel, Astrid (02.04.2008) Mixed finite elements for thin structures. Vortrag: GAMM 2008 Jahrestagung, Bremen/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sinwel, Astrid (22.09.2008) Mixed finite elements for thin elastic structures. Vortrag: Chemnitzer FEM Symposium (TU Chemnitz), Chemnitz/GERMANY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Sinwel, Astrid (25.04.2008) Hybridizing Raviart-Thomas elements for the Helmholtz equation. Vortrag: 4th Austrian Numerical Analysis Day, Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag

Sinwel, Astrid (31.05.2008) Hybridizing Raviart-Thomas elements for the Helmholtz equation. Vortrag: 4th European Finite Element Fair, Gothenburg/SWEDEN.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Song, Xinghua (01.07.2008) Circular spline approximation. Vortrag: 7th International Conference on Mathematical Methods for Curves and Surfaces, Tønsberg/NORWAY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Song, Xinghua (26.07.2008) Circular spline approximation. Vortrag: 4th International Conference on Symbolic and Numeric Scientific Computing, Hagenberg/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Song, Xinghua (28.03.2008) Circular spline approximation. Vortrag: 5th FSP S092 Workshop, Strobl/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Thonhauser, Stefan (03.12.2008) On transaction costs in insurance. Vortrag: Concluding Workshop, Special Semester on Stochastics with Emphasis on Finance, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/specsem/sef/>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Tomar, Satyendra (02.10.2008) Discontinuous Galerkin Methods: Basics, Computations and Applications. Vortrag: Special Course (Spezialvorlesung), Linz/AUSTRIA <http://www.kusss.jku.at/kusss/lvaregistrationlist.action?courseclassid=21680&showdetails=327038>.; Typ: Sonstiger Veranstaltungsbeitrag

Tomar, Satyendra (24.04.2008) A posteriori error estimates for nonconforming approximation of elliptic problems based on Helmholtz type decomposition of the error. Vortrag: 4th Austrian Numerical Analysis Day, Linz/AUSTRIA <http://www.ricam.oeaw.ac.at/workshops/anaday08/>.; Typ: Sonstiger Veranstaltungsbeitrag

Winterhof, A. (07.07.2008) Interpolation of the Double Discrete Logarithm. Vortrag: Workshop on Arithmetics in Finite Fields (WAIFI 2008)/ITALY.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Winterhof, A. (16.09.2008) On the Average Distribution of Power Residues and Primitive Elements in Inversive and Nonlinear Recurring Sequences. Vortrag: Conference on Sequences and Their Applications SETA 2008/UNITED STATES.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Zarzer, Clemens A (14.04.2008) On a Tikhonov-type Regularization Method with Non-Convex Sparsity Constraints. Vortrag: RICAM Group Seminar - Inverse Problems (Johann Radon Institute for Computational and Applied Mathematics), Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag

Wissenschaftliche Posterpräsentationen

Arning, Kattrin (04.02.2008) Modelling and Simulation of Ion Channels. Posterpräsentation: Joint Meeting of Biophysical Society 52nd Annual Meeting & 16th International Biophysics, Long Beach/UNITED STATES.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Arning, Kattrin (15.09.2008) Modelling, Simulation and Inverse Problems in Ion Channels. Posterpräsentation: Molecular Bioanalytics Summer school 2008, St. Wolfgang/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Arning, Kattrin (16.02.2008) Modelling and Simulation of Ion Channels. Posterpräsentation: X. Annual Linz Winter Workshop, Linz/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Buchberger, B.; Regensburger, G.; Rosenkranz, M.; Tec, L. (23.07.2008) General Polynomial Reduction with Theorema Functors: Applications to Integro-Differential Operators and Polynomials. Posterpräsentation: International Symposium on Symbolic and Algebraic Computation (ISSAC), Hagenberg/AUSTRIA.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Fornasier, Massimo (28.10.2008) Iteratively re-weighted least squares. Posterpräsentation: Hot topics Workshop: Multi-Manifold Data Modeling and Applications, Minneapolis/UNITED STATES <http://www.ricam.oeaw.ac.at/people/page/fornasier/IMA_poster.pdf>.; Typ: Named Lecture (internationale Veranstaltung)

James Lu, Clemens Zarzer, Rainer Machne, Gottfried Köhler (24.08.2008) Elucidating the HPA Axis Stress Response via Computational Inverse Analysis. Posterpräsentation: The Ninth International Conference on Systems Biology, Göteborg/SWEDEN.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Philipp Kügler, James Lu, Stefan Müller, Clemens Zarzer and Heinz W. Engl; Lukas Endler, Christoph Flamm Rainer Machne and Peter Schuster (10.03.2008) Inverse Problems in Systems Biology. Posterpräsentation: Computational and Systems Biology Course at CoSBi, Trento/ITALY <http://www.cosbi.eu/events/course08.php>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Stefan Müller, James Lu, Rainer Machne (24.08.2008) Model identification in systems biology: Solving ill-posed problems using regularization. Posterpräsentation: The Ninth International Conference on Systems Biology, Göteborg/SWEDEN <http://www.icsb-2008.org/>.; Typ: Sonstiger Veranstaltungsbeitrag (internationale Veranstaltung)

Theory and Practice, Doudan/FRANCE <https://matar.ciril.fr/CONGRES/homeicipe.php>.; Typ: ALT: Ausgewählter Beitrag (Selected/refereed lecture) (internationale Veranstaltung)

Lu, James (01.07.2008) Inverse modelling for studying HPA axis stress response. Vortrag: ECMTB 08, Edinburgh/AUSTRIA <http://www.maths.dundee.ac.uk/ecmtb08/>.; Typ: ALT: Ausgewählter Beitrag (Selected/refereed lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Lu, James (05.08.2008) Elucidating mechanisms in genetic oscillators via inverse analysis. Vortrag: SIAM Life Sciences, Montreal/CANADA <http://www.siam.org/meetings/ls08/>.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Lu, James (30.06.2008) Inverese methods for elucidating oscillatory gene models. Vortrag: EC, Edinburgh/UNITED KINGDOM.; Typ: ALT: Ausgewählter Beitrag (Selected/refereed lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Lu, James (30.06.2008) Inverese methods for elucidating oscillatory gene models. Vortrag: ECMTB 08, Edinburgh/UNITED KINGDOM <http://www.maths.dundee.ac.uk/ecmtb08/>.; Typ: ALT: Ausgewählter Beitrag (Selected/refereed lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Lu, S. (17.06.2008) Sparsity reconstruction by means of the standard Tikhonov regularization. Vortrag: 6th International Conference on Inverse Problems in Engineering: Theory and Practice ICIPE (Dourdan, 15.06.2008), Dourdan/FRANCE.; Typ: ALT: Ausgewählter Beitrag (Selected/refereed lecture) (internationale Veranstaltung)

Niebsch, Jenny (06.08.2008) Mathematical Imbalance Determination from Vibrational Measurements and Industrial Applications. Vortrag: DETC & Computers and Information in Engineering Conference (CIE), New York City/UNITED STATES.; Typ: ALT: Ausgewählter Beitrag (Selected/refereed lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Pereverzyev, S. (05.06.2008) Sparsity reconstruction by the standard Tikhonov regularization. Vortrag: The 13th International Conference on Mathematical Modeling and Analysis devoted to 70-th birthday of Professor Vainikko, Tartu/ESTONIA.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Pereverzyev, S. (05.06.2008) Sparsity reconstruction by the standard Tikhonov regularization. Vortrag: The 13th International Conference on Mathematical Modeling and Analysis devoted to 70-th birthday of Professor Vainikko, Tartu/ESTONIA.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Pereverzyev, S. (18.04.2008) Adaptive Learning via the Balancing Principle. Vortrag: Symposium on Nonlinear Evolution Equations, Bangalore/INDIA.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Pereverzyev, S. (28.04.2008) Adaptive Learning via the Balancing Principle. Vortrag: Invited Colloquium talk/INDIA.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Pereverzyev, Sergei V (02.07.2008) A model function method in total least squares. Vortrag: The 8th International Congress on Computational Mechanics, Venice/ITALY.; Typ: ALT: Eingeladener Beitrag (Invited lecture)

Pereverzyev, Sergei V (05.06.2008) Sparsity reconstruction by the standard Tikhonov regularization . Vortrag: 13th International Conference on Mathematical Modeling and Analysis devoted to 70-th birthday of Professor Vainikko , Tartu/ESTONIA.; Typ: ALT: Eingeladener Beitrag (Invited lecture)

Pereverzyev, Sergei V (17.09.2008) Indirect Regularization in non-Hilbert spaces by standard regularization methods. Vortrag: Annual Meeting of German Mathematical Union (DMV), Erlangen/GERMANY.; Typ: ALT: Eingeladener Beitrag (Invited lecture)

Pereverzyev, Sergei V (23.04.2008) The balancing principle for the regularization of elliptic Cauchy problems. Vortrag: Invited Colloquium talk/INDIA.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (Internationalität nicht zuordenbar, da nicht mit Veranstaltung verknüpft)

Pereverzyev, Sergei V (23.07.2008) Local solutions to inverse problems. Vortrag: Workshop "Optimization and Regularization for Computational Inverse Problems and Applications", Beijing/CHINA.; Typ: ALT: Eingeladener Beitrag (Invited lecture)

Thonhauser, Stefan (10.03.2008) Dividend maximization for a risk process under force of interest. Vortrag: L^2 Seminar (University of Lausanne Institute of Actuarial Sciences)/SWITZERLAND.; Typ: ALT: Eingeladener Beitrag (Invited lecture) (internationale Veranstaltung)

1.7. Scientific cooperations 2008

Group "Computational Methods for Direct Field Problems"

Here we only mention the most important scientific cooperations leading to joint publications or research projects with other RICAM groups and with other groups or scientists in Austria or worldwide:

Cooperations within the RICAM:

1. *S. Beuchler* with D. Wachsmuth (Optimal Control Group) on boundary concentrated FEM for optimal control problems.
2. *I. Georgiev* and *J. Kraus* with J. Schicho (Symbolic Group) ons symbolic techniques for optimal M-matrix approximation of (local) finite element stiffness matrices.

National Cooperations:

1. *S. Beuchler* with P. Pohl and G. Schütz (Institute for Biophysics, JKU Linz) on numerical simulation of the proton transfer along lipid bilayer membranes: FWF project application within the BioDK.
2. *S. Beuchler* with V. Pillwein (RISC+MathDK W1214, JKU Linz) and S. Zaglmayr (TU Graz) on sparse shape functions for H(div) and H(curl): 2 joint publications in preparation.
3. *S. Tomar* with B. Jüttler on isogeometric methods: FWF project application.

International Cooperations:

1. There is a special Collarative Research Project on "Robust Scientific Computing Methods and High Performance Algorithms" of RICAM with the Institute for Parallel Processing (IPP) of the Bulgarian Academy of Sciences (BAS) at Sofia (Bulgaria). There are numerous joint publications co-authored by *I. Georgiev*, *J. Kraus* and S. Margenov, see [List 17]. In particular, *J. Kraus* and S. Margenov are working on a monograph titled "Robust Algebraic Multilevel Methods and Algorithms" that will be published by Walter de Gruyter 2009.
2. *S. Beuchler* und *U. Langer* with T. Eibner (TU Chemnitz, Germany) on primal and dual interface concentrated Finite Element Methods: joint publication, see [List 17].
3. *C. Chniti* was cooperating with F. Nier (Rennes 1 University, France), F. Nataf (Paris six University, France), X. Antoine (Nancy 1 University, France), K. Ramdani

(INRIA Lorraine, France) and M. Gander (University of Geneva, Switzerland): joint publications, see [List 17].

4. *U. Langer* cooperates with V. Korneev (St. Petersburg, Russia) on a book on domain decomposition methods.
5. *S. Tomar* with T.J.R. Hughes (Austin, USA) on isogeometric method for numerical solution of partial differential equations: FWF project application and J.T. Oden Faculty research fellowship.
6. *S. Tomar* with S. Repin (St. Peteresburg, Russia) and R. Lazarov (College Station, USA) on a posteriori error estimates: joint publications, see [List 17].
7. *L. Zikatanov* is collaborating with R. Scheichl (University of Bath, England), O. Dubois (University of Minnesota) and I. Mishev (ExxonMobil Upstream Research) on developing upscale techniques based on energy minimizing bases with applications to reservoir modeling. The collaboration with Rob Scheichl is on theory for such upscaling techniques.
8. *L. Zikatanov* is collaborating with B. Ayuso (Universidad Autonoma de Madrid, Spain) on preconditioners for non-symmetric DG discretizations.
9. *L. Zikatanov* is collaborating with C. Rebbi and R. Brower (Boston University, USA) on fast solvers for Dirac equation with Applications in Quantum Chromodynamics.

Group "Inverse Problems"

Cooperations within RICAM:

Trung Thanh Nguyen

- Dr. Mourad Sini (inverse scattering theory, non-iterative methods for solving inverse obstacle scattering problems)
- Prof. Ronny Ramlau (regularization and denoising in the linear sampling method)

Hanna Pikkarainen

- Prof. Dr. Josef Schicho (Bayesian methods for algebraic computation problems with approximate data)

Esther Klann

- Prof Dr. Ronny Ramlau (reconstruction and segmentation of tomography data, Mumford-Shah like functionals, regularization theory)

Ronny Ramlau

- Dr. Esther Klann - FWF-project "Mumford-Shah Models for the Inversion of Tomography Data" –joint publication
- Dr. Jenny Niebsch – FWF-project "Mathematical methods for high-precision balancing of machine -tools" – joint publicacation
- Clemens Zarzer – cooperation on Inverse problems with sparity constraints – joint publication
- Stephan Anzengruber – FWF-project „Inverse problems with sparsity constraints" – joint publication

Stefan Müller

- Georg Regensburger (differential algebra for model reduction in systems biology)

National Cooperations:

Sergei Pereverzyev (Hui Cao, Shuai Lu, Sivananthan Sampath)

- Prof. Luigi del Re (JKU) - cooperation within EU-Project "DIAdvisor"

Hanna Pikkarainen

- Dr. Kristian Bredies, Karl Franzens Universität Graz, Austria (regularization of measure-valued inverse problems)
- Dr. Stefan Kindermann, Johannes Kepler Universität Linz, Austria (regularization in financial mathematics)
- Prof. Dr. Andreas Neubauer, Johannes Kepler Universität Linz, Austria (Bayesian inversion theory in infinite-dimensions)

Mourad Sini

- Dr. Stefan Kindermann, Johannes Kepler Universität Linz, Austria. (Coupling of iterative and non-itartive methods for detecting interfaces)
- Dr. Thanh Nguyen, RICAM, Linz, Austria. (Accuracy of reconstruction via the linear sampling method)

Esther Klann

- Prof Dr. Ronny Ramlau, Johannes Kepler Universität Linz, Austria (reconstruction and segmentation of tomography data, Mumford-Shah like functionals, regularization theory)
- Prof. Dr. Wolfgang Ring, University of Graz, Austria (reconstruction and segmentation of tomography data, Mumford-Shah like functionals, level-set methods, shape calculus)
- Mag. rer. nat. Elena Hötzl, University of Graz, Austria (reconstruction and segmentation of tomography data, Mumford-Shah like functionals, computational aspects, minimization strategies)

Ronny Ramlau

- Dr. Elena Resmerita, Johannes Kepler Universität Linz, Austria –joint publication (sparsity)
- Prof. Dr. Wolfgang Ring, University of Graz, Austria FWF-project “Mumford-Shah Models for the Inversion of Tomography Data“ –joint publication
- Mag. rer. nat. Elena Hötzl, University of Graz, Austria FWF-project “Mumford-Shah Models for the Inversion of Tomography Data“

Stefan Müller

- Christoph Flamm, Institute for Theoretical Chemistry, University of Vienna (development of the software package SOSlib for symbolic and numerical analysis of SBML models)
- Rainer Machne, Institute for Theoretical Chemistry, University of Vienna (development of SOSlib, bifurcation analysis of the GATA transcription factor network)

Clemens Zarzer

- Group of Prof. Köhler, Max F. Perutz Laboratories, University of Vienna, (Data-Driven Inverse Analysis of the Hypothalamic-Pituitary-Adrenal Axis) - joint research in progress, cooperation within WWTF-Project MA-07-030.

James Lu

- Christoph Flamm, Rainer Machne, University of Vienna - cooperation within WWTF project MA07, modeling yeast oscillations and HPA axis.
- Gottfried Koehler, Max F, Perutz Laboratories, University of Vienna - cooperation within WWTF project MA07, modeling yeast oscillations, HPA axis and analyzing fluorescence correlation spectroscopy data(FCS).

International Cooperations:

Trung Thanh Nguyen

- Prof. Dinh Nho Hao, Hanoi Institute of Mathematics, Vietnam (inverse heat conduction problems)
- Prof. Hichem Sahli, Vrije Universiteit Brussel, Belgium (practical applications of electromagnetic scattering theory in surveillance and security)

Sergei Pereveryzev (Hui Cao, Shuai Lu, Sivananthan Sampath)

- Prof. Giovanni Sparacino (University of Padova, Italy) - cooperation within EU-Project "DIAdvisor"
- Prof. Ernesto De Vito (University of Genova, Italy) - joint publication.
- Dr. Lorenzo Rosasco (MIT) - joint publication.
- Professor Michael Klibanov (University of North Carolina at Charlotte, USA) - joint publication, cooperation within FWF-Project P20235-N18.
- Professor Bernd Hofmann (TU Chemnitz, Germany) - joint publication, cooperation within FWF-Project P20235-N18.
- Professor Ulrich Tautenhahn (University of Applied Sciences Zittau/Görlitz, Germany) - joint publication, cooperation within FWF-Project P20235-N18.
- Professor Peter Mathe (WIAS-Berlin) - joint publication, cooperation within FWF-Project P20235-N18.
- Dr. Adel Mhamdi and Yi Heng (RWTH Aaachen, Germany) - joint research in progress, cooperation within FWF-Project P20235-N18.
- Professor Wang Yanfei (Institute of Geology and Geophysics, The Chinese Acad. of Sci., Beijing, China) - joint research in progress, cooperation within FWF-Project P20235-N18.
- Professor Phoolan Prasad (Indian Institute of Science, Bangalore, India) - joint research in progress, cooperation within FWF-Project P20235-N18.

Hanna Pikkarainen

Prof. Dr. Thorsten Hohage, Georg-August-Universität Göttingen, Germany (Bayesian inversion theory in infinite-dimensions)

Dr. Janne Huttunen, University of Kuopio, Finland / University of California, Berkeley, USA (non-stationary inverse problems and filtering)

Dr. Jarmo Malinen, Helsinki University of Technology, Finland (non-stationary inverse problems and control theory)

Dr. Roland Potthast, University of Reading, UK (Bayesian inversion theory in infinite dimensions)

Mourad Sini

- Prof. Gen Nakamura,Hokkaido University, Japan (Analytic extension and the uniqueness issue)
- Prof. Jijun Liu, South East University, China (Accuracy of the probing methods and coating effects)
- Prof. C. Roland Potthast, Univ. Reading, UK (Reconstruction of obstacles for Maxwell systems)
- Dr. Eva Sincich, University of Udine, Italy (Improved stability estimates of complex obstacles for acoustics)
- Dr. Lin He, Luminescent Technologies, USA (Reconstruction of complex obstacles from few incident waves)
- Prof. Fioralba Cakoni, University of Delaware., USA. (Asymptotic formulas for conductive obstacles via the linear sampling method)

Esther Klann

- Dr. Dirk Lorenz, University of Bremen, Germany (joint publication)
- Prof. Dr. Lothar Reichel , Kent State University, Ohio, USA (joint research in progress)
- Prof. Dr. Peter Maass, University of Bremen, Germany (joint publication)

Jenny Niebsch

- Iwona Piotrowska, University of Bremen –cooperation within the FWF-Project “Mathematical methods for high-precision balancing of machine -tools” – joint publication
- Christina Brandt, University of Bremen –cooperation within the FWF-Project “Mathematical methods for high-precision balancing of machine -tools” – joint publication
- Peter Maaß, University of Bremen – cooperation within the FWF-Project “Mathematical methods for high-precision balancing of machine -tools” – joint publication
- Andreas Krause, Oltman Riemer, Laboratory for Precision Machining, Bremen cooperation within the FWF-Project “Mathematical methods for high-precision balancing of machine -tools”
- Robert Liebich, FG Konstruktion und Produktzuverlässigkeit, TU Berlin – Consulting

Ronny Ramlau

- PD Dr. Gerd Teschke, University of Applied Sciences Neubrandenburg – joint publication (sparsity constraints, image impainting)
- Claudia Borries - University of Applied Sciences Neubrandenburg - discussions on sparsity contraints
- Dipl. Math. Mariya Zharyi, Konrad – Zuse Institute, Berlin, Germany – PhD supervisor
- Prof. Dr. Peter Maass, University of Bremen, Germany – cooperation □within the FWF-Project “Mathematical methods for high-precision balancing of machine -tools” – joint publication

- Prof. Dr. E. Brinksmeier, Laboratory for Precision Machining, University of Bremen, Germany –cooperation ☐within the FWF-Project “Mathematical methods for high-precision balancing of machine -tools” – joint publication
- Prof. Dr. Martin Burger, University of Münster, Germany – cooperation on medical imaging
- Prof. Dr. L. Reichel, Kent State University, Kent, USA - joint research in progress
- Prof. Dr. Antonio Leitao, Federal University of Santa Catarina, Brazil - joint research in progress
- Jocelyne Erhel, IRISA, Rennes, Frankreich - discussions

James Lu

- Douglas Murray, Keio University, Japan - cooperation within WWTF project MA07.
- Noriko Hiroi, currently at European Bioinformatics Institute, UK - cooperation within WWTF project MA07.

Industrial cooperations:

Jenny Niebsch

- Günther Stüber, Oerlikon Leybold Vacuum GmbH, Köln – Balancing of vacuum pumps
- Michael Melsheimer, Deutsche WindGuard Dynamics GmbH, Berlin – cooperation within the FFG-Project “Modell basierte Unwuchtbestimmung in Windenergieanlagen”
- Holger Fritsch, My-Sen GmbH, Rudolstadt (alle Germany) – cooperation within the FFG-Project “Modell basierte Unwuchtbestimmung in Windenergieanlagen”

Ronny Ramlau

- Dr. Ing. M. Lang, Siemens GmbH, Automation and Drives, Berlin, Germany – Verbesserte Rotormodelle
- Ing. M. Melzheimer Deutsche Windguard Dynamix GmbH, Berlin, Germany – cooperation ☐within the FFG-Project “Modell basierte Unwuchtbestimmung in Windenergieanlagen”
- Ing. H. Fritsch, MySen GmbH, Rudolstadt, Germany – cooperation within the FFG-Project “Modell basierte Unwuchtbestimmung in Windenergieanlagen”
- Dr. G. Stüber, Oerlikon Leybold Vacuum GmbH, Cologne, Germany– Balancing of vacuum pumps

Key publications:

- H.W. Engl, S. Kindermann, P. Mayer, H. Albrecher, Identification of the local speed function in a Levy model for option pricing, Journal of Integral Equations and Applications 20 (2008), 161-200
- H.W. Engl, V. Capasso, S. Kindermann, Parameter Identification in a random environment exemplified by a multiscale model for crystal growth, SIAM Multiscale Modelling and Simulation 7 (2008), 814-841
- S. Müller, J. Lu, P. Kügler, H.W. Engl, Parameter identification in systems biology: solving ill-posed inverse problems using regularization, RICAM Report 2008-25
- E. De Vito, S. V. Pereverzev, L. Rosasco, Adaptive Kernel Methods via the Balancing Principle, submitted, CBCL paper #274/ CSAIL Technical Report #TR-2008-052, Massachusetts Institute of Technology, Cambridge, MA, August 19, 2008
- H. Cao, M. V Klibanov, S. V. Pereverzev, A Carleman estimate and the balancing principle in the quasi-reversibility method for solving the Cauchy problem for the Laplace equation, Inverse Problems 25 (2009) 035005 (21pp)
- S. Lu, S. V. Pereverzev, U. Tautenhahn, Regularized total least squares: computational aspects and error bounds, to appear in SIAM Journal on Matrix Analysis and Applications
- S. Lu, S. V. Pereverzev, U. Tautenhahn, Dual regularized total least squares and multiparameter regularization, Computational Methods in Applied Mathematics, 8 (2008), 253-262.
- S. Lu, S. V. Pereverzev, U. Tautenhahn, A model function method in total least squares, submitted, RICAM report 2008-18
- S. Lu, S. V. Pereverzev, Sparsity recovery by the standard Tikhonov method, Numerische Mathematik 112 (2009), 403-424
- P. Mathe, S. V. Pereverzev, The use of higher order finite difference scheme is not dangerous, Journal of Complexity, 25 (2009), 3-10
- S. Lu, P. Mathe, Heuristic parameter selection based on functional minimization: Optimality and model function approach, submitted, WIAS preprint 1413
- Y. Heng, S. Lu, A. Mhamdi, S. V. Pereverzev, Model function approach in the modified L-curve method for the choice of regularization parameter, RICAM report 2009-18
- A. Neubauer, H. K. Pikkarainen, Convergence results for the Bayesian inversion theory, Journal of Inverse and Ill-Posed Problems, 16 (2008), 601-613
- H. K. Pikkarainen, J. Schicho, A Bayesian Model for Root Computation, RICAM Reports 2008-31
- N. Honda, G. Nakamura, R. Potthast and M.Sini. The no-response approach and its relation to other sampling methods. Annali di Matematica Pura ed Applicata. (4) 187, no. 1, 7—37, (2008).

- C. L. Lin, G. Nakamura and M Sini. Unique continuation for transversally isotropic dynamical systems and its applications. J. Diff. Equat, 245, 3008-3024, (2008).
- N. Honda, G. Nakamura and M. Sini. Analytic extension and reconstruction of obstacles from few measurements for elliptic second order operators. Submitted.
- J. Liu and M. Sini. On the accuracy of the numerical detection of complex obstacles from far field data using the probe method. To appear in Siam J. Sci. Comp (2009).
- J. Liu and M. Sini. Reconstruction of complex cracks by far field measurements. Accepted by Mathematical Methods in the Applied Sciences.
- J. Liu and M. Sini On the accuracy of reconstruction of obstacles from exterior measurements. Submitted.
- J. Liu, P. Krutitskii and M.Sini. Numerical solution of the scattering problem for acoustic waves by a two-sided crack in 2-dimensional space. Submitted.
- R. Potthast and M.Sini. The No-response Test for the reconstruction of polyhedral objects in electromagnetics. Accepted by J. Comp. Appl. Math.
- E. Sincich and M. Sini. Local stability for soft obstacles by a single measurement. Inverse Probl. Imaging 2, no. 2, 301 - 315, (2008).
- L. He, S. Kindermann and M.Sini. Reconstruction of shapes and surface impedances using few far field measurements. J. Comp. Phys 228, 717-730, (2009).
- M. Sini, Reconstruction of complex obstacles by far field measurements. Proceddings of the AIP conference, Vancouver, June 2007. J. Phys.: Conf. Ser. 124 012045 (9pp), (2008).
- P.A. Krutitskii, J.J. Liu and M. Sini, Reconstruction of complex cracks by exterior measurements, 6th International Conference on Inverse Problems in Engineering: Theory and Practice, Paris, J. Physics: Conference Series, Vol.135, (2008).
- M. Sini, Reconstruction of complex obstacles from few measurements. Proceedings of the Institute of Acoustics Spring Conference: Widening Horizons in Acoustics, Reading, UK, 10-11 April 2008, 30(2), (2008), CD-ROM.
- E.Klann, R.Ramlau. Regularization by fractional filter methods and data smoothing. Inverse Problems 24, No. 2., 26p. (2008).
- C. Brandt, H. R. Karimi, I. Piotrowska, J. Niebsch, A. Krause, O. Riemer, P. Maass, Process- Machine Interaction Model for Turning Process,Proceedings of the 1st International Conference on Process Machine Interactions, Hannover 2008, pp. 239-246
- K. Arning, M. Burger, R. S. Eisenberg, H. W. Engl, L. He, Inverse problems related to ion channels, PAMM, Vol. 7, Issue 1 Special Issue: Sixth International Congress on Industrial Applied Mathematics, (ICIAM07) and GAMM Annual Meeting, Zürich 2007 (published online 2008)

Further publications of the group can be found in chapter 17 in the Akademis report.

Group "Symbolic Computation"

Internal cooperations:

- Together with C. Constantinescu, H. Albrecher and G. Pirsic from the group "Financial mathematics", Regensburger and Rosenkranz gave closed formulas for Gerber-Shiu functions [1].
- Together with H. K. Pikkarainen, Schicho computed the posterior probabilities of the multiplicity patterns for roots of a univariate polynomial with noisy coefficients [2].

External cooperations:

- Together with C. Gosselin (Naval Univ., Montreal), Moore and Schicho classified the statically and dynamically balanced planar and spherical four-bar mechanisms [3,4].
- In the frame of the joint FWF project "Solving Algebraic Equations" with H. Hauser (Univ. Wien), members of the symbolic group and of Hausers group met regularily in a joint seminar. One result is a joint publication [5].
- Together with B. Buchberger and L. Tec from RISC, Univ. Linz, Regensburger and Rosenkranz implemented the basic data structures of integro-differential polynomials as well as the crucial algorithms needed for solving, multiplying and factoring boundary value problems [6].
- In the doctorate college "Computational Mathematics", which started in October, Hodorog and Schicho are cooperating with several groups in symbolic computation, numerical analysis, and inverse problems, at the University of Linz.
- Together with K. Horimoto (NIAIST, Japan) and H. Yoshida (Kyushu Univ.), Regensburger and Rosenkranz chaired the program of "Algebraic Biology 2008" in Hagenberg.
- Together with A. Galligo (Univ. Nice) and L. M. Pardo (Univ. Cantabria), Schicho edited a special issue on MEGA 2007 in J. Symb. Comp.

Key publications

[1] H.-J. Albrecher, C. Constantinscu, G. Pirsic, G. Regensburger, and M. Rosenkranz, An algebraic approach to the analysis of Gerber-Shiu functions, RICAM report 2008-33.

[2] H. K. Pikkarainen, a Bayesian model for root computation, RICAM report 2008-31.

[3] C. Gosselin, B. Moore and J. Schicho, Dynamic balancing of planar mechanisms using toric geometry, J. Symb. Comp., accepted.

[4] C. Gosselin, B. Moore and J. Schicho, Determination of the complete set of shaking force and shaking moment balanced planar four-bar linkages, Mech. Mach. Theory, accepted.

[5] G. Bodnar, H. Hauser, J. Schicho, and O. Villamayor, Plain varieties, Bulletin LMS 40, 2008, pp 965-971.
[6] General polynomial reduction with Theorema functors: applications to integro-differential operators and polynomials, Communications in Comp. Alg. 42(3), 2008, pp 135-137.

Group "Financial Mathematics"

The Financial Mathematics Group has several fruitful on-going collaborations both with other research groups at RICAM and external collaborations (some resulting joint publications for 2008 are given here):

With other research groups at RICAM

1. S. Kindermann, P. Mayer, H. Albrecher, H. Engl: Identification of the local speed function in a Levy model for option pricing, Journal of Integral Equations and Applications 20 (2), 161-200.
2. S. Kindermann and P. Mayer: On the calibration of local jump-diffusion market models, RICAM Report 2008-19, submitted for publication.
3. H. Albrecher, C. Constantinescu, G. Pirsic, G. Regensburger, M. Rosenkranz. An Algebraic Approach to the Analysis of Gerber-Shiu Functions, Insurance: Mathematics & Economics, to appear.

External collaborations and key publications resulting from 2008:

1. H. Albrecher, C. Constantinescu, E. Thomann. Asymptotic Analysis in Renewal Risk Models with Risky Investments. Preprint.
2. H. Albrecher, F. Avram, C. Constantinescu. On the Tax Identity for Renewal Risk Models. Preprint.
3. H. Albrecher, C. Hipp and D. Kortschak: Higher-order expansions for compound distributions and ruin probabilities with subexponential claims, Scand Actuarial Journal, to appear.
4. H. Albrecher, J.-F. Renaud and X. Zhou (2008). A Lévy insurance risk process with tax, Journal of Applied Probability 45, no. 2, 363—375.
5. C. Labbé, B. Rémillard and J.-F. Renaud. A simple discretization scheme for nonnegative diffusion processes, with applications in option pricing, Preprint.
6. A.E. Kyprianou and R. Loeffen: Refracted Lévy processes. Annales de l'Institut Henri Poincar\'e, to appear.
7. R.J. Elliott, V. Krishnamurthy, J. Sass, Moment based regression algorithm for drift and volatility estimation in continuous time Markov switching models, Econometrics Journal 11, 244-270.
8. B. Rudloff, J. Sass, R. Wunderlich: Entropic risk constraints for utility maximization. In: C. Tammer, F. Heyde (eds.): Festschrift in Celebration of Prof. Dr. Wilfried Grecksch's 60th Birthday. Shaker Verlag, Aachen, 149-180.

9. J. Sass, R. Wunderlich: Optimal portfolio policies under bounded expected loss and partial information. RICAM Report 2008-01.
10. H. Albrecher, J. Teugels, On Excess-of-Loss Reinsurance, Theory of Probability and Mathematical Statistics 79, 5-20, 2008.
11. F.Pillichshammer, G.Pirsic: The quality parameter of cyclic nets and hyperplane nets, Uniform Distribution Theory, to appear.
12. R.Hofer, F. Pillichshammer, G.Pirsic: Distribution properties of sequences generated by Q-additive functions with respect to Cantor representation of integers, Acta Arithmetica, to appear.
13. F.Pillichshammer, G.Pirsic: Discrepancy of hyperplane nets and cyclic nets, Proceedings of MCQMC 2008.
14. J. Trufin, H. Albrecher, M. Denuit: Properties of a risk measure derived from ruin theory. Submitted.
15. J. Trufin, H. Albrecher, M. Denuit: Ruin problems in the presence of underwriting cycles. Submitted.
16. H. Albrecher, C. Macci: Large deviation bounds for ruin probability estimators in some risk models with dependence. Proceedings of the Fourth Int. Workshop on Applied Probability, Compiegne, 2008.
17. H. Albrecher, K. Scheicher, J.L. Teugels: A combinatorial identity for a problem in asymptotic statistics, Applicable Analysis and Discrete Mathematics, to appear.
18. H. Albrecher, A. Badescu, D. Landriault: On the dual risk model with taxation. Insurance: Mathematics & Economics 42 (3), 1086-1094.
19. H. Albrecher, S. Borst, O. Boxma, J. Resing: The tax identity in risk theory - a simple proof and an extension. Insurance: Mathematics & Economics, to appear.
20. A. Cesmelioglu, A. Winterhof: On the average distribution of power residues and primitive elements in inversive and nonlinear recurring sequences. In: S.W. Golomb, M.G. Parker, A. Pott (Eds.), Sequences and Their Applications (SETA08). Lecture Notes Computer, 60-70.
21. A. Sarközy, A. Winterhof: Measures of pseudorandomness for binary sequences constructed using finite fields. Discrete Mathematics, to appear.
22. J. Gutierrez, A. Winterhof: Exponential sums of nonlinear congruential pseudorandom number generators with Redei functions. Finite Fields and Their Applications 14, 410-416, 2008.
23. Meletiou, A. Winterhof: Interpolation of the double discrete logarithm. In: Gathen, J. von zur (Hrsg.), Arithmetic in Finite Fields (WAIFI 2008), Lecture Notes Computer Science, S. 1-10.
24. H. Niederreiter, A. Winterhof: Exponential sums for nonlinear recurring sequences. Finite Fields and Their Applications 14, 59-64, 2008.

25. I. Shparlinski, A. Winterhof: On the number of distances between the coordinates of points on modular hyperbolas. Journal of Number Theory 128, 1224-1230, 2008.
26. I. Shparlinski, A. Winterhof: Visible points on multidimensional modular hyperbolas. Journal of Number Theory 128, 2695-2703, 2008.
27. R. Balasuriya, I. Shparlinski, A. Winterhof : An average bound for character sums with some counter-dependent recurrence sequences. Rocky Mountains Journal, to appear.
28. H. Albrecher, J.-F. Renaud and X. Zhou: A Lévy insurance risk process with tax, Journal of Applied Probability 45, no. 2, 363-375, 2008.

Scientific visits for external collaborations:

Prof. Albrecher:
University Louvain-la-Neuve; April 26-30, 2008
Hongkong University; July 9-14, 2008

Dr. Hahn:
TU Kaiserslautern; December 8-10, 2008

Dr. Kortschak:
Universität Karlsruhe; January 2008

Dr. Mayer:
WIAS Berlin, March 25 - April 4, 2008

Dr. Sass:
Goethe Universität Frankfurt am Main, January 2008
TU Kaiserslautern: April 21/22, May 5/6, 19/20, June 2/3, 16/17,
Universität Bonn, July 2008

Doz. Winterhof:
Sabanci University Istanbul; 15.06.2008 - 18.06.2008 and 19.12.2008 - 26.12.2008
University Newcastle; 26.05.2008 - 30.05.2008
University Luminy; 07.05.2008 - 16.05.2008
Universität Ulm: 20.02.2008 - 22.02.2008
University of Cantabria; 22.10.2008 - 26.10.2008

Group "Analysis of Partial Differential Equations"

The group internal cooperation between K. Anguige and C. Schmeiser led to the publication [17] and motivated the work leading to [18], [19].

A. Kuijper was the main organizer of the 2-day 32nd annual workshop of the Austrian Association for Pattern Recognition [1]. He was member of several program committees for international conferences. His cooperation with Leila Muresan, Bettina Heise, Dr. Peter Bauer (Department of Knowledge-Based Mathematical Systems - Fuzzy Logic Laboratory Linz-Hagenberg, Austria) led to the publications [1], [3], [5], [7], and the cooperation with M. Kostner and F. Schubert (University of Applied Arts, Vienna, Austria) to the publications [9], [10]. Scientific Visits of A. Kuijper included the Wolfgang Pauli Institute (Vienna, Austria), the University of Applied Arts (Vienna, Austria), and the Software Competence Centre Hagenberg (SCCH), Fuzzy Logic Laboratory Linz Hagenberg
(FLLL), & Fachhochschule Hagenberg, Hagenberg, Austria.

Renjun Duan has ongoing internal cooperations with P. Markowich and M. Fornasier, and an external cooperation with A. Lorz (Univ. of Cambridge, where R. Duan also visited), leading to the publication [21].

Massimo Fonte has an ongoing internal cooperation with P. Markowich and external cooperations with Alberto Bressan (PennState University, USA, where M. Fonte also visited), Klemens Fellner (DAMTP, University of Cambridge, UK), and Fabio S. Priuli (SISSA, Italy).

Andreas Langer obviously works with his advisor M. Fornasier and they have an ongoing external cooperation with Carola-Bibiane Schönlieb (DAMTP, Univeristy of Cambridge, UK) which led to the publications [29], [36], [39]. Research visits of M. Fornasier in 2008 include the Institute for Numerical Simulation (University of Bonn, Germany), the Program in Applied and Computational Mathematics (Princeton University, U.S.A.), the Department of Mathematics (University of Pavia, Italy), the School of Mathematics (University of Edinburgh, UK), and the Department of Applied Mathematics and Theoretical Physics (Center of Mathematical Sciences, Cambridge University, UK). His external cooperations resulting in publications include those with J. Carrillo, J. Rosado, and G. Toscani [26], [27], with the NuHAG group around H. Feichtinger and K. Gröchenig (Univ. Wien) [30], [33], [34], and with the group of I. Daubechies (Univ. Princeton) [31], [38].

Finally, the cooperation of Francesco Vecil with J.A. Carrillo (Univ. Autonoma Barcelona), T. Goudon, and P. Lafitte (both Univ. Lille) led to the publication [25].

References chapter 1.3, page 31.

Group "Optimization and Optimal Control"

D. Wachmsmuth started a scientific cooperation with Prof. Dr. Arnd Roesch, Universität Duisburg-Essen. K. Kunisch has many long-lived scientific cooperations, including for example, with Prof. Ito, North Carolina State University. Dr. Lu collaborates in addition with Dr. Kewei Liang, Zhejiang University, China.

Some selected publications:

- Michael Schmich and Boris Vexler: Adaptivity with Dynamic Meshes for Space-Time Finite Element Discretizations of Parabolic Equations" SIAM Journal on Scientific Computing, Vol. 30(1), 369 - 393, 2008.
- Samuel Amstutz, Takeo Takahashi and Boris Vexler: Topological Sensitivity Analysis for Time-Dependent Problems: ESAIM: Control, Optimisation and Calculus of Variations, Vol. 14(3), 427 - 455, 2008.
- Dominik Meidner and Boris Vexler: A Priori Error Estimates for Space-Time Finite Element Discretization of Parabolic Optimal Control Problems. Part II: Problems with Control Constraints, SIAM Journal on Control and Optimization, Vol. 47(3), 1301 - 1329, 2008.
- R. Griesse and D. Wachsmuth: Sensitivity Analysis and the Adjoint Update Strategy for Optimal Control Problems with Mixed Control-State Constraints, to appear in: Computational Optimization and Applications.
- R. Griesse and K. Kunisch: A Semismooth Newton Method for Solving Elliptic Equations with Gradient Constraints, to appear in: ESAIM Mathematical Modelling and Numerical Analysis

Group "Mathematical Imaging"

External collaborations and key publications resulting from 2008:

[1] J. Boulanger, C. Kervrann, J. Salamero, J.-B. Sibarita, P. Bouthemy, Non-parametric regression for patch-based fluorescence microscopy image sequence denoising, submitted
[2] J. Boulanger, C. Kervrann, P. Bouthemy. A simulation and estimation framework for intracellular dynamics and trafficking in video-microscopy and fluorescence imagery. Medical Image Analysis, 13, 132-142, 2009.
[3] P. Elbau, M. Grasmair, F. Lenzen, O. Scherzer, Evolution by Non-Convex Functionals, submitted
[4] S. Colutto, F. Frühauf, M. Fuchs, O. Scherzer, The CMA-ES on Riemannian manifolds to reconstruct shapes in 3D voxel images, submitted
[5] M. Fuchs, B. Jüttler, O. Scherzer, H. Yang, Shape Metrics Based on Elastic Deformations, submitted
[6] J. Abhau, O. Scherzer, A Combinatorial Method for Topology Adaptations in 3D Deformable Models, submitted
[7] M. Haltmeier, O. Scherzer, G. Zangerl, A Reconstruction Algorithm for Photoacoustic Imaging based on the Nonuniform FFT, submitted
[8] M. Haltmeier, O. Scherzer, G. Zangerl, Exact Series Reconstruction in Photoacoustic Tomography with Circular Integrating Detectors, submitted
[9] O. Scherzer, B. Walch, Sparsity Regularization for Radon Measures, accepted
[10] F. Lenzen, O. Scherzer, A Geometric PDE for Interpolation of M-channel Data, accepted

Seminars

Of course, there is a close cooperation within our group leading to numerous joint publications. But there is also a close cooperation of the RICAM group with the Institute for Computational Mathematics at the JKU. The same was true for the SFB F013. We have a monthly joint seminar that is attended by the RICAM group members and the people working at the Institute for Computational Mathematics and in the SFB projects resp. DK projects related to the Institute for Computational Mathematics.

As in the previous years, the talks have been structured in three groups:

Radon Colloquia:

In these talks, prominent external scientists should present overviews over important fields dedicated also to non-specialists. All RICAM employees are expected to attend these colloquia.

Radon Seminars:

These are a bit more specialized talks, both by our own scientists and by external visitors. They should not strictly focus on a specialized topic but have connections to the work of a least two groups in RICAM and should therefore be attended by all RICAM scientists. One purpose is to initiate internal cooperations, all new PostDocs should give talks in this series.

Group Seminars:

These are specialized talks by internal and external scientists intended mostly for members of the organizing group(s), although, of course, members of other groups are also welcome.

In 2008, the following talks were given in these three groups:

RADON COLLOQUIA
Prof. Arnold Reusken RWTH Aachen Monday, February 4, 16:30, BA9911
Title: Numerical Simulation of Two-Phase Incompressible Flows
Abstract: We consider a flow problem with two different immiscible incompressible newtonian phases (fluid-fluid or fluid-gas). A standard model for this consists of the Navier-Stokes equa-

tions with a viscosity and density that are discontinuous across the interface and with a localized force at the interface that describes surface tension effects. In this talk we present an overview of a solver for the numerical simulation of this class of problems that has been developed and implemented in our group. Important characteristics of the method are the following. For capturing the interface between the two phases the level set method is applied. The spatial discretization is based on a stable hierarchy of consistent tetrahedral grids. For discretization of velocity, pressure and the level set function we use conforming finite elements. For the pressure variable an extended linear finite element space (XFEM) is used which allows an accurate approximation of the pressure discontinuity across the interface. For the treatment of the surface tension force a special Laplace-Beltrami method has been developed.

The time discretization is based on a variant of the fractional step-scheme. For solving the linearized discrete problems we use inexact Uzawa techniques and Krylov subspace methods combined with special preconditioners. We apply a variant of the Fast Marching method for the reparametrization of the level set function. We will discuss certain aspects of our solver in more detail. Results of numerical experiments for a three dimensional instationary two-phase fluid-fluid flow problem with and without mass transport are presented.

Prof. Edward Waymire

Oregon State University

Monday, February 4, 15:00, BA9911

Title: Particle Tracking for Heterogeneous Porous Media in Theory and Computation

Abstract: This talk will focus on probabilistic approaches to deterministic models in the theory of transport in highly heterogeneous porous media, both from the point of view of its role in theory as well as in computation. Much of the talk is based on joint work with Julia Chastanet, Roy Haggerty, Jorge Ramirez, Enrique Thomann, and Brian Wood.

Prof. Giuseppe Toscani

University of Pavia

Monday, April 7, 15:30, HS 3

Title: Kinetic Models of Opinion Formation

Abstract: We introduce and discuss certain kinetic models of (continuous) opinion formation involving both exchange of opinion between individual agents and diffusion of information, by methods borrowed from the kinetic theory of rarefied gases. The density of opinions satisfies a nonlinear Boltzmann equation of Maxwell type, where collisions represent binary interactions between individuals. Analytical results are obtained by considering a suitable asymptotic limit of the model yielding a Fokker-Planck equation for the distribution of opinion. In analogous way, we discuss the possibility to describe the formation of opinion leading to a choice among a finite number of fixed possibilities. In this picture, the fixed choices are de-

scribed by a normalized Maxwellian, while the distribution of opinions of the individuals obeys a linear Boltzmann equation.

Prof. Hanke-Bourgeois

Johannes Gutenberg - Universität Mainz

Thursday, April 24, 15:30, HS 4

Title: Impedance tomography with only one pair of measurements

Abstract: We present two recent results on tomographic imaging, using only one pair of boundary potentials and boundary currents to detect electrostatic anomalies within a given object. The first result, which is joint work with Nuutti Hyvönen and Stefanie Reusswig, uses a convex source support concept to find the smallest convex source compatible with the given pair of Neumann data. The second result uses a sophisticated dipole approximation to "locate" the center of the anomaly. We provide theoretical and numerical examples, and compare our methods with the so-called location search method of Kwon, Seo, and Yoon.

Prof. Otmar Scherzer

Universität Innsbruck & RICAM

Wednesday, May 14, 17:15 HS 9

Title: Mathematical Methods in Imaging

Abstract: Imaging is an interdisciplinary area of science with profund applications in biological imaging. We give an overview on several imaging techniques such as denoising, tomography, hybrid imaging, and ground penetrating radar. Behind all these problems there are basic geometrical models, which are highlighted.
It is also worthwhile to mention that the mathematics in mathematical imaging has a very long tradition in Austria, to name of course Johann Radon and Paul Funk.
Actually Funk is most probably the first who should be associated with thermoacoustic tomography (hybrid imaging), a field which our group is very interested in.
Moreover, we present some universal method for the numerical solution of imaging problems.

Prof. Olof Widlund

Courant Institute, New York University

Wednesday, May 28, 2008, 17:15, HS9

Title: "Coarse Space Components of Domain Decomposition Algorithms"

Abstract: Domain decomposition algorithms now provide powerful preconditioners for the often very large systems of linear and nonlinear algebraic equations which must be solved in large scale finite element simulations. These preconditioners are combined with a conjugate gradient or other Krylov space method. Successful domain decomposition algorithms almost

always require the use a coarse space component as well as many local components. The latter are often simply the restrictions of the given problem to many subdomains into which the domain of the original problem has been subdivided. On large scale computing systems, as many as twenty and forty thousand degrees of freedom per subdomain are used while the dimension of the coarse problem is a small multiple of the number of subdomains; for elasticity in three dimensions, six degrees of freedom per subdomain is the minimum that is required.

The development of the coarse components of the preconditioners has always been at the core of domain decomposition work. Early work by Bramble, Pasciak, and Schatz has been quite influential and has led to the development of some quite exotic coarse spaces and also to important technical tools that have been used in many studies. The theory has much in common with work on multigrid but the emphasis has also differed in several respects. We will examine two families of domain decomposition methods and compare the findings with those for multigrid methods.

The two families are the iterative substructuring methods, based on subdomains which do not overlap, and the two- or multi-level overlapping Schwarz methods. We will also discuss methods which combine components from both families. The coarse component of a domain decomposition method can also serve purposes other than providing some global interchange of information, in each step of the iteration, across the entire domain. Recent results on mixed finite element approximation of almost incompressible elasticity will serve as an example.

Prof. Peter Maaß

Universität Bremen

Thursday, June 5, 15:30, HS3

Title: “Inverse Problems with sparsity constraints: Applications in signal and image processing“

Abstract: The talk consists of three parts.

The first part addresses the notion of sparse structures, which was introduced as a concept in image processing ten years ago and which has attracted growing interest in the inverse problems community since the pioneering papers by Daubechies, Defrise, DeMol and S. Osher, M. Burger in 2004.

First of all, we introduce the basic concept of sparse structures, which refers to objects which can be well approximated with very few components in an appropriate basis. Then, we review the present state of research concerning the regularization theory of inverse problems with sparsity constraints and sketch some recent results on deconvolution problems as well as parameter identification problems for partial differential equations.

The second part contains an overview of two industrial applications in signal and image processing (LCMS-spectra, Bruker Daltonik GmbH, HofmannLaRoche AG; HDTV-interpolation, Micronas AG).
In the final part we review some activities in the 'Year of Mathematics 2008' in Germany. This initiative has lead to some colourful 'mathematical happenings' and aims at changing the public view on mathematicians, mathematicians and its impact in industry and technology.

Prof. Martin Gander

University of Geneva

Wednesday, July 16, 17:00, HS9

Title: Schwarz Methods in the course of time

Abstract: Schwarz domain decomposition methods have been developed at two different levels: at the continuous level for partial differential equations, and at the discrete level of linear systems for parallel computing. At the continuous level, it was Hermann Amandus Schwarz himself who invented the alternating Schwarz method in 1869, as an analytical tool to obtain a rigorous proof of the Dirichlet principle, on which Riemann had founded his theory of analytic functions, without having a proof. More than a century later, in 1989, Pierre-Louis Lions analyzed the method as a tool for parallel computing, and introduced a more parallel variant of the method. At the discrete level, Schwarz methods were formulated by Max Dryja and Olof Widlund in 1987, in the form of Additive Schwarz (AS) and Multiplicative Schwarz (MS). More recently, Restricted Additive Schwarz (RAS) and Additive Schwarz with Harmonic extension (ASH) were discovered by Xiao-Chuan Cai and Marcus Sarkis in 1999, as a result of a programming error.
I will start my talk by showing the historical development of Schwarz methods, pointing out similarities and subtle differences between the classical continuous and discrete Schwarz methods. In particular, I will prove that the more parallel Schwarz method introduced by Pierre-Louis Lions and the Additive Schwarz method are different. I will then introduce at the algebraic level a new class of Schwarz methods, called optimized Schwarz methods, which converge significantly faster than classical Schwarz methods, at the same cost per iteration. These methods are motivated by an idea of Pierre-Louis Lions at the continuous level: they use transmission conditions adapted to the physics of the underlying continuous problem. I will conclude with three important open problems in this area of research.

Dr. Manuel Kauers

University of Linz

Monday, October 13, 15:00, HF136

Title: Symbolic Summation and Algorithmic Approaches to Positivty

Dr. Sven Beuchler

RICAM

Thursday, October 9, 13:00, HF136

Title: "High Order FEM-Fast Solvers for Tensor Product Elements"

Abstract: In this talk, the discretization of elliptic boundary value problems by means of the hp-version of the finite element method is considered. The presentation starts with a motivation for high order finite elements. In the main part of the talk, we will focus on the efficient solution of the system of linear algebraic equations. The solution of the system is performed by the preconditioned conjugate gradient method in almost optimal arithmetical complexity where the preconditioners exploit the tensor product structure of the elements. Several numerical examples show the efficiency of the proposed solvers.
Finally, a solver for an interface concentrated finite element discretization is presented.
The presented results are collaborations with D. Braess (Bochum), T. Eibner (Chemnitz), U. Langer, R. Schneider (Berlin), and C. Schwab (Zürich).

JKS-RISC-RICAM Kolloquium

Prof. Dr. Christian Krattenthaler, Universität Wien

Wednesday, November 26, 15:30, HF9901

Title: Advanced Determinant Calculus

Abstract: I shall present a selection of determinants which I came across during my work in combinatorics and number theory, and I shall use them to exemplify how one can compute also complicated determinants explicitly.

RADON SEMINARS

Dr. Sven Beuchler

University of Linz

Monday, March 10, 13:00, HF136

Title: High order FEM-shape functions and solvers

Abstract: In this talk, the discretization of an elliptic boundary value problem by means of the hp-version of the finite element method is considered.
The presentation starts with a motivation for high order finite elements.
Later, we define suitable shape functions for triangular and tetrahedral elements such that the local element stiffness matrices are sparse.

In the last part of the talk, we present a solver for an interface concentrated finite element discretization.
The presented results are collaborations with T. Eibner (Chemnitz), U. Langer, V. Pillwein (Linz), and J. Schöberl (Aachen).

Dr. Manuel Kauers
RISC, Johannes Kepler University
Monday, March 10, 14:15, HF 136

Title: "Summation and Integration of NON-Holonomic Functions"

Abstract: Holonomic functions play a crucial role in computer algebra. There are algorithms for computing sums or integrals over holonomic functions and these algorithms are now frequently applied to answer questions arising in various mathematical and non-mathematical contexts.
We will present extensions of these algorithms well beyond the class of holonomic functions. These extensions were recently discovered in collaboration with F. Chyzak and B. Salvy. We also discuss some approaches to summation and integration entirely independent of the holonomic theory, on which we have worked together with C. Schneider.

RICAM Seminar in cooperation with:
IMP, IMBA, Campus Vienna Biocenter, MFPL, GMI, Intercell Smart Vaccines, ÖGBM
Tero Aittokallio
University of Turku
Tuesday July 29, 12:00, IMP Lecture Hall, Vienna

Title: Multilevel modelling of biological systems - from networks to kinetic models

Dr. Ivan Georgiev
RICAM
Wednesday, November 26, 13:00, HF9901

Title: Preconditioning of rotated bilinear non-conforming FEM systems

Abstract: In this talk we present a new framework for multilevel preconditioning of large sparse systems of linear algebraic equations arising from the interior penalty discontinuous Galerkin approximation of second-order elliptic boundary value problems. Though the focus is on a particular family of rotated bilinear non-conforming (Rannacher-Turek) finite elements in two space dimensions (2D) the proposed rather general setting is neither limited to this particular choice of elements nor to 2D problems. One innovative
contribution of this work is the construction of robust methods for problems with large jumps (several orders of magnitude) in the PDE coefficients that can only be resolved on the finest finite element mesh.
The second part of this talk will be devoted to incomplete factorization preconditioning. A locally optimized construction for an M-matrix approximation of the global stiffness matrix is

the first step of the proposed algorithm. Symbolic solution technique is applied on element level for the arising local optimization problems. Then, the preconditioner is obtained by modified incomplete Cholesky factorization of the auxiliary global M-matrix. An
important achievement of this work is the developed original robust preconditioning scheme for strongly anisotropic problems based on properly skewed meshes.
The talk is based on joint work with S. Margenov form IPP-BAS (Bulgaria) and with J. Kraus and J. Schicho from RICAM (Austria).

Presentation of the START project: Sparse Approximation and Optimization in High Dimensions

Dr. Massimo Fornasier

RICAM

Tuesday, December 16, 15:00, HF136

Title: Presentation of the START project: Sparse Approximation and Optimization in High Dimensions

Abstract: In light of the recent award of the START-Preis and in view of the beginning of the project soon, we would like to present its main goals to RICAM members and to students.
The first motivation is in particular to emphasize openly directions of possible cooperation within the institute on the topics of the project.
The second motivation is possibly to capture the attention of talented JKU students who may be interested to join the START team during the next six years of activity.

GROUP SEMINARS

GROUP: Computational Methods for Direct Field Problems

Stefan Reitzinger

CST GmbH

Tuesday, March 11, 15:30, T1010

Title: Algebraische Mehrgitter Verfahren für die Numerische Simulation der Maxwell Gleichungen

Abstract: In der Praxis gewinnt die numerische Simulation der Maxwell Gleichungen immer mehr an Bedeutung. Zum einen werden die Packungsdichten immer grösser (z.Bsp. PCB - Printed Circuit Board), so dass hochfrequente Effekte in der Simulation berücksichtigt werden müssen. Zum Anderen ist das Design am Computer meist deutlich günstiger und schneller als der klassische Prototypenbau. In diesem Vortrag soll ein Überblick über verschiedene numerische Methoden gegeben werden, welche in kommerziellen Software Paketen zur Lö-

sung von 3D Maxwell Gleichungen Anwendung finden (z.Bsp. FIT, FEM, BEM). Ein besonderer Schwerpunkt wird auf die Lösung der entstehenden Gleichungssysteme gelegt, die typischerweise groß, (dünnbesetzt), indefinit und schlecht konditioniert sind. Bei der Konstruktion von geeigneten Verfahren liegt das Hauptaugenmerk auf

1.Robustheit (z.Bsp. Materialeigenschaften, Frequenz, ...) und

2. Effizienz (d.h. Speicherverbrauch und Rechenzeit), damit möglichst wenig - am besten keine - Benutzereinstellungen vom Anwender gemacht werden müssen. Im weiteren werden speziell adaptierte algebraische Mehrgitter Methoden diskutiert, die obige Eigenschaften - f˙ur eine vielzahl praktischer Beispiele - erfüllen (im Vergleich zu direkten bzw. klassischen iterativen Verfahren).

Dr. Satyendra Tomar

RICAM

Tuesday, January 22, 15:30, HF136

Title: A posteriori error estimates for nonconforming approximation of elliptic problems based on Helmholtz type decomposition of the error

Abstract: In this talk we shall present our work on a new type of a posteriori error estimates for nonconforming approximations of elliptic problems. The method is based on two key steps: (1) Helmholtz decomposition of vector-valued fields, and (2) splitting the residual functional with the help of an appropriate integral identity. We decompose the error into the ”gradient” and ”divergence-free” parts using the Helmholtz decomposition [1]. Following [3, 4] we then obtain computable two-sided bounds of the solutions of the resulting auxiliary problems. The estimates obtained differ from that was derived in [2, 5] using a projection to the conforming space. The numerical experiments confirm that the a posteriori estimates derived with the help of Helmholtz decomposition are qualitatively same as those with projection arguments and can be efficiently exploited in practical computations.
Key words: Discontinuous Galerkin FEM; a posteriori error estimates; Helmholtz decomposition.

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Dr. Chokri Chniti

RICAM

Wednesday, March 5, 16:15, HF136

Title: A matching of singularities in domain decomposition methods for reaction diffusion problems

Abstract: We consider the model reaction-diffusion problems with piecewise constant coefficients.The problem reduces to determining the coefficients of some transmission boundary conditions to obtain fast convergence of domain decomposition methods. After explaining the theoretical approach we explicitly compute the coefficients in the transmission boundary conditions.
The numerical results presented in this paper confirm the optimality properties.

Prof. Olof Widlund

Courant Institute, New York University

Tuesday, May 27, 15:30,

Title: Accomodating Irregular Subdomains in Domain Decomposition Theory

Abstract: In the theory for domain decomposition methods, we have previously often assumed that each subdomain is the union of a small set of coarse shape-regular triangles or tetrahedra. In this talk, we discuss recent progress which makes it possible to analyze cases with irregular subdomains such as those provided by mesh partitioners. Our goal is to extend our analytic tools to problems on subdomains that might not even be Lipschitz and to characterize the rates of convergence of our methods in terms of a few, easy to understand, geometric parameters of the subregions. For two dimensions, we have already obtained some best possible results for scalar elliptic and linear elasticity problems: the subdomains should be John or Jones domains and the rate of convergence is determined using the parameters that dene such domains and that of an isoperametric inequality. Progress on three dimensions will also be reported. New results have also recently been obtained concerning variants of classical two-level additive Schwarz preconditioners. Our family of overlapping Schwarz methods, borrows and extends coarse spaces from older iterative substructuring methods, i.e., methods based on non-overlapping subdomains. The local components of these pre-

conditioners, on the other hand, are based on Dirichlet problems dened on a set of overlapping subdomains which cover the original domain. Our methods are robust even in the presence of large changes, between subdomains, of the materials being modeled in the nite element models. An extra attraction is that our methods can be applied directly to problems where the sties matrix is available only in its fully assembled form. We will also discuss several applications of the new tools. They include new results on almost incompressible elasticity and mixed nite elements using spaces of discontinuous pressures. We will also touch on recent work on Maxwell's equations in two dimensions. Our work has been carried out in close collaboration with Clark R. Dohrmann of the Sandia National Laboratories, Albuquerque, NM and Axel Klawonn and Oliver Rheinbach of the University of Duisburg-Essen, Germany.

Rene Simon

SFB, University of Linz

Thursday, May 29, 15:30, HS11

Title: A Multigrid Solver for Saddle Point Problems in PDE-Constrained Optimization

Abstract: In this talk we consider a one-shot multigrid method for solving the discretized optimality system, also called the Karush-Kuhn-Tucker (KKT) system, of a PDE-constrained optimization problem. One of the most important ingredients of a multigrid iteration is an appropriate smoother. We discuss here the construction of additive Schwarz-type smoothers for a certain class of elliptic optimal control problems. The computational domain is divided into small patches. Each iteration step requires the solutions of several small local saddle point problems. Strategies for constructing such local problems are presented, which allow a rigorous multigrid convergence analysis. Finally, numerical experiments are shown which confirm the theoretical results.

Prof. Vadim Korneev

St.-Petersburg State Technical University

Tuesday, June 3, 15:30, T1010

Title: Simple and efficient a posteriory error estimators

Abner Solgado

Texas A&M University

Wednesday, July 16, 13:00, HF136

Title: A fractional step method for incompressible flows with variable density, based on a pressure Poisson equation.

Abstract: A new fractional time technique for solving incompressible flows with variable density is proposed. The main feature of this method is that, as opposed to other known algorithms, the pressure is computed by solving a Poisson equation, which greatly reduces the computational cost. The method is shown to be stable and it is numerically illustrated.

WITH: Optimization and Optimal Control

Subhendu Hazra
Department of Mathematics, University of Trier

Monday, July 21, 9:00, HF136

Title: Numerical Methods for Flow Simulation and Simulation-based Optimization in Applications

Abstract: Mathematical models of fluid flow problems result in non-linear (system of) Partial Differential Equations (PDEs). Due to complexity of the PDEs and/or of the application domains, analytical solutions to these equations do not exist in general. One possible alternative is to look for approximate numerical solutions. Therefore, PDE-simulation is widespread in scientific and engineering applications. As PDE-solvers mature, there is increasing interest in industry and academia in solving optimization problems governed by PDEs. These optimization problems are quite challenging since the size and the complexity of the discretized PDEs often pose significant difficulty for the contemporary optimization methods.
This talk will focus on numerical methods for such problems. Special emphasis will be given to application areas in parameter identification in multi-phase flow through porous media and in aerodynamic shape optimization. In the first problem class the PDEs are non-stationary and the optimization problems have been solved using multipleshooting methods for DAEs. In the second problem class, the involved PDEs are pseudostationary and the CFD is extremely expensive, especially when full convergence of the PDE solution is required. For these problems a new one-shot pseudo-time-stepping method, based on rSQP-methods, has been developed. This method is quite efficient since the optimality is achieved simultaneously with the feasibility of the state and the costate equations. Some of the results, obtained using these methods, will be presented.

Hua Xiang
Laboratoire de Recherche en Informatique

Tuesday, July 22, 10:00, HF136

Title: LU Factorization with Communication Avoiding Pivoting Strategy

Abstract: We present a low latency approach for computing the LU factorization. The scheme is based on a heuristic communication avoiding(CA) pivoting strategy, which is shown by numerical experiments to be stable in practice. With this scheme we decrease the number of

messages, and hence decreasing the time spent in communication. For the sparse case, the hypergraph partition is used to reorder the matrix, and an associated separator tree is used for distributing the data. We also apply the CA-pivoting strategy to reduce the latency, and obtain a balance between numerical stability and parallelism.

WITH: Inverse Problems, Optimization and Optimal Control, Analysis of Partial Differential Equations

Prof. Jens Lang

Darmstadt University of Technology

Friday, October 31, 9:00, HF136

Title: On Global Error Estimation and Control for Reaction-Diffusion Equations

Abstract: In this talk I will report on some joint activities with Jan Verwer (Center for Mathematics and Computer Science, Amsterdam) and Kristian Debrabant (TU Darmstadt) regarding efficiency and reliability questions for initial-boundary value problems. First, systems of ODEs are considered. Existing popular codes focus on efficiency by adaptively optimizing time grids in accordance to local error control. The reliability question, that is, how large are the global errors, has received much less attention. We have implemented classical global error estimation based on the first variational equation, and global error control, for which we have used the property of tolerance proportionality.
We have found, using the Runge-Kutta-Rosenbrock method ROS3P as example integrator, that the classical approach is remarkably reliable. For reaction-diffusion equations, the ODE approach is combined with estimates for the spatial truncation errors based on Richardson extrapolation.
Numerical examples are used to illustrate the reliability of the estimation and control strategies.

Prof. Ludmil Zikatanov

The Pennsylvania State University

Tuesday, Nov. 4, 15:30, MZ-005

Title: Subspace Correction Methods for discontinuous Galerkin approximations

Abstract: In this work we employ the subspace correction framework to design efficient iterative solution methods for the linear systems resulting from discontinuous Galerkin (DG) discretizations. Subspace correction methods refer to a large class of algorithms used in scientific and engineering computing, based on a divide and conquer strategies. Many iterative methods (simple or complicated, traditional or modern) fall into this category. Examples include the classical Jacobi, Gauss-Seidel and SOR methods, and also multigrid

and domain decomposition methods. The focus of our presentation will be on the design of new iterative techniques for DG based on special subspace splittings. The key construction is a simple orthogonal (in energy inner product) decomposition of the discontinuous finite element space, into sum of the well-known Crouziex-Raviart (CR) finite element space and its complementary space. Our algorithms can be regarded as special two-grid methods and include two basic steps: (1) local relaxation for the solution of a well-conditioned problem (damping the error components in the complementary spaces mentioned above); (2) solution of a linear system corresponding to more conforming (CR) discretization (resolving global error components).

The talk is based on joint work with B. Ayuso from Universidad Autonoma de Madrid, (Spain) and on an an ongoing joint work with J. Kraus and I. Georgiev from RICAM (Austria).

Dr. Johannes Kraus

RICAM

Tuesday, Nov. 11, 15:30, MZ-005

Title: Multilevel preconditioning in H(div) and applications to a posteriori error estimates for discontinuous Galerkin approximations

Abstract: In this talk we present an algebraic multilevel iterative (AMLI) method for solving linear systems arising from finite element discretization of certain minimization or boundary-value problems that have their weak formulation in the space H(div).
In particular we focus on an efficient solution of the discrete problem related to advanced (functional-type) a posteriori error estimates, see e.g., Repin (2003). As recently observed, when using these estimates for discontinuous Galerkin approximations of elliptic problems, the computation of such guaranteed a posteriori error estimates can be even more expensive than computing the solution of the original problem, and thus, demands fast iterative solvers. Preconditioners for such linear systems within the framework of domain decomposition and multigrid techniques have been studied by several authors, see e.g., Vassilevski and Wang (1992), Arnold, Falk and Winther (1997, 2000) and Hiptmair (1997). Our work is based on a different approach, namely, hierarchical basis multilevel methods.

Dr. Sven Beuchler

RICAM

Friday, December 12, 13:00, HF136

Title: Sparse high-order shape functions for H(curl) and H(div)

Abstract: In this talk, we construct high order polynomial functions on triangular and tetrahedral meshes in H(curl) and H(div).

We prove that the presented basis functions form a orthogonal system.
In H(curl), the orthogonality of all basis functions to each other is shown for the 2D case. In the 3D-case, all basis functions are orthogonal to most of the other basis functions. The proofs requires Mathematica packages which are derived by Veronika Pillwein.
The talk might be also of interest for the symbolic people.

GROUP: Optimization and Optimal Control

Dr. Thomas Richter
Aerospace Computational Design Laboratory, MIT, USA
Institute of Applied Mathematics, University of Heidelbeg, Germany

Monday, January 14, 14:00, HF 136

Title: "A posteriori detection of anisotropies with the dualweighted residual method"

Abstract: In this work we present a unified methodology for a posteriori error estimation and for the detection of anisotropic solution patterns of partial differential equations with the dual weighted residual method.
Especially for three dimensional problems, the use of anisotropic meshes is of utter importance. Local mesh refinement alone does not yield the required mesh resolution. With increasing order of the finite element spaces, this problems gets more and more determinant. The common approach for the detection of anisotropies is to analyze the Hessian of the finite element solution. This approach has been successfully generalized to higher order spaces, however it is strongly related to energy norm estimates and does not yield the correct anisotropic behavior considering functionals outputs of the solution.
Recent works try to combine the dual weighted residual method for a posteriori error estimation with a Hessian analysis for anisotropy detection. However the correct balancing of 'primal' and 'adjoint' anisotropy information is not solved.

Here we present a modification of the DWR method which allows for the direct estimation of 'directional errors'. Numerical examples will demonstrate the feasibility and necessity of the method.

Dr. Mariko Arisawa

Wolfgang Pauli Institut, Univ. Wien

Monday, Dec. 1, 2008, 15:15, HF136

Title: Ergodic problems of integro-differential equations with L´evy operators

Abstract: The L´evy operator is the infinitesmal generator of the jump process. We consider a class of fully nonlinear integro-differential equations which contain L´evy operators as nonlocal terms. We formulate the ergodic problem of the (pure) jump process as a nonlinear eigenvalue problem of the integro-differential equation. In order to solve the latter, a uniform

Holder estimate for the solutions of the integro-differential equations is shown, in any dimension. Here, the role of the singular density of the L´evy operator in the regularization effect is focused. We shall, then, apply the ergodic problem to solve the homogenization of the integro-differential equations. The result is applied to the analysis of the stochastic volatility model with the jump process, which has the very rapid mean-reverting property.

GROUP: Analysis of Partial Differential Equations

Dr. Massimo Fornasier

RICAM

Monday, January 28, 15:30, HF 136

Title: "PDE models for image processing"

Dr. Keith Anguige

RICAM

Monday, February 11, 15:30, HF136

Title: A one-dimensional model of cell diffusion and aggregation, incorporating volumefilling and cell-to-cell adhesion

Abstract: We develop and analyse a discrete model of cell motility in one dimension which incorporates the effects of volume filling and cell-to-cell adhesion. The continuum limit of the model is a nonlinear diffusion equation with a diffusivity which can turn negative if the adhesion is sufficiently strong - this is related to the development of patterns in numerical solutions of the discrete model. A combination of stability analysis of the discrete equations and steady-state analysis of the limiting PDE (and higher-order modifications thereof) is used to shed light on these and other qualitative predictions of the model. We will also discuss Stefan problems for the (ill-posed) 1-d continuum model, along with the inclusion of chemotactic effects and the extension of the model to 2-d.

Dr. Massimo Fonte

RICAM

Monday, February 25, 15:30, HF136

Title: An optimal transportation metric for nonlinear PDEs

Abstract: It is discussed an optimal transportation technique for nonlinear hyperbolic equations. It is defined a distance functional, based on a Wasserstein-like metric in H^1 which yields continuous dependence of the energy conservative solutions (with respect to the initial conditions), of two nonlinear water wave equations equations.

Dr. Arjan Kuijper

RICAM

Monday, March 17, 15:00, HF136

Title: Singularities in Gaussian scale space that are relevant for changes in its hierarchical structure

Abstract: The Gaussian scale space for an n-dimensional image L(x) is defined as its n+1 dimensional extension L(x, t) obtained by the heat equation.
A hierarchical structure in L(x, t) is derived by combining the critical curves (where the spatial gradient is zero) and special points on them, viz. catastrophe points (where the Hessian matrix degenerates) and scale space saddles (critical points in L(x, t)), with iso-intensity manifolds through the scale space saddles.
Until now, this structure has only been used for topological segmentation, while image matching and retrieval studies used only the special points and ignored the hierarchy.
In order to perform such tasks based on the hierarchical structure, one needs to know which transitions are allowed when the structure is changed under influence of one control parameter.
In this work we describe such relevant possible transitions for the hierarchical structure.
These transitions describe the creations and annihilations of catastrophe points and scale space saddles, as well as their interaction with iso-intensity manifolds.

WITH: Mathematical Imaging

Mag. Rachel Ward

Princeton University

Thursday, April 3, 14:30, HF136

Title: Cross Validation in Compressed Sensing

Abstract: Compressed Sensing decoding algorithms aim to reconstruct an unknown N dimensional vector x from m < N given measurements y = ?x, with an assumed sparsity constraint on x. All algorithms presently are iterative in nature, producing a sequence of approximations (s1 , s2 ,...) until a certain algorithm-specific stopping criterion is reached at iteration J, at which point the estimate x* = s_J is returned as an approximation to x.
In many algorithms, the error of the approximation is bounded above by a function of the error between x and the best k-term approximation to x. However, as x is unknown, such estimates provide no numerical bounds on the error. In this talk we demonstrate that tight numerical upper and lower bounds on the error ||x ? s_j ||_2 for j ? p iterations of a compressed sensing decoding algorithm are attainable with little effort. More precisely, we assume a maximum iteration length of p is pre-imposed; we reserve 4 log p of the original m measurements and compute the sj from the remaining measurements; the errors ||x ? s_j ||_2, for j = 1, ..., p

can then be bounded with high probability. Our observation has applications outside of Compressed Sensing as well.

Fabio S. Priuli

Math. Dept. NTNU, Trondheim, Norway

Thursday, April 17, 15:30, HF136

Title: Inverse problems for scalar conservation laws

Abstract: Given a scalar conservation law with discontinuous coefficients of the form $u_t + f(g(x), u)_x = 0$ (1) for a smooth f and a suitable discontinuous function g, we are interested in reconstructing properties of the system from observations of the solution u(t, x) to Cauchy problem for (1). In its full generality, the problem cannot be dealt with. First of all, already in the case of a flux function $f = f(u)$, which only depends on the conserved quantity u, discontinuities in the solution correspond to a loss of information that normally makes the inverse problem ill-posed in uniqueness. Moreover, the Cauchy problem for (1) in the general case is well posed only at price of additional assumptions on the flux function.
In this seminar, we will briefly review what can be proved in the simplest case $f = f(u)$ and then focus our attention on two special cases of the more general situation $f = f(g(x), u)$, which arise in traffic flow and two phases flow in porous media and which are known to have well-posed Cauchy problems. In both models, approximations of the unknown g can be constructed, but the most delicate point is to find a good compromise between the hypotheses which are physically reasonable and the ones needed to obtain a well posed mathematical description.

Prof. Riccardo March

University of Rome II

Thursday, May 29, 14:00, HF136

Title: Variational properties of a curvature depending functional for image segmentation

Abstract: A functional that arises in the theory of image segmentation is discussed by using the relaxation method of the Calculus of Variations. The functional includes a Mumford-Shah type energy and a term involving the curvature of the boundaries of segmentations. The curvature part of the energy is related to the reconstruction of occlusions between different shapes. The relation with the Nitzberg-Mumford-Shiota variational model is discussed (joint work with G. Bellettini).

Dr. Renjun Duan

RICAM

Monday, October 13, 13:30, HF136

Title: “Some Mathematical Theories on the Gas Motion under the Influence of External Forcing”

Abstract: This talk is divided into two parts, one of which is about the Boltzmann equation in the framework of perturbations near infinite vacuum or Maxwellians, and the other one related to the compressible Navier-Stokes equations. The emphasize is put on the well-posedness, stability and convergence rates of solutions. The presence of the external forcing produces some new physical phenomena and also leads to some mathematical difficulties. The energy method is the main analytical tool in the proof. All the results are collected from my PhD thesis in City U. Some related problems to be considered in the future are mentioned at the end of this talk.

Dr. Francesco Vecil

RICAM

Tuesday, October 7, 14:00, HF136

Title: Splitting methods for the solution of electron transport in semiconductors

Abstract: By using splitting methods, we decompose the Boltzmann Transport Equation into separate solutions of the collisions, the force field and linear advections; non-oscillatory interpolation techniques are required by the characteristics methods for linear advections. We present applications of these techniques starting from some simple test cases up to a solver for a nanoscaled MOSFET, described through a hybrid quantum-classical model.

GROUP: Inverse Problems

Prof. J.J. Liu

Department of Mathematics, Southeast University, China

Thursday, January 31, 11:00, HF136

Title: Numerical Realization of the Probe Method for Detecting 2-Dimensional Scatterers

Prof. Dr. Holger Rauhut
Hausdorff Center for Mathematics,
University of Bonn

Friday, April 11, 2008, 10:00, HF136

Title: “Compressed Sensing”

Abstract: Compressed sensing predicts that sparse signals can be recovered efficiently from a small number of linear and non-adaptive measurements. This recent paradigm has many potential applications in signal and image processing.
The talk gives an overview on compressed sensing with an emphasis on contributions by the speaker.

WITH: Optimization and Optimal Control

Dr. Shuai Lu

RICAM)

Tuesday May, 27, 10:30, HF136

Title: Model function method in Total Least Squares and Two-parameter Regularization

Abstract: In the talk, we investigate the dual regularized total least squares (dual RTLS) from a computational aspect. More precisely, we propose a strategy for finding two regularization parameters in the resulting equation of dual RTLS. This strategy is based on an extension of the idea of model function originally proposed by Kunisch, Ito and Zou for a realization of the discrepancy principle in the standard one parameter Tikhonov regularization.

For dual RTLS we derive a model function of two variables and show its reliability using standard numerical tests.

WITH: Optimization and Optimal Control

Dr. Nguyen Trung Thanh

ETRO department, Vrije Universiteit Brussel

Tuesday, July 15, 10:00, HF136

Title: An Inverse Problem for Parabolic Equations and Application in the Detection and Characterization of Buried Objects

Abstract: This talk introduces an inverse problem for a partial differential equation of parabolic type which arises in the detection and classification of buried objects using thermal infrared images of the ground. It consists of two main parts: thermal modeling and inverse problem. The aim of the thermal modeling is to simulate diurnal distribution of the soil temperature using a partial differential equation-based thermal model. Topics considered in this part are: (i) formulation of the thermal model; (ii) numerical methods for solving it; (iii) methods for estimating necessary input parameters of the model in practical situations using in situ measurements; and (iv) validation of the model for landmine detection by comparing simulations with outdoor experimental data. The inverse problem is aimed at detecting buried objects (anomalies) and classifying them bystimating their thermal and geometrical properties (shape, size). This part includes: (i) mathematical setup of the inverse problem using a least squares approach; (ii) its simplificationfor the case of cylindrical objects and a two-step method for solving it; (iii) gradient-based optimization algorithms with the formulation of the objective function's gradient using a discrete adjoint method; and (iv) application in the detection of buried landmines.

Pierre Garapon

Laboratory for Waves and Acoustics, ESPCI, Paris

Thursday, July 17, 11:00, HF136

Title: Elasticity modulus reconstruction in Elastography

Abstract: Elastography is a new medical imaging technique that aims to remotely measure elasticity of biological tissues. It is useful for the diagnosis of various pathologies such as breast cancer, liver fibrosis, ...
It consists of vibrating soft tissus of the body, and measure the displacements induced remotely using a magnetic resonnance imaging (MRI) system. Then one has to solve an inverse problem in order to reconstruct a map of elasticity. We perform both theoretical and numerical analysis of the spatial resolution of such an imaging system, we also discuss stability of the technique when noise is added.

Yi Heng

RWTH Aachen

Tuesday, October 7, 14:00, HF136

Title: Identification of heat transfer in pool boiling

Dr. Sivananthan Sampath

RICAM

Wednesday, November 12, 10:00, HF136

Title: “Learning approach to the prediction of blood glucose concentration”

Abstract: In this talk, we are going to present a method for predicting blood glucose level in 2 – hours time horizon from measurements made during past 45 – minutes. The method is based on Tikhonov regularization equipped with quasi-optimality criterion for a choice of the regularization parameter. The general framework of the problem can be formulated via statistical learning theory. Developed predictor should learn from experiences and improve its competence. We observe that the crucial issues of parameter and kernel choice can also be addressed by learning from examples. The performance of proposed predictor is tested in experiments with real data.
Preliminary results within the DIAdvisor – Project

GROUP: Financial Mathematics

Prof. Enrique Thomann

Oregon State University

Monday, February 4, 14:00, HF136

Title: Probabilistic methods of solution and analysis of the Navier-Stokes Equations

Abstract: This overview talk will present some probabilistic methods that are used to establish existence of solutions of the Navier-Stokes equations and to analyze some of the regularity properties of such solutions.
This talked is based on published and ongoing work in collaboration with Larry Chen, Scott Dobson, Chris Orum, Mina Ossiander and Ed Waymire from Oregon State University, Rabi Bhattacharya from University of Arizona and Sun-Chul Kim from Chung Ang University, Korea.
The talk may be of interest to other research groups at RICAM, too.

Teitur Arnarson
KTH Stockholm

Thursday, April 10, 14:00, HF136

Title: Free boundary regularity close to initial state and applications to finance

Abstract: The choice whether to hold or exercise an American option in finance is determined by a free boundary occurring in the obstacle problem solved by the option pricing function. It is, however, hard to calculate this free boundary numerically close to the option expiry (or initial state for the time reversed problem). The problem is well studied and good results are known in the basic
one-dimensional Black-Scholes setting. We present a method for determining the free boundary regularity with less precision but in a more general setting, suitable for higher-dimensinal and non-linear models.

Dr. Corina Constantinescu

RICAM

Tuesday, April 8, 14:00, AS50

Title: Risk procesess with stochastic returns on investments

Abstract: A survey on various results concerning ruin probabilities for risk processes with stochastic returns on investments will be given, for both continuous and discrete time models.

Dr. Philipp Mayer

RICAM

Thursday, June 19, 11:00, HF136

Title: On the calibration of local Levy type market models

Abstract: In this talk we are concerned with so called local Levy models and in particular the inverse problem of their calibration to market data (European option prices). The considered

type of model accommodates a wide range of well-known market models like local volatility or exponential Levy models. However, as the model has parameters in an infinte dimensional space, its calibration is not straight-forward and needs a precise mathematical treatment. We propose some calibration methods, that are asymptotically exact and especially ensure stability and robustness of the model with respect to small changes in the data.
Therefore, a particular reformulation of the calibration problem is used, more precicely, the forward partial integro-differential equation (PIDE) for the option price serves as definition of the forward operator. Finally, we comment on computationally tractable implementation methods and present some numerical experiments to underpin the theoretical results.

GROUP: Symbolic Computation

Dr. Georg Regensburger and Dr. Markus Rosenkranz

RICAM

Tuesday, February 26, 10:00, AS50

Title: Canonical Forms for Integro-Differential Polynomials

Abstract: We propose an algebraic structure for treating integral operators in conjunction with derivations. This provides an instrument for describing adjunction in an integro-differential algebra (i.e. an algebra with a derivation and an integral). Its elements can be interpreted as nonlinear integral/differential operators with specified initial values. We present an algorithm for computing canonical forms.

Dr. David Sevilla

RICAM

Tuesday, March 4, 10:00, AS50

Title: The Tschirnhaus-Weierstrass form of a curve

Abstract: We generalize the concept of Weierstrass form of an elliptic curve to curves of genus greater than one.

David Sevilla (RICAM): homotopy equivalence in singular homology
Josef Schicho (RICAM): minimal model programming
Niels Lubbes (RICAM): excision

Monday, March 31, 11:00 – 13:30, 14:00-16:00, AS50

Niels Lubbes

RICAM

Tuesday, May 27, 10:00, AS50

Title: Line bundles on algebraic varieties

Prof. Hassan Aly

University of Cairo

Tuesday, June 3, 10:00, AS50

Title: Perfect Nonlinear functions over Finite Fields”

Abstract: Perfect nonlinear functions are used to construct secret-key cryp-tosystems that are resistant to differential attacks, construct optimal constant-composition codes, and other applications in finite geometry and combinatorial designs. This talk will review the definition, the known families of perfect nonlinear functions over finite fields, some properties of type of functions and some open research points in this direction.

Brian Moore

RICAM

Tuesday June 10, 10:00, AS50

Title: On the ability of a cable-driven robot to generate a prescribed set of wrenches.

Abstract: A cable-driven robot, or simply cable robot, is a parallel robot whose actuated limbs are cables. The lengths of the cables can be adjusted in a coordinated manner to control the pose (position and orientation) and/or wrench (force and torque) at the moving platform.
A general and non-iterative method to verify if a given set of wrenches can be generated at the moving platform is presented. The proposed approach makes use of the geometrical concept of zonotopes, a particular class of convex polytopes. This work is a collaboration with the main investigators: Samuel Bouchard and Clement Gosselin from Universite Laval in Canada.

GROUP: Mathematical Imaging

WITH: Inverse Problems

Dr. Laurence Guillot

Université d'Orléans

Tuesday, February 12, 10:30, HF136

Title: Segmentation by gradient vector flow and geodesic active contours

Abstract: We consider an image segmentation model to detect boundaries without connexity or convexity assumptions on the contours. We are interested in the Gradient Vector Flow of C.Xu and JL.Prince as a front propagation flow combined with the geodesic active contours. Our aim is to study GVF properties. This mixed model introduced by Paragios, Mellina-Gottardo and Ralmesh leads to an Hamilton-Jacobi equation with existence and uniqueness results of a viscosity solution. The numerical implementation will be illustrated by the application to the segmentation of tuffeau (calcareous stone) images obtained by microtomography.

Dr. Markus Engeli

ETH Zürich

Monday, March 3, 13:00, HF136

Title: A Riemann-Roch-Hirzebruch Formula for Traces of holomorphic Differential Operators

Abstract: The classical Riemann-Roch-Hirzebruch theorem will be stated and generalized to an identity of traces of holomorphic differential operators.
Let D be a holomorphic differential operator acting on sections of a holomorphic vector bundle on an n-dimensional compact complex manifold. Then there is a formula, conjectured by Feigin and Shoikhet, giving the Lefschetz number of D as the integral over the manifold of a differential form. The class of this differential form is obtained via formal differential geometry from the canonical generator of the Hochschild cohomology in degree 2n of the algebra of differential operators on a formal neighborhood of a point. If D is the identity, the formula reduces to the Riemann-Roch-Hirzebruch formula.

Dr. Jérôme Boulanger

Institut Curie, Centre de Recherche

Monday, March 3, 14:00, HF136

Title: Adaptive patch-based image denoising and image sequence denoising

Abstract: Denoising is a recurrent problem in image processing applications. We present here a general method for the restoration of images based on the analysis of the correlation between small patches lying in a local region of the image. A statistical analysis of the bias-variance trade-off allows selecting the optimal dimension of this region. Although the proposed approach is not based on any pre-existing base or learned dictionary, exciting results are obtained on classical benchmark. Moreover, this method has been extended to fluorescence video-microscopy in order to allow acquisitions perturbing less the cell and thus allowing observing its behaviour on longer periods.

Ioana Durus

University of Metz

Wednesday, September 24, 13:30,HF136

Title: "Modelling and numerical methods for the debonding membranes"

Abstract: We are interested in quasistatic evolution processes for capacitary measures and shapes that model debonding membranes. These debonding membranes can be represented in two ways: by measures or by open sets. We propose numerical implementation of these two models. Methods of descent are associated with evolution strategies in relation to the shape derivative, level set method and mesure derivative.

Special Semester on Stochastics with Emphasis on Finance

September 3 - December 4, 2008

The Special Semester on Stochastics with Emphasis on Finance took place from September 3, 2008 until December 4, 2008, http://www.ricam.oeaw.ac.at/specsem/sef/

Scientific Committee

Hansjörg Albrecher, RICAM & Johannes Kepler University Linz

Karl Kunisch, RICAM & Karl-Franzens University Graz

Hanna Pikkarainen, RICAM

Wolfgang Runggaldier, University of Padova (Chair)

Walter Schachermayer, University of Vienna

The goal of the semester was to gather leading experts, talented PostDocs and PhD students of various fields related to stochastics and finance and discuss different approaches to deal with challenges in this field, in particular concerning inverse and partial information problems, optimization and optimal control, computational methods, stochastic methods for partial differential equations, applications of deterministic and stochastic PDEs and general modeling issues in finance and insurance. Altogether, there were 258 participants (from 34 countries) and 115 invited speakers.

The semester was preceded by the Second Int. Workshop on Gerber-Shiu Function organized by H. Albrecher and C. Constantinescu, held at RICAM on August 27-29, with about 40 international participants presenting and discussing recent advances in risk theory (invited speakers included H. Gerber (Lausanne), X.S. Lin(Toronto), G. Willmot (Waterloo), H. Schmidli (Köln) and J. Paulsen (Bergen)). After that, tutorial courses for the younger participants of the semester were given. The official start of the semester was then the Kick-Off Workshop, which included a Practitioner's Day, bringing together scientists with people working in the financial industry to discuss recent advances and challenges both in theory and practice. These events were followed by several further workshops, for which the details will be given below. The final workshop, in addition to having several international speakers, then also provided a platform for Austrian scientists working in this field, in particular for promising younger local scientists.

As a further result of the semester, a book entitled "Advanced Financial Modelling" will be published in the Radon Series on Computational and Applied Mathematics of deGruyter (Berlin), which contains a collection of research surveys related to the Special Semester, written by selected invited speakers.

The following workshops were held:

Tutorials, September 3-6, 2008

Speaker: Wolfgang Runggaldier, University of Padova
Title: Optimization problems in finance under full and partial information

Speaker: Hansjörg Albrecher, RICAM & Johannes Kepler University Linz
Title: Risk modelling in insurance

Speaker: Manfred Deistler, Vienna University of Technology, Austria
Title: System Identification General Aspects and Structure

Speaker: Walter Schachermayer, RICAM & University of Vienna
Title: Pricing and Hedging under Transaction Costs

Speaker: Michael Monoyios, University of Oxford, UK
Title: Optimal investment and hedging under partial information

Speaker: Jean-Pierre Fouque, University of California at Santa Barbara, USA
Title: Partial Differential Equations in Option Pricing

Speaker: Thorsten Hohage, University of Göttingen, Germany
Title: Nonlinear Statistical Inverse Problems and Instrumental Variables

Kick-off-Workshop, September 8-12, 2008

Speaker: Dilip Madan, Morgan Stanley New York, USA
Title: Correlating Levy Processes with Applications

Speaker: Peter Leonii, Electrabel - Commodities Trading, Belgium
Title: Challenges for Power and Gas Derivatives

Speaker: Alberto Elices Vallejo, Grupo Santander, Spain
Title: Models with time-dependent parameters using transform methods: application to Heston's model

Speaker: Peter Schaller, Bank-Austria - Creditanstalt Vienna, Austria
Title: Pivotal quantile estimates in Value at Risk calculations

Speaker: John Crosby, Lloyds, UK

Title: A new class of Levy process type models with almost perfect calibration to both barrier and vanilla FX options

Speaker: Stefan Fink, Raiffeisenlandesbank Oberösterreich, Austria
Title: Efficient solutions for mid- size problems in interest rate derivative pricing and risk management

Speaker: Andreas Weingessel, Erste Bank, Austria
Title: Challenge ICAAP

Speaker: Wim Schoutens, Katholieke Universiteit Leuven, Belgium
Title: Jump Driven Prepayment and Default Models for LCDS, ABS and portfolios of LCDSs

Speaker: Ralf Korn, University of Kaiserslautern, Germany
Title: Optimal leverage strategies for a CDPO

Speaker: Thaleia Zariphopoulou, The University of Texas at Austin, USA
Title: Portfolio choice under space-time monotone performance criteria

Speaker: Manfred Deistler, Vienna University of Technology, Austria
Title: Generalized linear dynamic factor models - a structure theory

Speaker: Jean-Pierre Fouque, University of California Santa Barbara, USA
Title: Multiname and Multiscale Default Modeling

Speaker: Claudia Klüppelberg, Technical University Munich, Germany
Title: Operational Risk and Pareto Levy copulas

Speaker: Xunyu Zhou, University of Oxford, UK
Title: A Universal Portfolio Choice Model in Continuous Time

Speaker: Damir Filipovic, University of Vienna, Austria
Title: Dynamic CDO Term Structure Modelling

Speaker: Huyên Pham, Université Paris VII, France
Title: A problem of optimal portfolio/consumption choice in a liquidity risk model with random trading times

Speaker: Jozef Teugels, Katholieke Universiteit Leuven, Belgium
Title: Change point analysis of extreme values

Speaker: Peter Laurence, University La Sapienza, Italy
Title: Sabr stochastic volatility models and asymptotic methods

Speaker: Christoph Reisinger, University of Oxford, UK

Title: Modeling and Pricing of Oil Derivatives in an Incomplete Market

Speaker: Dirk Becherer, Humboldt University Berlin, Germany

Title: Optimal portfolio liquidation in illiquid markets with finite resiliency

Workshop on Advanced Modeling in Finance and Insurance, September 22-26, 2008

Speaker: Ole E. Barndorff-Nielsen, University of Aarhus, Denmark

Title: BSS models and Intermittency/Volatility

Speaker: Claudia Klüppelberg, Technical University of Munich, Germany

Title: The Lévy-driven continuous-time COGARCH model

Speaker:Jan Kallsen, University of Kiel, Germany

Title: On hedging and indifference pricing in models with stochastic volatility and jumps

Speaker: Robert Stelzer, Munich University of Technology, Germany

Title: Multivariate Lévy driven stochastic volatility models

Speaker: David Hobson, University of Warwick, UK

Title: Optimal Liquidation of Derivative Portfolios

Speaker: Miklos Rasonyi, Hungarian Academy of Sciences and University of Vienna

Title: Modelling markets with transaction costs

Speaker: Jeannette Woerner, University of Goettingen, Germany

Title: Analyzing market microstructure

Speaker: Chris Rogers, Cambridge University, UK

Title: Contracting for optimal investment with risk control

Speaker: Fred Espen Benth, University of Oslo, Norway

Title: Modeling spot and forward prices in energy markets

Speaker: Hanspeter Schmidli, University of Cologne, Germany

Title: On CAT Options and Bonds

Speaker: Ernst Eberlein, University of Freiburg, Germany

Title: Analysis of valuation formulae and applications to option pricing in Lévy models

Speaker: Semyon Malamud, ETH Zuerich, Switzerland

Title: Information Percolation

Speaker: Saul Jacka, University of Warwick, UK

Title: Representation of coherent risk measures by trading

Speaker: Georg Pflug, University of Vienna, Austria

Title: Multi-period risk functionals

Speaker: Alexander Schied, Cornell University, USA

Title: Optimal portfolio liquidation

Speaker: Hans Foellmer, Humboldt University, Germany

Title: Asymptotic arbitrage and large deviations

Workshop on Optimization and Optimal Control, October 20-24, 2008

Speaker: Christian Hipp, University of Karlsruhe, Germany

Title: Control for the Lundberg model, with emphasis on optimal reinsurance

Speaker: Jostein Paulsen, University of Bergen, Norway

Title: Optimal dividend payments and reinvestments of diffusion processes with both fixed and proportional costs

Speaker: Bernt Øksendal, University of Oslo, Norway

Title: Optimal control with partial information for stochastic Volterra equations

Speaker: Agnès Sulem, INRIA, France

Title: Maximum Principles for optimal control of forward-backward stochastic differential equations with jumps

Speaker: Nicole Bäuerle, University of Karlsruhe, Germany

Title: MDP Algorithms for Portfolio Optimization Problems in pure Jump Markets

Speaker: Hanspeter Schmidli, University of Cologne, Germany

Title: Controlled Risk Processes and Large Claims

Speaker: Manfred Schäl, University of Bonn, Germany

Title: Non-dangerous risky investments for insurance companies

Speaker: Bruno Bouchard, University Paris-Dauphine, France

Title: Stochastic Target Problems with Controlled Loss

Speaker: Huyên Pham, University of Paris VII, France

Title: Backward SDEs with constrained jumps and Quasi-Variational Inequalities: Applications to impulse and switching controls in finance

Speaker: Gordan Zitkovic, The University of Texas at Austin, USA

Title: Stability and equilibria of financial markets

Speaker: Damien Lamberton, University of Marne-la-Vallée, France

Title: Some properties of American option prices in exponential Lévy mdels

Speaker: Nizar Touzi, Ecole Polytechnique, France

Title: Market illiquidity and dual formulation of target problems

Speaker: Xunyu Zhou, University of Oxford, UK

Title: Thou Shalt Still Buy and Hold

Speaker: Romuald Elie, University Paris-Dauphine, France

Title: Optimal consumption investment strategy under drawdown constraint

Speaker: Mihail Zervos, London School of Economics, UK

Title: Optimal Consumption and Investment with Habit Formation and Hyperbolic Discounting

Speaker: Fausto Gozzi, LUISS, Italy

Title: Optimal management of pension funds: a stochastic control approach

Speaker: Peter Tankov, Paris VII University, France

Title: Discrete hedging in models with jumps

Speaker: Mogens Steffensen, University of Copenhagen, Denmark

Title: Optimal Control in Finite State Markov Chains with Applications to Personal Finance and Credit Risk Management

Speaker: Hans Gerber, University of Lausanne, Switzerland

Title: On optimal dividends

Workshop on Inverse and Partial Information Problems: Methodology and Applications, October 27-31, 2008

Speaker: Bernard Mair, University of Florida, USA

Title: Algorithms for Penalized Maximum Likelihood Estimation from Blurred Photonic Data

Speaker: Jong-Shi Pang, University of Illinois, USA

Title: Inverse optimization and applications in finance

Speaker: Guillaume Bal, Columbia University, USA

Title: Physics-based modeling of measurement correlations

Speaker: Ivan Mizera, University of Alberta, Canada

Title: Regularization prescriptions and convex duality: density estimation and Renyi entropies

Speaker: Samuli Siltanen, Tampere University of Technology, Finland

Title: Discretization invariant Bayesian inversion and Besov space priors

Speaker: Axel Munk, University of Göttingen, Germany

Title: The estimation of different scales in microstructure noise models from a nonparametric regression perspective

Speaker: Sergei Pereverzyev, RICAM, Austria

Title: Adaptive Learning via the Balancing Principle

Speaker: Tapio Helin, Helsinki University of Technology, Finland

Title: Statistical image segmentation with Bayesian approach

Speaker: Lassi Roininen, Sodankylä Geophysical Observatory, Finland

Title: Two Dimensional Anisotropic Correlation Priors

Speaker: Hanna Katriina Pikkarainen, RICAM, Austria

Title: Convergence results for the Bayesian inversion theory

Speaker: Bernd Hofmann, Chemnitz University of Technology, Germany

Title: Nature of ill-posedness and regularization approaches for some inverse problems in option pricing

Speaker: Rama Cont, Columbia University, USA

Title: Inverse problems in option pricing: stochastic control formulation and duality methods

Speaker: Jorge Zubelli, IMPA, Brazil

Title: On the Inverse Problem for the Risk Premium of Options in a Stochastic-Volatility Financial Model: Malliavin and PDE Techniques

Speaker: Karyn Sutton, North Carolina State University, USA

Title: Inverse Problems in Epidemiology

Speaker: Nicolai Bissantz, Ruhr-Universität Bochum, Germany

Title: Multi-Scale Selection of the Stopping Criterion for MLEM Reconstructions in PET

Speaker: Frank Bauer, Johannes Kepler University Linz, Austria

Title: Using Stochastic Information for pMRI

Speaker: Olivier Pironneau, University of Paris VI, France

Title: Some calibration techniques for the calibration of option pricing models

Speaker: Peter Mathe, Weierstrass Institute for Applied Analysis and Stochastics, Germany

Title: On Non-stability of some Inverse Problem in Option Pricing

Speaker: Manfred Deistler, Vienna University of Technology, Austria

Title: Generalized Linear Dynamic Factor Models

Speaker: Mihaela Pricop, University of Goettingen, Germany

Title: Nonlinear Tikhonov regularization with random noise for identifying a spacewise dependent heat source

Speaker: Stefan Kindermann, Johannes Kepler University Linz, Austria

Title: Crystal Growth and Inverse Problems in Random environments

Speaker: Thorsten Hohage, University of Göttingen, Germany

Title: Nonlinear statistical inverse problems and instrumental variables

Speaker: H. Thomas Banks, North Carolina State University, USA

Title: Comparison of Probabilistic and Stochastic Formulations in Modeling Growth Uncertainty and Variability

Speaker: Liliana Borcea, Rice University, USA

Title: Imaging and velocity estimation in randomly layered media

Workshop on Computational Methods with Applications in Finance, Insurance and the Life Sciences AND Stochastic Methods in Partial Differential Equations and Applications of Deterministic and Stochastic PDEs, November 17-21, 2008

Speaker: Mike Giles, Oxford University, UK

Title: Multilevel Monte Carlo path simulation

Speaker: Vlad Bally, University of Marne-la-Valée, France

Title: Tubes estimates for Ito processes

Speaker: Cornelis Oosterlee, Delft University of Technology, Netherlands

Title: Efficient methods for pricing options with and without early exercise features

Speaker: Benjamin Jourdain, CERMICS - ENPC, France

Title: Robust adaptive variance reduction for normal random vectors

Speaker: Christoph Schwab, ETH Zuerich, Switzerland

Title: Convergence Rates of sparse tensor approximations for elliptic sPDEs

Speaker: Gilles Pages, University of Paris VI, France

Title: Optimal quantization for the pricing of American style derivatives

Speaker: Emmanuel Gobet, INP Grenoble-ENSIMAG, France

Title: Approximate closed formulas in stochastic volatility models

Speaker: Stefan Geiss, University of Jyväskylä, Finland
Title: Variational properties of BSDEs and fractional smoothness

Speaker: Peter Forsyth, University of Waterloo, Canada
Title: A Hamilton Jacobi Bellman Approach to Optimal Trade Execution

Speaker: Bruno Bouchard, University Paris-Dauphine, France
Title: Strong Approximations of BSDEs in a domain

Speaker: Yves Achdou, Universite Paris Diderot, France
Title: Mean Field Games: Numerical Methods

Speaker: Christoph Reisinger, Oxford University, UK
Title: Numerical solution of an SPDE arising in credit modelling

Speaker: Arturo Kohatsu-Higa, Osaka University, Japan
Title: A Semigroup Approach for Weak Approximations with an Application to Infinite Activity Lévy Driven SDEs

Speaker: Enrique Thomann, Oregon State University, USA
Title: Branching processes in Fluid Mechanics - An application to the Navier-Stokes and LANS-alpha equations

Speaker: Peter Friz, University of Cambridge, UK
Title: Towards a (rough) pathwise theory of fully non-linear stochastic partial differential equations

Speaker: Andrea Pascucci, University of Bologna, Italy
Title: Kolmogorov equations and applications to path dependent derivatives

Speaker: Josef Teichmann, Vienna University of Technology, Austria
Title: Numerical methods for SPDEs with applications to the HJM equation

Speaker: Edward Waymire, Oregon State University, USA
Title: Skew Brownian Motion and Applications in Partial Differential Equations with Discontinuous Coefficients

Concluding Workshop, December 2-4, 2008

Speaker: Johannes Leitner, Vienna University of Technology, Austria
Title: Robust Martingale Representations for Marked Point Processes

Speaker: Martin Keller-Ressel, Vienna University of Technology, Austria

Title: Moment explosions and long-term properties of affine stochastic volatility models

Speaker: Markus Hahn, RICAM, Austria

Title: Estimating Models Based on Markov Jump Processes Given Fragmented Observation Series

Speaker: Irina Penner, Humboldt University, Germany

Title: Markets with convex transaction costs

Speaker: Corina Constantinescu, RICAM, Austria

Title: Erlang(n) risk models with risky investments

Speaker: Philipp Mayer, Graz University of Technology, Austria

Title: A generalized Dupire formula and a stable way to estimate it

Speaker: Erika Hausenblas, University of Salzburg, Austria

Title: An explicit formula for the Hellinger Kakutani product of purely discontinuous processes

Speaker: Uwe Schmock, Vienna University of Technology, Austria

Title: Generalization of the Dybvig-Ingersoll-Ross Theorem and Asymptotic Minimality

Speaker: Stefan Thonhauser, RICAM, Austria

Title: On transaction costs in insurance

Speaker: Carlo Sgarra, Politecnico di Milano, Italy

Title: On the Esscher transforms and other equivalent martingale measures for Barndorff-Nielsen and Shephard stochastic volatility models with jumps

Speaker: Mariko Arisawa, Wolfgang Pauli Institute, Austria

Title: Homogenizations of Lévy operators with asymmetric Lévy density -application to the stochastic volatility model with jump processes-

Speaker: Christa Cuchiero, Vienna University of Technology, Austria

Title: A new class of analytically tractable processes with applications to option pricing

Speaker: Zorana Grbac, University of Zagreb, Croatia

Title: Credit rating-based Lévy Libor model

Speaker: Friedrich Hubalek, Vienna University of Technology, Austria

Title: On Trades, Volume, and the Martingale Estimating Function Approach for Stochastic Volatility Models with Jumps

Speaker: Ronnie Loeffen, RICAM, Austria

Title: Refracted Lévy processes

Speaker: Antonis Papapantoleon, Vienna University of Technology, Austria

Title: A new approach to LIBOR modeling - application of affine processes

Speaker: Elisa Alòs, University of Pompeu Fabra, France

Title: On the impact of correlation on option prices: a Malliavin Calculus approach

Speaker: Dominik Kortschak, RICAM, Austria

Title: Asymptotic properties of compound distribution tails

Speaker: Piotr Jaworski, University of Warsaw, Poland

Title: On a subjective risk measurement and capital allocation

Speaker: Verena Goldammer, Vienna University of Technology, Austria

Title: Modeling and Estimation of Dependent Credit Rating Transitions

2. Annex: Data from AkademIS (CD-ROM)