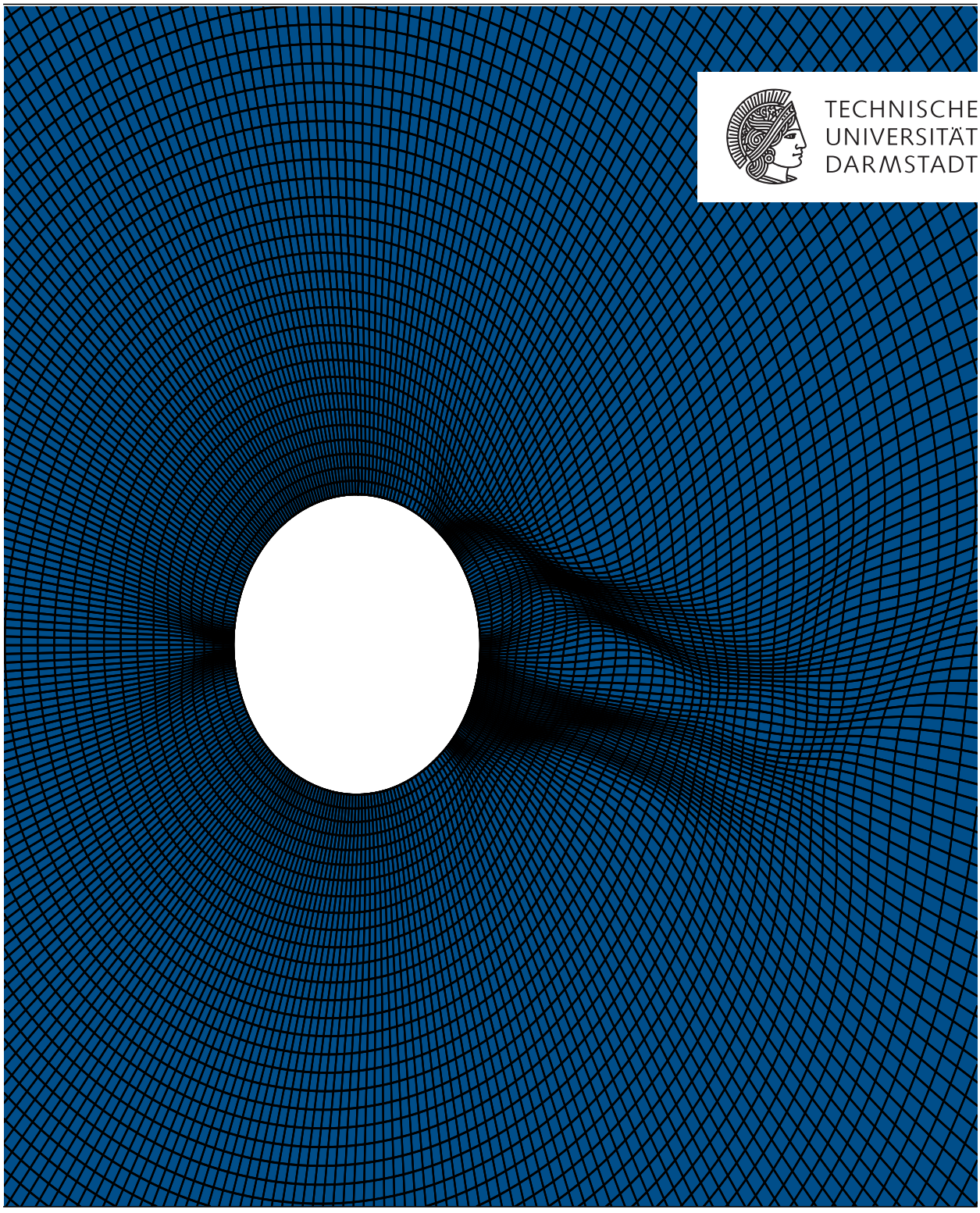
Biannual Report

Department of Mathematics
2011 and 2012



TECHNISCHE UNIVERSITÄT DARMSTADT

Contents

Dear Reader, Dear Friend of the Department of Mathematics at TU Darmstadt!

Mathematics is a very traditional science, and yet has changed substantially over the past decades. New real world applications have increased the interest in mathematical techniques and strengthened the role of applied mathematics as well as of the pure disciplines. The structure of our department reflects these developments: our eight research groups are centred around well-defined topics, but they each combine branches of expertise which would traditionally be separated across the divide of pure and applied mathematics.
The pivotal role of mathematics at a technical university primarily rests on those areas of mathematics that have close ties with engineering and the sciences, such as numerical analysis, optimization, and much of stochastics and analysis. Nevertheless, we firmly believe that both research and teaching take advantage of the full spectrum of mathematics and the interactions it creates. We consequently strive for a good balance between our strengths in areas with more immediate applications and in more theoretical areas of mathematics.

Looking back onto the past two years, we would like to mention some highlights.
It is good news that at the time of writing the department has successfully filled all its permanent professorship positions. Noteworthy enough, this is for the first time in at least 10 years. We welcome the new faculty employed in 2011/12, namely Volker Betz (stochastics), Herbert Egger (numerical analysis), Marc Pfetsch (optimization), and Irwin Yousept (optimization/CE), and are looking forward to successful future work. Moreover, two outstanding colleagues, namely Jan Bruinier (algebra) and Stefan Ulbrich (optimization), who had offers from other universities, could be retained for the department.
The department hosted two large-scale international conferences: in May 2011, the *SIAM conference on optimization*, with Stefan Ulbrich as the local organiser; and in March 2012, the *GAMM Annual Meeting* of the Association of Applied Mathematics and Mechanics, with Hans-Dieter Alber as the mathematics co-chair of the local organising committee. Both meetings made use of the facilities at the Darmstadtium conference centre.
The German Science Foundation (DFG) decided in 2012 on extensions of the programmes funded by the *Exzellenzinitiative*. Our department is crucially involved in two of these. Funding for the graduate school *Computational Engineering* was extended in an expanded format. Regrettably, the Cluster *Center of Smart Interfaces* was not awarded funding for another five year period, very favourable reviews of its performance notwithstanding. Alternative strategies for funding are currently under investigation.
We want to mention two very different prizes that the department can be proud of. In 2011, Ulrich Kohlenbach (logic) won the prestigious *Kurt Gödel Research Prize*, including 100000 euros. Our university awarded a prize for interdisciplinary teaching to Martin Ziegler (logic).

Let us mention some research initiatives, which are documented in more detail in this report.
The International Research Training Group *Mathematical Fluid Dynamics* is a joint project of our department with two Japanese partners, Waseda University and University of Tokyo. The project leader at TU Darmstadt is Matthias Hieber. The work of the group up to 2012 was very favourably reviewed in January 2013, and we are confident that DFG will approve the 5-year extension.

The department is involved in two current DFG-Sonderforschungsbereiche of our university: SFB 805, *Control of Uncertainties in Load-Carrying Structures in Mechanical Engineering*, for which funding was extended in 2012, and SFB 666, *Integral Sheet Metal Design with Higher Order Bifurcations*. Another Sonderforschungsbereich the department was involved in, SFB 568, *Flow and Combustion in Future Gas Turbine Cobustion Chambers*, reached the end of its funding in December 2011. Third party funding for these and other projects has grown by about a factor 10 over the last decade, and now exceeds 4 million euros per annum. Our report gives an impression of all these and many more activities by members of our department.

Teaching is another important part of our work, and we can claim to teach more students and to have more graduates than most other mathematics departments in Germany. We place particular emphasis on the quality of our teaching, for instance by complementing lectures with small exercise groups – not just for our own students, but also for the engineering and science students we teach in mathematics. Our efforts are rewarded in various rankings and through the preference applicants give to our department.
Over the past years, our department and the university at large have been faced with a vast increase in student numbers. Admission numbers of other departments can have dramatic effects on courses taught by our department. In some cases we even had to deal with class sizes that far exceeded the seating capacity of available lecture halls.
We have experienced only a moderate increase of students in the mathematics degree schemes, but also here, the large number of drop-outs has been perceived as a problem. To ascertain that students admitted to study programmes in mathematics meet our standards, both in terms of motivation and prerequisites, the department introduced new admission procedures in 2011, involving a so-called *Eignungsfeststellungsverfahren*. Below a certain level of baccalaureate grades, applicants are now invited for an interview. Although the vast majority of applicants interviewed are accepted, we suspect that the procedure will have substantial impact on the selection and performance of our Bachelor cohorts; this effect may be even stronger for the teaching degrees (Lehramt). The department will monitor the effects of this new measure.
In 2011 the department had its Bachelor and Master degree schemes re-accredited by the agency Asiin. As observed by Asiin, we are facing a particular challenge in balancing our high teaching load towards other departments with the demands of our own degree schemes. By terminating admission of new Bachelor students to mathematics programmes in the summer, the department has managed to strengthen its Master programme and to retain attractive features of its Bachelor programme, such as the bilingual stream.

With two separate locations in town, the department now has the volume of rooms it needs. Nevertheless the split in location is unfortunate for our daily work – we look forward to being reunited in a common building, as promised by our university, before 2020.

We hope that the present biannual report contains the information that you, the reader, are interested in and thank you for your interest in our work.

Burkhard Kümmerer, Karsten Grosse-Brauckmann, Martin Otto
(Dean, Vice-Dean, Dean of Studies of the Department of Mathematics)

1 Research

1.1 Overview

Besides the research done in the eight research groups, the department is involved in a number of interdisciplinary research projects including excellence projects, collaborative research centres and priority programs. This section gives a brief overview of these activities.

1.1.1 Center of Smart Interfaces

The Center of Smart Interfaces (CSI) is a Cluster of Excellence (EXC 259), funded by the German Research Foundation (DFG). The initial funding period started in November 2008 and runs until October 2014, having a total volume of about 42 Million EUR. The CSI is an international center for interdisciplinary research, focusing on the scientific areas “static and dynamic wettability”, “heat transfer enhancement”, “near wall reactive flows”, “near wall multiphase flows” and “drag and circulation control” with the aim to understand and design fluid boundaries.

The CSI has 24 Principal Investigators, combining the expertise of the departments of Mechanical Engineering, Physics, Chemistry, Mathematics, and Material Sciences at the TU Darmstadt with four non-University research institutes in Darmstadt and Mainz. In addition, six research professors and three young research group leaders were newly appointed at the Cluster of Excellence.

With the four Principal Investigators Reinhard Farwig, Matthias Hieber, Jens Lang and Stefan Ulbrich and the two newly appointed professors Dieter Bothe and Jürgen Saal, the Department of Mathematics is strongly involved in the CSI. Scientifically, mathematics also plays an eminent role for the fundamental research in all of the above mentioned areas which is performed at the CSI. The involved mathematical disciplines are Mathematical Modeling, Analysis of Partial Differential Equations, Numerical Analysis, and Optimization. This enabled relevant contributions to the understanding of continuum mechanical flow models via their mathematical analysis, numerical simulation and the solution of inverse problems such as the optimization concerning complex model parameters.

The CSI was involved in several activities in mathematics. Both in 2011 and 2012, a section on Interfacial Flows was co-organized by members of the mathematical group from the CSI. At the CSI, the seminar series on experiments, modeling and theory of contact line dynamics was continued. Furthermore, together with the IRTG ”Mathematical Fluid Dynamics” and the Graduate School ”Computational Engineering”, the International Workshop on Modeling, Simulation and Optimization of Complex Fluid Flows was organized by Bothe, Lukacova, Schäfer and Ulbrich in June 2012. With main speakers including Y. Bazilevs, K. Kunisch, R. Kupfermann, R. Löhner, A. Reusken, M. Tabata, Y. Teramoto, and S. Turek, this was an outstanding international event. Another highlight was the 7^{th} International OpenFOAM Workshop with more than 300 participants from all over the world. Finally, the CSI was strongly involved in the organization of the GAMM annual meeting 2012.

1.1.2 Collaborative Research Centre SFB 568

The Collaborative Research Centre SFB 568 “Flow and Combustion in Future Gas Turbine Combustion Chambers" started in 2001 and aims at the formulation of an integral model for the development and optimization of new gas turbine combustion chamber concepts which make more efficient use of rare resources in the conversion of energy compared to today’s technology. The main points that have to be considered are the occuring and highly complex coupled and interacting physico-chemical processes such as turbulent transport, two- or multi-phase flows, materials transport, chemical reactions/combustion and radiation. The integral model comprises four main elements:

1. submodels of physical/chemical mechanisms and interactions
2. suitable numerical methods
3. consideration of basic conditions and neighboring components and interactions
4. implementation of targeted validation experiments

The Department of Mathematics contributes to the SFB 568 within two subprojects (Lang, Ulbrich). The topics under investigation are the control of errors of the numerical simulation, model reduction techniques and the numerical optimization of gas turbine relevant problems. To control and estimate errors of the complex numerical simulations, grid refinement strategies based on suitable error estimators are investigated. To reduce the cost of the simulations, model reduction techniques are further developed to account for turbulence (Lang). Since the simulation itself is a challenging task, new mathematical techniques for the optimization have to be developed that make optimization applicable in reasonable time (Ulbrich).

1.1.3 Collaborative Research Centre SFB 666

The Collaborative Research Centre SFB 666 “Integral Sheet Metal Design with Higher Order Bifurcations”, established in 2005, considers the enormous prospective potential of the new technique linear flow splitting for sheet metal and develops methodical tools to integrate this technique into the product development processes. The collaborative research centre SFB 666 is currently in its second funding period, the proposal for the third has just been evaluated.
The investigated technologies of the SFB, linear flow splitting and linear bend splitting, make it possible to produce branched sheet metal products in integral style. Hereby the disadvantages of conventional procedures to create branched sheet metal structures, e.g., gluing or welding, can be avoided. The SFB is structured into the four main units of development, production, evaluation and synthesis. In each of these units, new methodologies, techniques and procedures arise. They cope with all occurring unique requirements of this new product category. Engineers are involved in the research center as well as mathematicians and material scientists. This interdisciplinary research environment has lead to novel product development methodologies by combining engineering expertise with mathematical modeling and optimization methods. The Department of Mathematics participates in the SFB 666 within three sub-projects (Kohler, Pfetsch, Ulbrich). The mathematical research is concentrated on development and on evaluation. In the product development

process, the aim is to provide an optimal design of the desired product as well as an optimal process control of selected forming methods. This is done by means of discrete optimization and PDE-constrained nonlinear optimization. In the evaluation process, statistical methodologies are used to provide estimates for relations between properties of the considered sheet metal part and its structural durability. Thus, a smaller number of costly and time consuming experiments have to be carried out.

1.1.4 Collaborative Research Centre SFB 805

The Collaborative Research Centre SFB 805 “Control of Uncertainties in Load-Carrying Structures in Mechanical Engineering" was established in January 2009. The second funding period started in January 2013. Its main objective is the development of methods and techniques to control uncertainties in the development, production and usage of load-carrying structures to significantly enhance their safety, reliability and economic efficiency. While uncertainty cannot be avoided or eliminated, its influence during the product lifecycle—from material properties to production and usage—can be controlled and hence minimized. Especially in the area of light-weight construction, the trade-off between low weight and low production cost on one hand and adequate load-bearing capacity on the other hand makes the influence of uncertainties critical. Hence, the control of uncertainty is of significant importance and is therefore a focus of the research to be conducted by the SFB 805.
The control of uncertainty through the entire process chain of development, production and usage necessitates a close interdisciplinary cooperation of engineers and mathematicians. Within the collaborative research centre, the engineering sciences address uncertainty in terms of physical and technical phenomena, whereas the mathematical research assesses the influence and effects of uncertainty and its interdependencies and derives from this optimal solution strategies for processes with minimal uncertainty and optimal design concepts for load-carrying systems.
The Department of Mathematics is involved in three projects of SFB 805 (Lorenz, Pfetsch, Ulbrich). To deal with uncertainty, the tool of robust optimization is applied, where complex products are optimized while controlling inherent uncertainty already in the product development phase. Uncertainty may occur because of uncertain loadings, uncertain material properties or unknown user behavior. Furthermore, the SFB 805 examines the use of active elements to react on uncertainty in a load-carrying system. The question of optimal placement of active elements in the structure is a challenging nonlinear mixed-integer optimization problem. In the production process, the optimization of process chains under uncertainty is considered in order to reduce costs and uncertainty caused by uncertain market conditions.

1.1.5 Graduate School of Computational Engineering

Computational Engineering (CE) denotes computer based modeling, analysis, simulation, and optimization. It is a cost-effective, efficient and complementary approach to study engineering applications and to engineer new technical solutions when experimental investigations are often too complex, risky, or costly. CE enables the creation of scalable models to support research, development, design, construction, evaluation, production and operation of engineering applications which address key issues in future technology developments for the economy and society in areas such as energy, health, safety,

and mobility. However, such engineering applications are becoming increasingly complex. Consequently, the theory and methodologies required to investigate corresponding systems is becoming challenging. With the Graduate School of Computational Engineering, the TU Darmstadt was able to further strengthen its role in CE. The school enables highly talented PhD students to develop their scientific skills in a focused way, and to cooperate under optimal conditions in a highly stimulating interdisciplinary environment based on the interaction of Computer Science, Mathematics, and Engineering Sciences. Partnerships with well established research organizations as well as cooperation with industry increase the impact of the Graduate School. Building on the well established interdepartmental expertise at TU Darmstadt, the Graduate School focusses on the following key research areas: modeling and simulation of coupled multi-physics problems, simulation based optimization, and hierarchical multi-scale modeling and simulation. The research efforts in the above fields are accompanied by corresponding developments of methods of visualization, simulated reality, high-performance computing, verification and validation, as well as software engineering and lifecycle research. The PhD students work together within research foci comprising one or more of the above topics. The joint research on specially defined use cases will further strengthen the interdisciplinary skills and cooperation. Six professors of the Department of Mathematics are principal investigators within the Graduate School Computational Engineering (Egger, Joswig, Lang, Pfetsch, Stannat, Ulbrich) with expertise in Discrete Algortihmic Mathematics, Numerical Analysis, Discrete Optimization, Stochastics, Nonlinear Optimization and Optimal Control. They supervise more than 10 interdiciplinary PhD projects within the Graduate School in close cooperation with a co-supervisor from Engineering or Computer Science.

1.1.6 Graduate School of Energy Science and Engineering

The mission of the Darmstadt Graduate School of Energy Science and Engineering is to educate tomorrow's leading Energy Engineers in a multidisciplinary field of expertise needed to identify and master the most demanding scientific, engineering, economic and social challenges in an interdisciplinary approach. The main challenge is viewed to be a continuous transition from the carbon-based, non-renewable primary energy sources of today to renewable and environmentally friendly energy resources of tomorrow.
The optimal strategy to meet this challenge is on the one hand to improve conventional energy technologies and render them progressively more efficient, to meet the ever more stringent demands on pollutant emissions, and on the other hand to simultaneously develop innovative, advanced renewable energy technologies, which must be brought to a competitive technological readiness level and provide safe, reliable and cost-effective solutions.
Two professors of the Department of Mathematics are principal investigators within the Graduate School Energy Science and Engineering (Lang, Ulbrich) with expertise in Numerical Analysis, Nonlinear Optimization and Optimal Control.

1.1.7 International Research Training Group IRTG 1529

The International Research Training Group “Mathematical Fluid Dynamics" (IRTG 1529) is funded by the German Research Foundation (DFG) and the Japan Society for the Promotion of Science (JSPS). It is associated with TU Darmstadt and with two Universities located in Tokyo, Japan, Waseda University and University of Tokyo.

The research of the program focuses on analytical, numerical and stochastic aspects as well as on modeling, optimization and aerodynamics of fluid dynamics. It distinguishes itself through joint teaching and supervision. The core program consists of interdisciplinary lectures and seminars and includes research and study periods in Tokyo. Presently, there are 12 PhD students and 2 Postdocs on the Darmstadt side and a similar amount on the Japanese side.
The principal investigators at Darmstadt are Dieter Bothe, Reinhard Farwig, Matthias Geissert, Horst Heck, Matthias Hieber, Maria Lukacova, Wilhelm Stannat, Cameron Tropea, and Stefan Ulbrich. The participating colleagues in Tokyo are Tadahisa Funaki, Yoshikazu Giga, Hideo Kozono, Takaaki Nishida, Yoshihiro Shibata and Masao Yamazaki.
IRTG 1529 is organizing seminars, short courses, workshops and conferences on a regular basis in Darmstadt and Tokyo. The list of speakers in 2011 and 2012 includes leading experts of the field, e.g., E. Feireisl (Prag), G. Galdi (Pittsburgh), G. Huisken (Golm), N. Masmoudi (Courant), R. Klein (Berlin), K. Kunisch (Graz), Kupfermann (Jerusalem), Ch. Liu (Penn State) F. Otto (Leipzig), E. Titi (Irvine and Weizmann), and S. Turek (Dortmund). Highlights of the program were alltogether 8 conferences or bigger workshops in 2011 and 2012, e.g., the “International Workshops on Mathematical Fluid Dynamics" at Waseda University, Tokyo, in March 2011, June and November 2012 and the “International Conference on Complex Fluids “ as well as on “Simulation and Optimization of Complex Fluid Flow “ in summer 2012 in Darmstadt. A joint summerschool with the DFG-Research Training Group 1463 in Hanover took place in September 2011. A special summerschool in Darmstadt which was completely selforganized by our PhD students attracted many other PhD-students to this special event to Darmstadt.
A Klausurtagung im November 2012 was preparing the evaluation of this program by DFG scheduled for January 2013.

1.1.8 LOEWE Centre AdRIA

The LOEWE Centre “AdRIA: Adaptronics: Research, Innovation, Application” was established in 2008 and is funded with an amount of 34 million Euro for 6 years by the State of Hesse within the research support program LOEWE-Landes-Offensive zur Entwicklung Wissenschaftlich-ökonomischer Exzellenz. It is an interdisciplinary collaboration of Fraunhofer LBF, TU Darmstadt and Hochschule Darmstadt.
The aim of the LOEWE Centre AdRIA is the scientific and technological study of adaptronic systems in order to ensure a systematic and holistic development of advanced adaptronic products. A particular emphasis is the development of light weight structures based on adaptronic systems with improved energy efficiency, functionality and performance. The LOEWE Centre AdRIA is structured into several technology areas in order to advance basic research as well as three exemplary technological demonstrator applications.
The Department of Mathematics participates in the Centre within the technology area “Simulation Tools” (Ulbrich) and contributes to the development of optimization methods for adaptronic systems, in particular the optimal placement and control of sensors, actuators and active absorbers.

1.1.9 LOEWE Research Priority Program Cocoon

The LOEWE Priority Program “Cooperative sensor communication (Cocoon)” was established in January 2011 and is funded with an amount of 4.5 million Euro for 3 years

by the State of Hesse. The grant was secured within the frame of the third round of the research support program LOEWE-Landes-Offensive zur Entwicklung Wissenschaftlich-Ã¶konomischer Exzellenz.
Research in the field of wireless sensor communication will enable us to make an essential contribution to the improvement of our daily life. Sensors we consider in our research include environmental sensors, mobile phones, PDAs, navigation equipment, car keys, electronic purses or pulse rate measurement devices. New diverse applications, which can be integrated into the context of a smart city, will arise. This concept requires an intelligent environment in which daily life supporting services are ubiquitous.
The Department of Mathematics participates in the LOEWE Priority Program within a sub-project (Ulbrich). The mathematical research considers the development of efficient discrete-continuous optimization methods for the optimal design of wireless communication networks, which leads to challenging nonconvex mixed-integer polynomial optimization problems.

1.2 Research Groups

1.2.1 Algebra

The main research areas of this group are algebraic geometry, number theory and conformal field theory.
We are interested in automorphic forms and their applications in geometry and arithmetic. For example we investigate intersection and height pairings of special algebraic cycles on Shimura varieties and their connection to automorphic L-functions. We also study the relation between the representation theory of conformal field theories and automorphic forms. Regularized theta lifts play an important role in both areas.

Project: Harmonic weak Maass forms

In this project the Fourier coefficients and periods of weak Maass Forms are investigated. In particular, we study the coefficients of weight $1/2$ harmonic weak Maass forms. If such a form f maps under the ξ-operator to a newform g of weight $3/2$, then the Fourier coefficients of the holomorphic part of f are given by periods of normalized algebraic differentials of the third kind associated to the Shimura lift of g. For instance, the real periods of differentials of the third kind on rational elliptic curves are related to coefficients of such harmonic Maass forms. We also use (regularized) theta lifts to investigate periods of harmonic Maass forms. In joint work with Ono we construct a lift from harmonic Maass forms of weight -2 to harmonic Maass forms of weight $-1/2$ and study its integrality properties. As an application, we derive a finite algebraic formula for the partition function. This lift is generalized by C. Alfes to arbitrary weights. In joint work with Funke and Imamoglu we investigate a regularized theta lift from weak Maass forms of weight 0 to weak Maass forms of weight $1/2$ and show that the coefficients of the lift are given by CM traces and period integrals. In particular we find a definition of the central value of the (non-existent) L-function of Klein's j-invariant.

Partner: K. Ono, Emory University; J. Funke, Durham University; O. Imamoglu, ETH Zürich

Support: DFG, NSF

Contact: J. H. Bruinier, C. Alfes

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Project: Arithmetic intersection theory on Shimura varieties

We study special cycles on integral models of Shimura varieties associated with unitary similitude groups of signature $(n-1,1)$. We construct an arithmetic theta lift from harmonic Maass forms of weight $2-n$ to the first arithmetic Chow group of a toroidal compactification of the integral model of the unitary Shimura variety, by associating to a harmonic Maass form f a suitable linear combination of Kudla-Rapoport divisors, equipped with the Green function given by the regularized theta lift of f. Our main result expresses the height pairing of this arithmetic Kudla-Rapoport divisor with a CM cycle in terms of a Rankin-Selberg convolution L-function of the cusp form of weight n corresponding to f and the theta function of a positive definite hermitian lattice of rank $n-1$. When specialized to the case $n=2$, this result can be viewed as a variant of the Gross-Zagier formula for Shimura curves associated to unitary groups of signature $(1,1)$. We also prove that the generating series of the height pairings of arithmetic Kudla-Rapoport divisors with a fixed CM cycle is an elliptic modular form of weight n. These results rely on (among other things) a new method for computing improper arithmetic intersections.

Partner: B. Howard, Boston College; T. Yang, University of Wisconsin at Madison

Support: DFG, NSF

Contact: J. H. Bruinier, S. Ehlen, S. Zemel

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Project: The converse theorem for Borcherds products

R. Borcherds constructed a lift from vector valued weakly holomorphic elliptic modular forms of weight $1-n/2$ to meromorphic modular forms on the orthogonal group $\mathrm{O}(n,2)$ whose zeros and poles are supported on special divisors and which possess infinite product expansions analogous to the Dedekind eta function. Conversely, we prove that in a large class of cases every meromorphic modular form on $\mathrm{O}(n,2)$ whose divisor is supported on special divisors is the Borcherds lift of a weakly holomorphic modular form of weight $1-n/2$. To this end we develop a newform theory for vector valued modular forms for the

Weil representation. We also derive lower bounds for the ranks of the Picard groups and the spaces of holomorphic top degree differential forms of modular varieties associated to orthogonal groups.

Partner: E. Freitag, Universität Heidelberg

Support: DFG

Contact: J. H. Bruinier

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Project: Topology of Kac–Moody groups

The main purpose of this project is to analyse a group topology on Kac–Moody groups, originally introduced by Kac and Peterson. This topology has recently been shown to be Hausdorff, moreover it has been shown that in the case of 2-spherical groups, the quotient topology on the associated twin building naturally leads to topological twin buildings in the sense of Kramer and others.
Currently, we investigate associated topologies on $\mathbb{F}$-forms of Kac–Moody groups and their homogeneous spaces. Of particular interest are the groups of type E_{10} and E_{11} due to their application in String Theory.

Contact: A. Mars, W. Freyn

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Project: Algebraic geometry over the field $\mathbb{F}_1$

The aim of this project is a geometric understanding of algebraic groups over the "field" with one element, denoted $\mathbb{F}_1$. Sometimes the "field" $\mathbb{F}_1$ is assumed to be the multiplicative monoid $\mathbb{F}_1 = \{0,1\}$ whose multiplication is given by $0 \cdot 1 = 1 \cdot 0 = 0$ and whose addition is completely degenerate.
The concept of a "field" $\mathbb{F}_1$ was introduced in 1956 by J. Tits; the basic idea of most constructions involving $\mathbb{F}_1$ is the need to make sense of limits $q \to 1$ of certain geometric or representation theoretic constructions defined over finite fields $\mathbb{F}_q$.
The subject received new interest during the last few year due to a conjectured relation between the Riemann hypothesis and algebraic geometry over $\mathbb{F}_1$; it is suggested, that one should be able to define a kind of "variety" over $\mathbb{F}_1$, whose ζ-function is the Riemannian ζ-function. Then it is hoped, that this setting allows for an adaption of Deligne's geometric proof of the Weil conjectures.

Pioneering work in this direction was performed by A. Connes and C. Consani. One of her achievements was the construction of "Chevalley groups" over $\mathbb{F}_1$, using a functorial approach.
In this project we develop a $\mathbb{F}_1$-version of the Tits approach to Chevalley groups. It turns out, that the combinatorial flag varieties, introduced by Borovik, Gelfand and White can be interpreted as a building over $\mathbb{F}_1$. Remark here that the notion of $\mathbb{F}_1$, used today, is more subtle than the original notion of J. Tits.

Partner: L. Carbone, C. Consani

Contact: W. Freyn

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Project: Hyperbolic Kac-Moody geometry

The main purpose of this project is the development of hyperbolic Kac-Moody geometry. A blueprint of hyperbolic Kac-Moody geometry is given by affine Kac-Moody geometry and the finite dimensional geometry governed by simple Lie groups. Recall that a simple Lie group is the symmetry group of geometric objects such diverse as symmetric spaces, buildings, polar actions and isoparametric submanifolds. Structure properties of the symmetry groups are reflected in the geometry of these objects. A similar picture was established for affine Kac-Moody groups and their geometries, hence affine Kac-Moody symmetric spaces, twin cities, proper Fredholm isoparametric submanifolds in Hilbert spaces. We conjecture the existence of similar classes of geometric objects associated to more general classes of Kac-Moody groups, especially hyperbolic Kac-Moody groups.
Guiding questions come from important conjectures in mathematical physics due to T. Damour, H. Nicolai oder P. West, which relate the equations of motion of M-theory, a generalized version of string theory, with the structure of geodesics on certain Kac-Moody symmetric spaces, conjecturally associated to the split real Kac-Moody groups of type E_{10} and E_{11}.

Partner: L. Carbone, A. Feingold, H. Sati

Contact: W. Freyn

Project: Submanifolds with splitting tangent sequence

Mok classified pairs (N, M), where M is a complex manifold with constant holomorphic sectional curvature, and $N \subset M$ a submanifold with splitting tangent sequence. Generalizing the classes of M's to the non Kähler Einstein case the only additional examples are modular families of false elliptic curves. We generalized Mok's result to that case using our classification of manifolds with projectice structure (Preprint). The characterization of submanifolds with splitting tangent sequence is an older question, already in 2005 I studied such pairs. It is possible to model a manifold not only after a projective space as in the case of manifolds with projective structure above. But we can also consider manifolds modelled after arbitrary hermitian symmetric spaces. A classification in dimension three is complete for the hyperquadric (2005). We now work on the general case.

Partner: I. Radloff (Universität Tübingen)

Contact: P. Jahnke

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Project: Classification of singular Fano threefolds

It is known that for any n there are only finitely many deformation families of smooth Fano varieties of dimension n (Campana, Kollár, Miyaoka, Mori, 90s). This means it is theoretically possible to write down complete lists. Up to dimension $n = 3$ this was done: there is one "Fano curve" (rational curve), 10 families in dimension two (del Pezzo surfaces) and 106 families of smooth Fano threefolds (Iskovskikh, Mori, Mukai, 80s). In 2001 Borisov proved boundedness also in the singular case, there are only finitely many families of Fano threefolds with at most canonical Gorenstein singularities. Following an idea of McKernan this remains true in the almost Fano case. Up to now there does not exist a complete classification in the singular case, but we have some partial results. The project is not to find complete lists, but to answer some questions on the general structure like bounds for certain numerical invariants.

Partner: T. Peternell (Universität Bayreuth), I. Radloff (Universität Tübingen)

Contact: P. Jahnke

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Project: Invariant subalgebras of vertex algebras

Let G be a complex, reductive group and let V be a finite-dimensional representation of G. A basic problem in invariant theory going back to the nineteenth century is to describe the ring $\mathbb{C}(V)^G$ of invariant polynomial functions on V. Hilbert's famous theorem from 1890 asserts that $\mathbb{C}(V)^G$ is finitely generated, and many foundational results in commutative algebra such as the Basis Theorem, Nullstellensatz, and Syzygy Theorem, were introduced by Hilbert in connection with this problem. One can study the analogous problem for vertex algebras; given a strongly finitely generated (SFG) vertex algebra $\mathcal{V}$ and a reductive group $G \subset \mathrm{Aut}(\mathcal{V})$, when is $\mathcal{V}^G$ SFG? This is a subtle and nonclassical phenomenon that generally fails if $\mathcal{V}$ is abelian. Isolated examples have been known since the mid 1990s, but the first general results of this kind appear in my work [2], in which I proved this

when $\mathcal{V}$ is a free field vertex algebra (either a bc-system, $\beta\gamma$-system, or $bc\beta\gamma$-system). Certain interesting vertex algebras (such as various $\mathcal{W}$-algebras) can be realized as invariant vertex algebras, and our techniques have allowed us to prove some old conjectures on the structure of these vertex algebras. For example, the $\mathcal{W}_{1+\infty}$ algebra with central charge $-n$ was conjectured in the 1990s to be of type $\mathcal{W}(1,2,\dots,n^2+2n)$, and we showed in [3] that this is a formal consequence of Weyl's first and second fundamental theorems of invariant theory for GL_n. I am currently investigating several related phenomena, jointly with Thomas Creutzig. For example, in [1] we have identified the super $\mathcal{W}_{1+\infty}$ algebra at integer level with a $\mathcal{W}$-algebra associated to a purely odd simple root system of $\mathfrak{gl}(n|n)$.

Contact: A. R. Linshaw

References

[1] T. Creutzig and A. R. Linshaw. The super $\exists_{1+\infty}$-algebra with integral central charge. Preprint, submitted, TU Darmstadt and Brandeis University, 2012.

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[3] A. R. Linshaw. Invariant theory and the $\mathcal{W}_{1+\infty}$ algebra with negative integral central charge. *Journal of the European Mathematical Society*, 13:1737–1768, 2011.

Project: Orthogonal groups of discriminant forms

A discriminant form is a finite abelian group D with a nondegenerate quadratic form $q : D \to \mathbb{Q}/\mathbb{Z}$. Discriminant forms play a prominent role in the theory of automorphic forms. A discriminant form of prime level p is a vector space over $\mathbb{F}_p$ with a nondegenerate quadratic form. In this case Witt's Theorem says that for two nonzero vectors v, w of the same norm there is an automorphism f of D preserving q with $f(v) = w$. An important question is under which condition two elements of an arbitrary discriminant form D are conjugate under $\mathrm{O}(D)$. This problem has been solved in [1] for discriminant forms of odd order. The general case is investigated at the moment.

Contact: N. Scheithauer

References

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Project: Moonshine for Conway's group

The fake monster algebra is an infinite-dimensional Lie algebra describing the physical states of a bosonic string moving on a 26-dimensional torus. Its denominator identity is given by

$$e^{\rho}\prod_{\alpha\in II^{+}_{25,1}}(1-e^{\alpha})^{[1/\Delta](-\alpha^2/2)}=\sum_{w\in W}\det(w)\,w\left(e^{\rho}\prod_{n=1}^{\infty}(1-e^{n\rho})^{24}\right)$$

where

$$\Delta(\tau)=q\prod_{n=1}^{\infty}(1-q^n)^{24}=q-24q^2+252q^3-1472q^4+4830q^5-6048q^6+\dots$$

is Dedekind's delta function. The real simple roots of the fake monster algebra correspond to the Leech lattice and the automorphism group of the Leech lattice acts by diagram automorphisms on the Lie algebra. Borcherds conjectured that the corresponding twisted denominator identities are automorphic forms of singular weight on orthogonal groups. It is now well-known that this holds for elements of squarefree level. Some of the remaining cases are proved in [1, 2].

Contact: N. Scheithauer

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[2] N. Scheithauer. Some constructions of modular forms for the Weil representation of $\mathrm{SL}_2(\mathbb{Z})$. Preprint, TU Darmstadt, 2011.

Project: Classification of automorphic products

Borcherds' singular theta correspondence is a map from vector valued modular forms, which transform under the Weil representation of $\mathrm{SL}_2(\mathbb{Z})$ on discriminant forms, to automorphic forms on orthogonal groups. Since these automorphic forms have nice product expansions they are called automorphic products. They have found various applications in algebra, geometry and arithmetic. A famous example is the function

$$\Phi(Z) = e((\rho, Z)) \prod_{\alpha \in II^+_{25,1}} \left(1 - e((\alpha, Z))\right)^{[1/\Delta](-\alpha^2/2)}$$

where Δ is Dedekind's delta function. This function is an automorphic form of weight 12 for a discrete subgroup of $\mathrm{O}_{26,2}(\mathbb{R})$. One of the main problems in the theory of automorphic forms on orthogonal groups is to derive classification results. In [1] automorphic products of singular weight, whose divisors are zeros of order one corresponding to roots, on lattices of squarefree level are classified. The result is that there are only 10 such functions. They are in one-to-one correspondence with the solutions of the equation

$$\frac{k}{k-2}\frac{1}{B_k}\prod_{p|N}\frac{1}{p^k-1}\left(\epsilon_p\left(\frac{-1}{p}\right)^{n_p/2}\left(p^{k-n_p/2}+p^{n_p/2}\right)-2\right)=1\,.$$

The goal of this project is to prove classification results without assumptions on the lattices and on the divisors. A first step in this direction is the following result. The function Φ defined above is the only holomorphic automorphic product of singular weight on an unimodular lattice.

Contact: N. Scheithauer

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1.2.2 Analysis

The research group Analysis consists of six professors, H.-D. Alber, D. Bothe, R. Farwig, M. Hieber, S. Roch (apl.) and J. Saal, and about 22 assistants as state employees or paid by third party funding. The field of research of this group covers theory and applications of partial differential equations and of integral equations. Having close contact to the departments of engineering and natural sciences, the group of analysis at TU Darmstadt is open to new mathematical problems and scientific challenges.

One focal point of research activities is the investigation of the nonlinear equations of fluid mechanics including an enhanced analysis of linear model problems which are solved by methods of evolution equations, maximal regularity and harmonic analysis. A famous open problem concerning the existence of smooth solutions of the so-called Navier-Stokes equations is one of the seven Millennium Problems of the Clay Mathematics Institute.

A second focus is put on the modeling and analysis of problems in solid mechanics with a special emphasis on viscosity and plasticity; these questions are of crucial importance in material sciences and fracture mechanics. Furthermore, models of phase transitions and microstructures in crystal lattices are under investigation. The mathematical tools in this field are based on nonlinear analysis and homogenization. Recently also numerical simulation is used to validate phase field models.

The third point is on mathematical modeling and computational analysis of complex flow problems, in particular two-phase flows and transport processes occurring at fluid interfaces. The research builds on continuum mechanical modeling employing and further developing sharp-interface models with increasing levels of physico-chemical interface properties. For a deep understanding of the elementary transport and transfer processes, direct numerical simulations with the Volume-of-Fluid method are employed.

The fourth focal point lies in the analysis and numerical approximation techniques for singular integral equations which can be applied in fluid mechanics, computer tomography and image processing.

The research group Analysis presents two “Open Seminars" on a regular weekly basis, introductory seminars on functional analytic tools in the theory of partial differential equations as well as graduate seminars on recent questions in the above-mentioned fields of research. In addition to basic courses on mathematics for engineers, the research group offers lectures on analysis for majors in mathematics as well as advanced courses on partial differential equations and on related fields for graduate students. Moreover, once or twice a year, the research group organizes a workshop called "Analysistag" with speakers from Germany and abroad covering a wide spectrum of fields in analysis and its applications.

Several members of the research group Analysis are principal investigators of the German Research Foundation-Excellence Cluster "Smart Interfaces", where fluid interfaces and boundaries are investigated in an interdisciplinary environment, and/or of the International Research Training Group (IGK 1529) (Internationales Graduiertenkolleg) “Mathematical Fluid Dynamics" funded by DFG and JSPS and associated with TU Darmstadt, Waseda University in Tokyo and University of Tokyo in Japan. The program seeks to combine methods from several mathematical disciplines such as analysis, stochastics, geometry and optimization to pursue fundamental research in Fluid Dynamics.

Project: Analytical and numerical comparison of a hybrid phase field model for phase transitions and damage with the Allen-Cahn model

Simulation of phase transitions and damage is an issue of increasing importance in material science. The mathematical models, on which these simulations are based, are either of the sharp interface or phase field type. Phase field models are computationally advantageous. Practically all phase field models are of the Allen-Cahn or Cahn-Hilliard type. However, for realistic simulation of phase interfaces carrying low surface energy the parameters in these models must be chosen such that the diffusive interfaces in these models become almost sharp. In such situations, which are very common, simulations become very ineffective and the computational advantage of phase field models is lost.
In recent years two new models have been developed in the working group, which we call hybrid models. The analytical results obtained up to now indicate that with these models interfaces with low surface energy can be simulated effectively. However, because of the unusual form of the evolution equation in these models, standard mathematical methods to prove existence and convergence results cannot be used. We derived such results only for very special situations. Therefore the hybrid models must be justified and validated by numerical tests. Matlab-simulations based on a finite difference scheme have been carried out for some special situations. These simulations confirm the analytical results. However, for a thorough and reliable validation many more numerical tests must be carried out. In particular, computations based on the finite element method must be performed.
In cooperation with B. Markert from the Institut für Angewandte Mechanik of Stuttgart University we therefore plan to develop numerical methods for the hybrid model and to compare the computational results for the Allen-Cahn model with the results for the hybrid model.

Partner: B. Markert, Universität Stuttgart

Contact: H.-D. Alber

Project: Solution of the hybrid phase field model with finite elements

For the hybrid phase field model, which is explained in the preceding project description, we aim in this PhD research project to develop alternative numerical methods. As basic computational tool we want to use finite elements.

Contact: H.-D. Alber, A. Böttcher

Project: Existence theory for phase field models

For the hybrid phase field model described above existence results are only available in one space dimension when the constitutive relation is linear. When the constitutive relation is nonlinear or when the space dimension is greater than one no results exist. Moreover, no convergence results are known. The goal of this project is therefore to prove such existence and convergence results.

Partner: Peicheng Zhu, Basque center of applied mathematics, Bilbao

Contact: H.-D. Alber

Project: A directionally un-split geometrical Volume of Fluid (VoF) transport algorithm on unstructured meshes in OpenFOAM®

The research is focused on developing a numerically consistent geometrical advection algorithm for the volume fraction field used to approximate the solution of the sharp interface model of two-phase flow, with a second-order convergent Finite Volume Method that supports arbitrary unstructured meshes. Combination of support for arbitrary unstructured meshes and an accurate volume fraction advection present a basis for simulating two-phase flow phenomena driven by capillary forces in flow domains of arbitrary geometrical complexity. Within the project, the transport algorithm was implemented, validated and parallelized using the domain decomposition approach. Geometrical mapping algorithm was developed that enables local dynamic Adaptive Mesh Refinement, significantly increasing the ratio of accuracy and computational cost. Future developments will be focused on improvements of the flow solution algorithm as well as curvature calculations in order to improve the balance of forces acting on the discrete interface.

Contact: D. Bothe, T. Maric

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Project: Numerical Modeling of complex fluid-structure interaction (FSI)

This project investigates FSI problems with viscoelastic fluids, where a main difficulty lies in an accurate and stable simulation of flows of such fluids. Various high resolution schemes are used to investigate the accuracy at resolving the stress boundary layer. The stability problem is referred to the High Weissenberg Number Problem (HWNP). The exponential growth of the stress in the fluid models attributes to the problem. Within the project, several stabilization approaches like the log conformation or the square root conformation transformation are compared for several benchmark cases. A strategy for the coupling of a viscoelastic fluid and an elastic structure is developed.

Partner: M. Schäfer, FNB, TU Darmstadt

Support: Center of Smart Interfaces, Graduate School of Computational Engineering

Contact: D. Bothe, X. Chen

Project: Modeling and Numerical Simulation of Mass Transfer in Bubbly Flows with OpenFOAM

The hydrodynamics and species transfer in bubble column reactors is investigated by means of numerical simulations on two different levels of detail. Direct Numerical Simulation methods are developed and applied which provides detailed insights into the flow field, allowing for an improved closure for interfacial species transport in bubble groups. The resulting closure is used to study species transfer in bubble column reactors using a Two-Fluid Model.

Partner: M. Schlüter, TU Hamburg-Harburg

Contact: D. Bothe, D. Deising

Project: Reactive Mass Transfer from Rising Gas Bubbles

Mass transfer from single rising gas bubbles, modeled as incompressible two-phase Navier-Stokes equations coupled to a system of convection-diffusion-reaction equations, is investigated. Direct numerical simulation (DNS) is used to study the interaction of mass transfer and hydrodynamics. The goal of this project is to develop numerical methods for DNS which accurately capture local mass transfer at deformable fluid interfaces.

Support: DFG – project PAK 119

Partner: M. Schlüter, TU Hamburg-Harburg; H.-J. Warnecke, Universität Paderborn; B. Weigand, Universität Stuttgart

Contact: D. Bothe, S. Fleckenstein

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Project: Stability of falling films

The hydrodynamic stability of thin films of viscous liquids that run down an inclined plane under the action of gravity is investigated. Non-periodic perturbations and non-parallel base flows are taken into account by a global linear stability algorithm, which is closely related to Arnoldi's algorithm for the eigensystem analysis of sparse matrices. For this, it is necessary to evaluate the response of the base flow to perturbations, which is done with the volume of fluid in-house code *FS3D*. Moreover, the influence of insoluble surfactant on the primary instability is investigated analytically in the space-periodic setting.

Partner: T. Nishida, Kyoto University, Kyoto; Y. Teramoto, Setsunan University, Osaka; A. Tezuka, Waseda University, Tokyo

Contact: D. Bothe, C. Albert

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Project: Direct Numerical Simulation of Multicomponent Surfactant Transport on Fluidic Interfaces

Computational Fluid Dynamics (CFD) is applied to accomplish Direct Numerical Simulation (DNS) in order to gain detailed insight into the hydrodynamics of single drops growing at a capillary [1]. An Arbitrary Lagrangian Eulerian (ALE) interface tracking method is employed. Governing equations are discretized by an unstructured collocated Finite-Volume method and a Finite-Area method [3]. Local adaptive re-meshing allows for significant interface deformation. Indications for future improvements of the established evaluation procedure regarding surface tension are provided. As for the influence of surfactants, diffusive interfacial transport is considered by Maxwell-Stefan equations, which are iteratively inverted [2]. The surfactant transport is solved by a block coupled solution algorithm. A variety of state-of-the art models for diffusion-limited and sorption-limited sorption processes are implemented.

Support: DFG Priority Program – SPP 1506

Partner: R. Miller, MPI Colloids and Interfaces, Potsdam/Golm

Contact: D. Bothe, K. Dieter-Kissling

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Project: L_p-Theory for Incompressible Newtonian Flows subject to Energy Preserving Boundary Conditions

This project aimed at a rigorous derivation as well as an analysis of a large class of boundary conditions for the Navier-Stokes equations, which contains classical boundary conditions for fixed walls (e. g. no-slip, Navier, perfect slip conditions), classical boundary conditions, which arise in model problems for free boundary problems (e. g. Neumann conditions), as well as numerous *artificial boundary conditions*, which already proved to be useful for direct numerical simulations. The obtained results are available in [1, 2].

Partner: J. Prüß, Universität Halle-Wittenberg

Support: Center of Smart Interfaces (DFG Cluster of Excellence 259)

Contact: D. Bothe, M. Köhne

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Project: L_p-Theory for Two-Phase Flows with Soluble Surfactant

The presence of surfactants has a pronounced effect on the surface tension and, hence, on the stress balance at the phase separating interface of two-phase flows. The transport of momentum induced by the local variations of the capillary forces are known as Marangoni effects. The aim of this project is to study a model which assumes the surfactant to be soluble in one of the adjacent bulk phases and which represents a generalization of the two-phase Navier-Stokes equations. The obtained results are available in [1].

Partner: J. Prüß, Universität Halle-Wittenberg

Support: Center of Smart Interfaces (DFG Cluster of Excellence 259)

Contact: D. Bothe, M. Köhne

References

[1] D. Bothe, M. Köhne, and J. Prüß. On Two-Phase Flows with Soluble Surfactant. *Preprint: http://arxiv.org/abs/1210.8131*, 2012.

Project: Direct Numerical Simulation of binary collisions of viscous and non-Newtonian droplets

Direct Numerical Simulations based on an extended Volume of Fluid (VOF) method are used to investigate binary droplet collisions. During collisions, extremely thin fluid lamellas appear especially in case of a shear-thinning rheology. These have to be accounted for within the numerical simulation in a physically sound way. One major finding is that an effective constant viscosity can be calculated which leads to the same collision dynamics. In order to simulate viscoelastic two-phase flow, the VOF method has been extended to the Oldroyd-B model. The energy balance and the elongation of the polymer molecules is studied numerically during droplet collision.

Partner: M. Sommerfeld, Universität Halle-Wittenberg

Support: DFG - project SPP 1423

Contact: D. Bothe, C. Focke

Project: Thermodynamically consistent modeling of chemically reacting multicomponent fluid systems

Multicomponent diffusion in fluid systems is commonly modeled via the Maxwell-Stefan equations. This approach is also employed for chemically reacting systems, but the standard derivation does not cover this case. This project aims at a rigorous deduction of the Maxwell-Stefan equations together with an extension to chemically reactive mixtures. The approach is based on partial balances in particular of the species momenta, where the entropy principle is exploited to obtain information on the interspecies momentum transfer. This yields a closed system of partial mass and momentum balances, from which the system of (extended) Maxwell-Stefan equations follows via an entropy based model reduction.

Partner: W. Dreyer, WIAS Berlin

Contact: D. Bothe

Project: Direct Numerical Simulation of Taylor Bubble Flow – Benchmark study

Validation of mathematical models and numerical methods for interfacial two-phase flow simulation is accomplished [1]. The Priority Program SPP 1506 *Transport Processes at Fluidic Interfaces* by the German Research Foundation DFG, headed by Prof. Dr. Bothe and Prof. Dr. Reusken (RWTH Aachen), proposes a benchmark problem by means of Taylor Bubble Flow. Its use is demonstrated by assessing and approving the numerical reliability and accuracy of conceptually different interfacial flow solvers. Special emphasis is set upon different approaches to surface tension calculation both for interface capturing (e.g. force-balanced approaches) and interface tracking (e.g. force-conservative approach) methodologies.

Support: DFG Priority Program – SPP 1506

Partner: Helmholtz-Zentrum, Dresden-Rossendorf; RWTH Aachen; Karlsruhe Institute of Technology (KIT)

Contact: H. Marschall, D. Bothe

References

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Project: Well-posedness and instantaneous reaction limit for reactive flows

In this project on reactive flows we regard the question of global well-posedness for a general system with triangular structure from the class of reaction-convection-diffusion equations in terms of unique weak solutions ([1]). In view of the complexity of huge reaction networks also the situation of fast chemical reactions is studied, where we investigate the link between the limit behaviour of solutions subject to increasing reaction speeds and a related model which is based on a certain kind of model reduction ([1]).

Partner: M. Pierre, G. Rolland

Support: DFG, Rennes Métropole

Contact: D. Bothe, A. Fischer

References

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Project: Global existence in electro-reaction-diffusion systems

A coupled system of reaction-electromigration-diffusion equations and a Poisson equation, the Nernst-Planck-Poisson system, with reversible chemical reactions is studied. The goal is to construct global-in-time weak solutions in space dimension $n \geq 3$ and characterize the long-time behaviour ([1]).

Partner: M. Pierre, G. Rolland

Support: DFG, Rennes Métropole

Contact: D. Bothe, A. Fischer

References

[1] D. Bothe, A. Fischer, M. Pierre, and G. Rolland. Global existence for diffusion-electromigration systems in any space dimension. *In preparation*.

Project: The Kato Square Root Problem for mixed boundary conditions

We study a system of second-order elliptic differential equations in divergence form on a bounded domain Ω. Our focus lies on non-smooth situations, i.e. bounded measurable complex-valued coefficients, Lipschitz domains and mixed boundary conditions. In particular, we do not assume the coefficients to be symmetric. Hence, the corresponding elliptic operator A is not necessarily self-adjoint on $L^2(\Omega)$. Although A formally is of second order, its natural domain in general does not admit two weak derivatives in $L^2(\Omega)$. On the other hand, the square root of A, figuratively a first-order operator, often has the expected regularity property $D(\sqrt{A}) = H^1(\Omega)$. This has first been conjectured by Kato in 1961. With the above assumptions on the coefficient the problem remained open for more than 40 years, even on the whole space $\Omega = \mathbb{R}^d$. By now, this so-called Kato Square Root Problem is solved on the whole space and on strongly Lipschitz domains subject to homogeneous Dirichlet- or Neumann boundary conditions. In the case of mixed boundary conditions a positive answer is given for a certain class of smooth domains and their bi-Lipschitz images. In this project we will head for a positive answer to the Kato Square Root Problem problem in the general setting described above.

Contact: M. Egert, R. Haller-Dintelmann, P. Tolksdorf

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Project: Regularity of weak solutions of the Navier-Stokes equations

For the three-dimensional non-stationary Navier-Stokes system there exist many classical conditions on initial values u_0 to guarantee the existence of a local in time regular solution, ranging from the condition $u_0 \in H^1_0(\Omega)$ over $u \in D(A^{1/4})$ (with the Stokes operator A) to $u \in L^3(\Omega)$. Over the last decades the assumptions on u_0 could be weakened step by step. The optimal result in this field was found recently by H. Sohr, W Varnhorn and R. Farwig (2009, 2012) using the notion of Besov spaces: Let $\mathbb{B}^{-2/s}_{q,s}(\Omega)$ denote the Besov space of solenoidal vector fields with vanishing normal component on the boundary $\partial\Omega$ such that $\int_0^\infty \|e^{-tA}u_0\|_q^s \, dt < \infty$. Then there exists a local in time regular solution $u \in L^s(0,T;L^q(\Omega))$ with $\frac{2}{s} + \frac{3}{q} = 1$ (Serrin's class) and with initial value u_0 if and only if $u_0 \in \mathbb{B}^{-2/s}_{q,s}(\Omega)$.
The aim of the project is to apply this necessary and sufficient condition not only at $t_0 = 0$ but at all or almost all epochs $t_0 \geq 0$ to prove new global regularity and uniqueness results of a given weak solution. Important arguments will be the strong energy inequality of the weak solution in order to apply classical uniqueness theorems on weak solutions and the fact that the defining integrability condition of the space $\mathbb{B}^{-2/s}_{q,s}(\Omega)$ can be replaced by $\int_0^\delta \|e^{-tA}u_0\|_q^s \, dt < \infty$ for an arbitrarily small $\delta > 0$.

Partner: H. Sohr (Universität Paderborn), W. Varnhorn (Universität Kassel)

Contact: R. Farwig

Project: Fluid flow in unbounded domains with Navier slip boundary condition

The flow of a viscous incompressible Newtonian fluid in unbounded domains poses new technical problems since the classical Helmholtz projection well-defined on $L^q(\Omega)$, $1 < q < \infty$, for bounded and exterior domains Ω or layer type domains does not exist in general unbounded domains unless $q = 2$. One possibility to solve this problem is the use of the function spaces $\tilde{L}^q(\Omega) = L^q(\Omega) \cap L^2(\Omega)$ when $2 \leq q < \infty$ and $\tilde{L}^q(\Omega) = L^q(\Omega) + L^2(\Omega)$ when $1 < q < 2$. In this setting the Helmholtz projection is bounded on every space $\tilde{L}^q(\Omega)$, $1 < q < \infty$, and the corresponding Stokes operator - together with Dirichlet boundary conditions - is a well-defined closed operator generating a holomorphic but possibly not bounded semigroup.
The aim of the project is to generalize these results from the Dirichlet case to the case of Navier slip and Robin boundary conditions, i.e., resolvent estimates and maximal regularity for the corresponding Stokes operator in suitably adapted $\tilde{L}^q$-spaces. The first main step is a careful analysis of known *a priori* estimates and the dependence of constants on the boundary regularity of bounded domains. The second step is the passage to the limit for a weakly convergent subsequence of solutions on a sequence of uniformly smooth bounded domains exhausting the given unbounded domain. A key lemma will be the L^2-case in which constants in *a priori* estimates are independent of the domain. Then the case $q > 2$ can be solved using the L^2-result, whereas the case $1 < q < 2$ is based on duality arguments.

Partner: S. Shimizu (Shizuoka University, Shizuoka, Japan)

Contact: R. Farwig, V. Rosteck

Project: Stationary fluid flow in a two-dimensional aperture domain of Jeffery-Hamel type.

Stationary Navier-Stokes flow in a two-dimensional unbounded domain poses severe difficulties compared to the three-dimensional case since for a sequence of approximate solutions bounded in the homogeneous Sobolev space $\hat{H}_0^{1,2}$ no embedding into any L^q-space is available. Therefore, knowledge on the behavior of solutions at space infinity will get lost in the limiting procedure. Actually, it is an open problem whether there exists a stationary Navier-Stokes solution for flow past a two-dimensional obstacle with prescribed velocity at space infinity, unless the obstacle and the fluid flow satisfy some symmetry assumptions. The situation is almost similar for a two-dimensional aperture domain consisting of two half spaces connected by a hole in an infinite separating wall. In this case the flux through the hole (or the pressure drop at space infinity) is necessary to get uniqueness even in the linear case.
G.P. Galdi, M. Padula and V.A. Solonnikov (1996) proved the existence and uniqueness of a symmetric stationary solution with prescribed small flux in a weighted L^∞-space which behaves near space infinity as a Jeffery-Hamel flow. Crucial arguments in their proof are cancellation properties of integrals for symmetric functions. The aim of the project is to generalize - possibly in different function spaces - their result to non-symmetric aperture domains allowing also for non-symmetric solutions.

Partner: T. Hishida (Nagoya University, Japan)

Contact: R. Farwig

Project: Conditional regularity of weak solutions of the Navier-Stokes system by components of the vorticity vector

Consider a weak solution u of the nonstationary Navier-Stokes system in three dimensions. In addition to the classical Serrin condition on $L^s(0,T;L^q(\Omega))$-integrability of the velocity vector u where $\frac{2}{s}+\frac{3}{q}=1$ there do exist numerous other conditions on components of u, on components of the gradient ∇u, on the vorticity vector $\omega = \operatorname{curl} u$, the associated pressure or eigenvalues of the symmetric gradient $\frac{1}{2}\big(\nabla u + (\nabla u)^T\big)$. An interesting result by D. Chae, H. J. Choe (1999) proves regularity of u when two (!) components of ω lie in $L^s(L^q)$, $\frac{2}{s}+\frac{3}{q}=2$. This result is close to the two-dimensional situation where ω has only one nonzero component. However, an analogous result using only one component of the vorticity vector seems to be out of reach and closely related to the open Millennium problem (2000) of Clay Mathematics Institute on global regularity.
In a recent paper J. Neustupa and P. Penel (2012) proved a conditional regularity result using only one component of a vorticity-like term: They used the spectral decomposition of the self-adjoint operator curl with spectral resolution $(E_\lambda)_{\lambda\in\mathbb{R}}$ and its positive part only, i.e., $\int_0^\infty \lambda\, dE_\lambda$. Since this operator can be written also in terms of classical singular integral operators, we expect a generalization of the results of Neustupa and Penel to the L^q-setting and into a more physically motivated language.

Partner: J. Neustupa (Czech Academy of Sciences, Prague)

Contact: R. Farwig

Project: Fundamental solutions for fluid flow around moving obstacles

The fundamental solution of a partial differential equation is an indispensable tool in the investigation of local regularity properties and of decay properties as time or the spatial variable goes to infinity. In this project we are looking for the fundamental solution of instationary flow of a viscous incompressible fluid past a moving obstacle. Working in a coordinate system attached to the moving and/or rotating obstacle we are lead to a modified (Navier-)Stokes system with several additional terms, some of which are not subordinate to the Laplacian or are time-dependent. Nevertheless, using a special transformation defined by an auxiliary ODE system, the problem can be simplified to the classical Stokes or Oseen system. Then the fundamental solution can be found in terms of classical functions including - due to the use of the Helmholtz projection - Kummer functions and the solution of the ODE system, let it be known either explicitly or only implicitly. By these means, we are able to find the more or less explicit fundamental solution in several special physical situations of moving and rotating obstacles, e.g. for flow generated by a fan or a rotating body with precession or around helicopter blades. The next step will be to find the leading terms in an asymptotic expansion and to prove the existence and describe the shape of the wake region behind the obstacle.

Partner: Š. Nečasová (Czech Academy of Sciences, Prague)

Contact: R. Farwig

Project: IRTG 1529: Mathematical Fluid Mechanics (Concentration-diffusion Phenomenon

One of the projects of the IRTG 1529 deals with the asymptotic structure of solutions of the Boussinesq equations in the whole space $\mathbb{R}^n$ and the so-called concentration-diffusion phenomenon. The Boussinesq equations describe the flow of a viscous incompressible and heat-conductive Newtonian fluid where the momentum equation and the heat equation are coupled mainly by the buoyancy term $g\vartheta$ in the momentum equation; here ϑ is the temperature and g, the gravity force of a bounded mass distribution, is assumed to decay like $|x|^{n-1}$. In this setting we construct mild and strong solutions and get a decay for the velocity u as $|x|^{-n}$ when $\int g\vartheta \neq 0$ - in contrast to the usual Navier-Stokes case with vanishing force where the decay $|x|^{-n-1}$ is optimal. Moreover, under special symmetry assumptions on g and u_0 we find for each finite set of epochs t_j an initial value ϑ_0 such that the decay of u changes from $|x|^{-n}$ to $|x|^{-n-1}$ and back to $|x|^{-n}$ only in the neighborhood of each t_j but nowhere else, called a concentration-diffusion phenomenon. For this solution, the leading term of type $|x|^{-n}$ changes its orientation near t_j due to a leading coefficient with sign change. In the project similar results are under investigation for the half space case, the equations of magnetohydrodynamics and Navier-Stokes equations with Coriolis force term modeling rotating fluids.

Partner: International Research Training Group (IRTG 1529) on Mathematical Fluid Mechanics, TU Darmstadt - Waseda University Tokyo

Contact: R. Farwig, M. Yamazaki

Project: Smart Interfaces: Understanding and Designing Fluid Boundaries

We consider the cooling of some object by the flow of a viscous incompressible fluid over the surface of the object or the heating of a fluid via the contact with the surface of a heating device. The cooling or heating is strongly influenced by the regularity or roughness

of the boundary which in general is assumed to be of Lipschitz type only. The underlying model is the Boussinesq system in which the classical Navier-Stokes system is coupled with the heat equation mainly via the buoyancy term. The heat flux through the boundary is an important physical quantity which should be controlled, either maximized or minimized depending on the physical problem at hand.
In the first part of the project we build up the theory of weak and strong solutions to the Boussinesq system in unbounded domains with Lipschitz boundary. The second aim is the analysis of the change of the boundary condition for a sequence of domains Ω_k with oscillating boundaries and decreasing amplitude, but increasing frequency. The main tool in this analysis is the theory of Young measures. A consequence of the boundary oscillations in the case of Robin boundary conditions for the temperature is a new weight factor in the Robin condition depending on the way of convergence of Ω_k. This result for perturbed half spaces will be generalized to bounded domains and coupled with methods from optimal control theory.

Partner: Cluster of Excellence at TU Darmstadt: Smart Interfaces: Understanding and Designing Fluid Boundaries

Contact: R. Farwig, C. Komo

Project: Global L^p solutions for Oldroyd-B models

We investigate existence and uniqueness of global solution for Oldroyd-B models. To be more precise, we first prove existence of stationary solutions. In a second step we show that global solutions exist for initial data sufficiently close to stationary solutions. Finally, we investigate stability of stationary solutions.

Partner: Y. Shibata, Waseda Univeristy, Tokyo

Contact: M. Geissert

Project: Square roots of divergence form operators in non-smooth situations

Elliptic regularity of divergence form operators in non-smooth situations, i.e. bounded measurable coefficients, Lipschitz domains and mixed boundary conditions, is a delicate matter. For instance it is possible for every $p > 2$ to construct such an operator of second order whose domain on the corresponding $W^{-1,p}$-space is not contained in a Sobolev space of type $W^{1,p}$, i.e. the gain in regularity when solving the corresponding equation is not two. Nevertheless, for scalar equations we could show in [2] that the square root of such an operator behaves nicely, which means that its domain on the same $W^{-1,p}$-space is L^p, i.e. the gain in regularity is one.
Based on this result, in the future we will head for a corresponding result for systems of equations and deal with applications to parabolic linear and quasilinear equations.

Partner: J. Rehberg (Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin) and P. Auscher (University of Paris-Sud (Paris XI))

Contact: M. Egert, R. Haller-Dintelmann

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[2] P. Auscher, N. Badr, R. Haller-Dintelmann, and J. Rehberg. The square root problem for second order, divergence form operators with mixed boundary conditions on L^p. Preprint, 2012. arXiv: 1210.0780.

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Project: Hölder regularity for solutions to mixed boundary value problems

In non-smooth situations (Lipschitz domains, discontinuous coefficients, mixed boundary conditions) one can in general not expect that even for regular data f the solution u to the elliptic problem $-\nabla \cdot \mu \nabla u = f$ lies in a Sobolev space $W^{1,p}$ for $p > 2$. In particular, one cannot infer continuity of the solution from a Sobolev embedding argument, as soon as the space dimension is greater than 2.
Based on earlier work on this topic, we want to formulate a general geometric framework that allows to prove Hölder continuity of the solution directly also in cases, where the Sobolev embedding is not applicable. In particular, we want to treat arbitrary space dimensions.

Partner: J. Rehberg (Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin)

Contact: R. Haller-Dintelmann

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Project: The Klein-Gordon equations on a star-shaped network

We consider the Klein-Gordon equations on n copies of the interval $(0, \infty)$ glued together at the origin with usual Kirchhoff (or other) transmission conditions in the vertex. In earlier work we already established a spectral representation of the corresponding operator and, based on this, an explicit solution formula.
Exploiting this formula, we intend to understand effects in a quantitative manner related to the tunnel effect like retarded reflection and advanced transmission. Furthermore, we study the L^∞-time decay of the solutions and apply this to non-linear equations.

Partner: F. Ali Mehmeti, V. Régnier (University of Valenciennes and Hainaut-Cambresis)

Contact: R. Haller-Dintelmann

References

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Project: The Stokes and Navier-Stokes Equation in Spaces of Bounded Functions

This project deals with properties of the Stokes or Navier-Stokes equations on so called admissable domains $Omega$ on $L^\infty_\sigma(Omega)$. We already proved that the Stokes operator generates an analytic semigroup on $L^\infty_\sigma(\Omega)$. Our aim is to give a rather precise description of its domain. This then would allow to treat various nonlinearities arsinf in applications e.g. to complex fluids.

Partner: K. Abe and Y. Giga, University of Tokyo, Japan

Contact: M. Hieber

Project: Viscoelastic Flow past rotating obstacles

The aim of this project is to consider various viscoelastic flows, e.g. Oldroyd-B flows past rotating obstacles. This moving domain problem is transformed first by a suitable change of coordinates to a problem on a fixed domain involving terms of Ornstein-Uhlenback type. We then aim to prove global existence results for the original problem taking advantage of Ornstein-Uhlenbeck theory.

Partner: P. Galdi, University of Pittsburgh

Contact: M. Hieber

Project: Free boundary value problems in Geophysical Flows

In this project we consider the free boundary value problem for the promitive equations arising in geophysical fluid dynamics. Our first aim is to prove local wellposedness of this system. Our approach will be based on the Hanzawa transformation.

Partner: E. Titi, UC Irvine and Weizmann Institute, Rehovot

Contact: M. Hieber

Project: Operator theory and numerical analysis

On the operator theory side, our main interest is twofold: first in index formulas for Toeplitz plus Hankel operators. These operators occur in many applications, e.g. in numerical analysis for singular integral equations. Whereas the Fredholm theory for Toeplitz plus Hankel operators with piecewise continuous generating functions is fairly well understood, the known formulas for the Fredholm index of these operators are quite involved and hard to use. Recently we succeeded to derive an (as we believe, handy) index formula, which is based on the observation that several Hankel operators belong to the Banach algebra generated by Toeplitz operators. It would be interesting to extend this formula for other classes of Toeplitz plus Hankel operators. Our second objective in the field of operator theory is limit theorems of Szegö type. The classical Szegö theorems study the asymptotic behaviour of the determinants of the finite sections $P_nT(a)P_n$ of Toeplitz operators. We want to generalize these results to operators which have non-constant functions on their diagonals. Particular attention is paid to operators with almost periodic coefficients, which are of immense importance in applications (the prominent Almost Mathieu operator is an

example of a band operator with almost periodic coefficients). Whereas the generalizations of the so-called first and strong Szegö limit theorems to this context is now widely accomplished, some serious questions still remain open. For example, the case of operators where more than one "irrationality" occurs is largely open. Second part: For the numerical solution of an operator equation on an infinite-dimensional space, one discretizes the operator to obtain a sequence of $n \times n$ matrices A_n. Interesting asymptotic properties of the sequence (A_n) can be studied by embedding this sequence into an appropriate C^*-algebra and by studying the structure of that algebra. Of particular interest are algebras of matrix sequences which own the following (self-similarity) property: Every sequence in the algebra can be rediscovered from each of its infinite subsequences modulo a sequence tending to zero in the norm. Examples of such algebras arise, for instance, from the finite sections method for Toeplitz or singular integral operators. Sequences (A_n) in self-similar algebras are distinguished by their excellent asymptotic properties: for example, the pseudospectra of the A_n converge with respect to the Hausdorff metric. A basic tool to analyse algebras of matrix sequences is a Fredholm theory of sequences, which has also found interesting applications: a proof of the Arveson dichotomy for self-adjoint sequences, a proof of the index formula for band-dominated operators, and the creation of an algorithm to determine partial indices of matrix functions numerically, for instance. We derived results along these lines for spatial discretizations of several classes of C^*-algebras including Cuntz algebras and reduced group C^*-algebras and (still) plan to extend them to multi-dimensional disk algebras and other algebras generated by isometries.

Partner: T. Ehrhardt, B. Silbermann

Contact: S. Roch

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Project: Spectral theory of band operators

Our main interest is in Jacobi (= tridiagonal band) operators, which occur, for example, as discretizations of one-dimensional Schrödinger operators. We consider random potentials (and can allow also random entries on the other diagonals), which are deterministically modelled by pseudo-ergodic sequences, following an idea by E. B. Davies. We study a version of the finite section method for the approximate solution of equations $Ax = b$ in infinitely many variables, where A is a pseudo-ergodic Jacobi operator. In other words, we approximately solve infinite second order difference equations with stochastic coefficients by reducing the infinite volume case to the (large) finite volume case. Our goal is to design the finite sections by choosing the truncations in such a way that the associated limit operators are of a special form (e.g., Toeplitz operators) and to derive spectral inclusions.

Partner: M. Lindner

Contact: S. Roch

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[1] M. Lindner and S. Roch. Finite sections of random Jacobi operators. *SIAM J. Numer. Anal.*, 50:287–306, 2012.

Project: Band-dominated operators, their Fredholm theory and finite sections

A band-dominated operator is the norm limit of a sequence of band operators, i.e., of operators which have a band matrix as their representation with respect to a fixed basis. For example, pseudodifferential operators on $L^2(\mathbb{R}^N)$ with symbols in $S^0_{0,0}$ and several classes of convolution operators own this property. Fredholm properties of band-dominated operators can be studied via their limit operators, which reflect the behaviour of the operator at infinity. A typical result says that a band-dominated operator is Fredholm if and only if each of its limit operators is invertible and if the norms of their inverses are uniformly bounded. Also the index of a Fredholm band dominated operator (on $l^2(\mathbb{Z})$) can be expressed in terms of (local) indices of its limit operators. One goal of the project is to use the above methods to study the Fredholm properties of Schrödinger operators (and other operators of mathematical physics) and the decay of their eigenfunctions. A second line of research concerns the Fredholm theory and numerical analysis of discretized differential operators acting on periodic nano-structures (like honeycomb structures and nano-tubes). Third, as we observed only recently, the above sketched methods seem to apply to study diffraction by ($\mathbb{Z}^1$- or $\mathbb{Z}^2$-) periodic graphs for second order elliptic equations. In general, the study of the solvability of pseudodifferential operators on a periodic graph rises serious difficulties because the graph is a singular manifold with an infinite set of singular points. We are mainly interested in a setting where the graph is periodic, but the coefficients of the operator and in the transmission conditions are not (such that the standard Floquet method does not apply).

Partner: V. S. Rabinovich

Support: CONACYT, DFG

Contact: S. Roch

References

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[4] V. S. Rabinovich and S. Roch. Essential spectrum of difference operators on periodic metric spaces. *Funk. Anal. Appl.*, 43:151–154, 2009.

Project: Numerical analysis for convolution-type operators

The goal of this project is to investigate the stability of projection methods for several classes of convolution type operators. In particular, we will consider operators on $L^p(R)$

which belong to the closed Banach algebra generated by all operators of multiplication by a piecewise continuous function, all operators of convolution by a piecewise continuous Fourier multiplier, and by a flip operator. The latter operator involves serious difficulties since localization techniques do not apply in the standard way. Another difficulty arises because the spectra of the generators become massive sets, which makes it much harder to verify the inverse closedness of the considered algebras in the algebra of all bounded linear operators on $L^p(R)$. In the reference cited below we succeeded to derive a Fredholm criterion for operators in this algebra, which applies in particular to Wiener-Hopf plus Hankel operators on Lebesgue spaces L^p, and to Toeplitz plus Hankel operators on Hardy spaces H^p. In a next step we plan to turn to numerical analysis for these operators. Formally, this means to identify the above mentioned operators with constant sequences and to examine an algebra which contains these constant sequences together with a (non-constant) sequence of projections. Moreover, we wish to define this algebra in such a way that it contains with each sequence (A_t) the (appropriately defined) sequence $(F^{-1}A_tF)$, with F the Fourier transform. This algebra should provide a suitable frame to study approximation methods with cut-off both in the original space as in the frequency domain.

Partner: P. dos Santos

Support: CEAF/FCT

Contact: S. Roch

References

[1] S. Roch and P. Santos. Two points, one limit: Homogenization techniques for two-point local algebras. Preprint, TU Darmstadt, 2011.

[2] S. Roch, P. Santos, and B. Silbermann. *Non-commutative Gelfand Theories. A Tool-kit for Operator Theorists and Numerical Analysts*. Springer, 2011.

Project: Well-posedness and stability of electro-kinetic flows

The term "Electro-kinetic flows" summarizes the class of phenomena, where a fluid with charged solutes exhibits a flow as response to an externally applied electrical field. In order to model such situations we consider a coupled system of Navier-Stokes and Nernst-Planck equations complemented by a Poisson equation for the electro-static potential, which describe the evolution of the velocity and the concentration fields of dissolved constituents in an electrolyte solution. For the resulting Navier-Stokes-Nernst-Planck-Poisson system we are concerned with local and global well-posedness as well as existence and uniqueness of steady states and their stability properties, cf. [1].

Partner: D. Bothe

Support: DFG

Contact: J. Saal, A. Fischer

References

[1] D. Bothe, A. Fischer, and J. Saal. Global well-posedness and stability of electro-kinetic flows. submitted.

Project: Navier-Stokes equations on wedge domains

Objective of this project is the understanding and treatment of three phase contact line problems. Finding an approach to such problems leads to questions under which circumstances one can solve initial boundary value problems on domains with non-smooth boundary. In a first step well-posedness for Stokes and Navier-Stokes equations with full-slip boundary conditions on a wedge domain is considered, cf. [1].

Support: DFG

Contact: S. Maier, J. Saal

References

[1] S. Maier and J. Saal. Stokes and Navier-Stokes equations with perfect slip on wedge type domains. submitted.

Project: L^p-theory for the Tornado-Hurricance Equations

The Tornado-Hurricane equations represent a system of equations modeling the evolution of cyclones. Based on a first approach given in [1] in L^2, the objective is to develop an L^p-theory. In this setting preciser results on well-posedness as well as new results on regularity and stability seem to be available.

Support: DFG

Contact: S. Maier, J. Saal

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1.2.3 Applied Geometry

The research group "Geometry and Approximation" investigates geometric objects, typically surfaces, as well as approximations thereof.
Classical Differential Geometry deals with curves and surfaces. Surfaces arising in the sciences are frequently minimizers to certain functionals. In the simplest case, say for a biological cell, they might bound a given volume in such a way that the area of the surface is minimal. Other interfaces minimize functionals involving curvatures. Critical points satisfy Euler equations, namely non-linear partial differential equations. Our goal is to establish new solutions and properties of solutions, in Euclidean 3-space but also in other Riemannian spaces, by employing analysis and Riemannian Geometry.
In Geometric Modeling, mathematical tools for the explicit description of geometric objects are developed and analyzed. Unlike in elementary geometry, the focus is not on simple objects like circles or spheres, but on more complex structures, as they arise in various applications. One may think of a car body, a piece of cloth, or a dinosaur in an animated film.
The surfaces considered in Differential Geometry and Geometric Modeling typically have a fairly complicated structure. For further processing, it is necesary to approximate them in a function space of reduced complexity, say a spline space. For that reason, the development of tools for efficient approximation of geometric objects is an important task, giving rise to interesting mathematical questions in the field of multivariate approximation theory.

Project: New teaching ideas for a course in differential geometry

This project develops ideas to re-structure the syllabus of differential geometry courses to make the content more accessible. This is of particular interest for teaching mathematics education majors and non-mathematics majors. The aim of the method is to enable students who do not have very deep knowledge of analysis to understand crucial concepts of differential geometry, including geodesics, curvature, and the Gauss-Bonnet theorem. The project also deals with interactive displays of curves and surfaces in a classroom setting, and how to produce high-quality illustrations. The concept of metric geometry is used to explain curvature without differentiation; this also makes it possible to give students easy access to current research topics.

Contact: R. Gunesch

References

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Project: Blackboard teaching, video recording, and web transmission: a mathematical perspective

Students greatly benefit from being able to review lectures and actually "see" the content repeatedly. Thus there is a need for a mechanism for recording visual information during class and for transmitting it easily to the students. Several such mechanisms already exist; however, they are not tailored towards mathematics. In particular, when dealing with the "chalk on blackboard" style of teaching which has remained very common in mathematics and which is highly popular both with lecturers and with students, existing software often have serious shortcomings. This project develops reliable, easy-to-use, affordable methods for this type of recording and transmission. Most importantly, these methods do not require lecturers to adapt their teaching style or worry about technology.

Contact: R. Gunesch

References

[1] R. Gunesch.

[2] R. Gunesch. Improving advanced university courses with new lecturing technology: practical studies of classroom video recording and dissemanation on the www. 2013.

Project: Surfaces in homogeneous 3-manifolds

Minimal and constant mean curvature surfaces are a traditional subject when the ambient space is Euclidean space or more generally a space form such as hyperbolic space or a sphere. Recently, the case of homogeneous 3-manifolds has received much attention. We study these spaces as Riemannian fibrations and investigate minimal surfaces in these spaces in order to obtain minimal and constant mean curvature surfaces in Riemannian product spaces by the Benoit sister construction.

Partner: R. Kusner (Amherst, MA)

Contact: K. Grosse-Brauckmann

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[2] K. Grosse-Brauckmann and R. B. Kusner. Conjugate plateau constructions for homogeneous 3-manifolds. in preparation.

Project: Periodic surfaces and interfaces

Periodic surfaces play an important role for the modelling of various naturally occuring interfaces. The functional to be minimized is often not exactly known. Nevertheless, there are obvious candidates such as area, the Willmore functional, etc.; perhaps under a volume constraint. In the constrained Willmore case, limits of the surface families form a way to construct a Schoen skeletal graph rigorously as a periodic Steiner tree in three-dimensional space.

Partner: G. E. Schröder-Turk (Universität Erlangen-Nürnberg)

Contact: K. Grosse-Brauckmann

Project: Ambient B-Splines

Ambient B-Splines are a new approach to approximating functions on embedded manifolds with arbitrary smoothness and order. It is based on restricting standard tensor product splines, defined on ambient space, to the manifold. The well-known stability problem is solved by extending the function defined on the manifold constantly in normal direction. In this project, we investigate applications of the method in the reconstruction of smooth surfaces and in the approximation of large data sets in geo-sciences, like the geoid.

Partner: Fraunhofer IGD, Darmstadt

Contact: U. Reif

Project: Generalized Lane-Riesenfeld Algorithms

We investigate various generalizations of the fundamental Lane-Riesenfeld algorithm under the assumption that equal operators are used for avaraging and refinement. In particular, we consider geometric variants, where standard affine combinations are replaced by general nonlinear mappings, which are invariant under similarities.

Partner: K. Hormann and T. Cashman

Contact: U. Reif

Project: Geometric Subdivision Algorithms

While linear subdivision algorithms are well understood, the analysis of newly devised geometric algorithms offers a new challenge. In this project, we develop an approach to determining critical Hölder exponents of univariate schemes which are invariant with respect to the group of similarity transformations.

Partner: M. Sabin (University of Cambridge)

Contact: U. Reif

Project: Two-Stage Approximation on Domains

Approximation of functions or scattered data on n-dimensional domains is a frequent task in applications. In this project, we settle the notorious stability and fairness problems near

the boundary of the domain by using extended B-splines. Our method is the first one which yields optimal approximation order on the whole domain with constants independent of the distribution of data sites.

Partner: O. Davydov and J. Prasiswa

Contact: U. Reif

1.2.4 Didactics and Pedagogics of Mathematics

Research in the Didactics and Pedagogics of Mathematics
The working group didactics of mathematics deals with different questions how to teach and to learn mathematics. Theoretical studies are the focus of our working group e.g. explaining curricular decisions as well as theoretically founded lesson concepts and their long-term testing for secondary level I and II for the development of mathematical competences. Results of Action Theory form an important basis for our work: we based a theory of working with tasks on it as well as a model to describe typical instructional situations. In the field of university teaching, we are researching which pedagocical content knowledge future teachers are learning e.g. for the assessment of their own respective instruction quality.
In the center of our research in 2011 and 2012 were the following topics and projects:

1. Constructing and testing competence models (part of the Priority Research Program "Competence Models")

2. The development and evaluation of integrated teaching concepts as well as corresponding training and further training concepts for maths teachers, e.g. the computer-based teaching and learning of mathematics (CAliMERO) or models for initial differentiation (MABIKOM) within the scientific framework of different model tests in Lower Saxony in Germany

3. The development and evaluation of e-learning - activities in research and development (participation in the postgraduate program on e-learning at TU Darmstadt), in the teacher further training (www.proLehre.de) and for game-based learning

The DFG priority program "Competence Models" not only allowed to gain valuable insight into the possibilities of further development of maths lessons but also to develop new survey tools for the collection of ideas on the teaching and learning of maths which were presented on national and international conferences 2011 and 2012. New computer-based learning and teaching arrangements for Mathematics and Didactics of Mathematics have been developed and tested.

Research Group in Operator Algebras and Mathematical Physics
Quantum probability is an extension of classical probability theory that allows to treat also probabilistic effects of quantum systems. Operator algebras allow a unified treatment of both cases, classical probability as well as probability in quantum systems. All basic notions of probability like expectations, random variables, stochastic processes, martingales, etc. can be formulated in the language of operator algebras in such a way that they reduce to the notions of classical probability whenever the operator algebra is commutative.

Our **research interests** range from theoretical mathematical investigations to physical applications. Consequently, the members of our research group as well as our research partners range from pure mathematicians to physicists.
Common to most of our research is its focus on certain **dynamical behaviour**, be it the dynamics of classical and quantum stochastic processes (Markov processes, noise, quantum trajectories, filtering, etc.), be it the dynamics generated by completely positive maps (ergodic properties, existence and numerical computation of equilibrium states, quantum state preparation, etc.). Our investigations on the long time behaviour of Markov processes have opened the door to our recent research on quantum coding. It links quantum probability in a new and unexpected way with the fields of quantum information and quantum control.

Project: Effects of Learning and Diagnostic Environments for Mathematics with Game Elements (Effekte mathematischer Lern- und Diagnoseumgebungen mit spielerischen Elementen) (2011-2013)

Funded by the department "FiF – Forum für interdisziplinäre Forschung" of TU Darmstadt an interdisciplinary research cooperation was initiated. The cooperation was launched with Prof. Regina Bruder (Working Group Didactic of Mathematics, FB 4), Prof. Ralf Steinmetz (Working Group Serious Games, FB 18) and Prof. Bernhard Schmitz as heads of the project and Kristina Richter (FB 4) as project coordinator.
The research project addresses the topic of instructional and diagnostic support of game elements in learning environments for mathematics. The scope of the cooperation is the conception and development of a learning game as well as the investigation of effects on motivation and learning outcomes of students in mathematics classrooms. The conceptualization and development is in progress, the pilot studies are in preparation.
`http://www3.mathematik.tu-darmstadt.de/ags/didaktik/forschung/didaktik/projekte/fif-seit-2011/der-wechsel-ein-mathekrimi.html`

Support: FiF - Forum interdisziplinäre Forschung (2011-2013)

Contact: R. Bruder and K. Richter

Project: (HEUristic work with REpresentations of functional relationships and the diagnosis of mathematical COmpetencies of students (HEUREKO)

The research goal of this project was the development and the empirical verification of a competence structure model concerning the field of functional relationships in grade 9 and 10 . In this context we focused on situations where processes of growth and change are mathematically assessed (overarching idea "change"). We systematically investigated the ability to translate between different forms of representation (algebraic, graphic, numerical and verbal form of representation). Therefore we used methods of item response theory to gain an important prerequisite for the development of effective teaching and learning concepts. Additionally we focused on certain elements of cognitive action to get a deeper understanding in the translation process action (Identification, Construction, Description and Explanation).
Concerning the translations between different forms of representation we empirically tested the anticipated 5 dimensional competence structure model. In comparison with other possible models (using information criteria measures) our model showed the best model fit and could be verified.

Concerning the elements of cognitive action we additionally analyzed the data set and verified a 3 dimensional model with within-item-multidimensionality (http://www.kompetenzmodelle.dipf.de).

Partner: T. Leuders and M. Wirtz, Freiburg; T. Kelava, Darmstadt

Support: DFG (Priority Research Program "Competence Models"

Contact: R. Nitsch, R. Bruder

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[2] R. Nitsch, A. Fredebohm, R. Bruder, D. Naccarella, T. Leuders, and M. Wirtz. Students' Competencies in Working with Functions in Secondary Mathematics Education - Empirical Examination of a Competence Structure Model. In *International Journal of Science and Mathematics Education*. to appear.

Project: MABIKOM 2008-2012

The project MABIKOM (technology supported mathematics classes with a competency development that considers individual student differences) is based on the results of the school trial CALiMERO, a joint project of the TU Darmstadt, Texas Instruments and the ministry of education in Niedersachsen.
The school trial CALiMERO develops and tests a teaching concept for using CAS-able pocket computers in mathematics classes in secondary schools, classes 7 to 10 in Niedersachsen. The project showed the need for other measures for considering individual student differences combined with the use of new technologies. Therefore the MABIKOM-project was established in 2008.
The growing demand for individualization and differentiation of teaching and learning processes needs an adequate instrument for checking the progress in learning and educational diagnostics. A useable repertoire of methods for a flexible organization of the learning environment is also needed.
These requirements are connected to a high standard of teaching and they need many preparations that can be managed by a teacher only in a very limited scale. This shows the need of adequate supporting instruments like teaching-models and elaborated, tested and flexible topic-specific teaching and learning materials.
This means a teaching concept is needed that is adequate for daily use and appropriate for considering individual differences in mathematics classes (grade 5 to 10, starting to use technologies in grade 7). It has to meet the claims that many students in a heterogeneous study group are appealed cognitive and motivational and that an effective learning progress is possible. Details: http://www.proLehre.de

Partner: T. Wehrse (Niedersachsen)

Support: TEXAS Instruments and Ministry of Education Lower Saxony

Contact: R. Bruder

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[1] J. Reibold and R. Bruder. Erfahrungen mit Elementen offener Differenzierung im Mathematikunterricht der Sekundarstufe I im niedersächsischen Modellprojekt MABIKOM. In R. Lazarides and A. Ittel, editors, *Differenzierung im mathematisch-naturwissenschaftlichen Unterricht*, pages 67–92. Verlag Julius Klinkhardt, 2011.

Project: CALiMERO 2005-2013

On the basis of the experiences made with graphics calculators in the German Federal State of Lower Saxony the school project started in summer 2005 with the aim to introduce the reasonable use of CAS-calculators in secondary school level I. To reach this target it is planned to develop a curriculum and design concept for maths lessons where a new tasks culture is established and the calculator is used for the enhancement of mathematical competencies. The project CAliMERO was started in the school year 2005/2006 in six Gymnasiums with 29 classes of level 7 which are working very closely with the developed lesson elements. In the current school year they are already 50 schools to use the material developed and tested the year before. In the next years CAliMERO will be continued up to class level 10. In order to enhance sustainable maths learning with CAS it is necessary, as described by Stacey (2003), to establish a teaching culture which corresponds to the use of CAS. Therefore a further training course of several days took place at the beginning of the project with representatives of the participating schools, experts from Lower Saxony and under the direction of Prof. Dr. Regina Bruder. There were discussions about appropriate teaching methods to support the development of competencies in CAS-supported lessons according to the German education standards (KMK, 2003). The teaching concept developed with the participating teachers intends to make use of the complex potential of calculators for the discovery of maths and for effective exercises for a better understanding. Additional meetings during the project are organized every three months to improve communication between the participants, to develop the next teaching elements and learning materials for the students and to discuss the state of evaluation. Moreover the TU Darmstadt offers project coaching by means of a special internet platform which allows to exchange the ideas of the participants and contains all developed materials (`http://www.prolehre.de`).

Partner: G. Pinkernell, Heidelberg

Support: TEXAS Instruments and Ministry of Education Lower Saxony

Contact: R. Bruder

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[2] R. Bruder and W. Weiskirch. *CAliMERO - Computer-Algebra im Mathematikunterricht. Band 9: Methodische und didaktische Handreichung*.

Project: Internet based professional training for math teachers

The Department of Mathematics at TU Darmstadt currently provides six Internet based professional training courses for math teachers in the German Federal State of Hesse with the focus on "Educational Standards for Math". The first half year course "Problem solving" started in the school year 2005/2006 followed by the course "Basics" in 2006/2007

and "Mathematical Modeling" in 2007/2008. In the school year 2010/2011 two courses "Mathematical Arguing" and "Within Differentiation" were established. In the school year 2011/2012 a new course "long-term building-up of Competence" went to start. Already about 500 teachers have been trained in these courses. Two internet platforms developed at the TU Darmstadt (Prof. Dr. Regina Bruder et al) are used as supporting systems for the courses: `http://www.madaba.de` (structured collection of math tasks) and `http://www.problemloesen.de` (materials for problem solving). An Evaluation and investigation of the sustainability of the professional trainings is proceeding in the frame of a part project. Research questions are how the teachers estimate the increase of their knowledge, which elements of the competences are conversant to the teacher after half respectively one year and how the teachers estimate the effects of the courses. Details on `http://www.proLehre.de`

Partner: J. Reibold, R. Szymanski, A. Böhnke

Support: Ministry of Education Hesse and Project SINUS-Transfer in Hessen

Contact: R. Nitsch

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Project: E-Learning Label and third party certification of E-Learning-Quality for computerbased learning environments (TUD-Gütesiegel)

Details on `http://www.elc.tu-darmstadt.de/` and `http://www.tud-guetesiegel.de`.

Partner: A. Müller, S. Melikov, J. Sonnberger (Research Training Group on Feedback Based Quality Management in eLearning)

Support: TU Darmstadt

Contact: R. Bruder

Project: PEDALE (PEer-based Diagnostic And Learning Environment) (2009-2012)

Starting as an interdisciplinary research cooperation, which was established in the context of the Research Training Group on Feedback Based Quality Management in eLearning (GRK E-Learning), the research project PEDALE (PEer-based Diagnostic And Learning Environment) was continued by Prof. Regina Bruder (Working Group Didactic of Mathematics, FB 4) and Prof. Ralf Steinmetz (Working Group Serious Games, FB 18) as heads of the project and Kristina Richter (FB 4) and Johannes Konert (FB 18) as project members. The technical development was finalized and a testing study was conducted in seven classrooms in Hesse.

The research project PEDALE (PEer-based Diagnostic And Learning Environment) adresses the topic of instructional support for mathematics classes with appropriate eLearning conceptions. The scope of PEDALE is the development of a computer-supported and peer-based learning and diagnosis environment for secondary school mathematics. The learning environment is designed to provide and distribute tasks, to manage peer review processes within the classroom network and to support the diagnostic activities of the teacher. The

project is in progress.
http://www3.mathematik.tu-darmstadt.de/index.php?id=1480

Support: DFG - GK E-Learning (2009-2011)

Contact: R. Bruder, K. Richter

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Project: TELPS - Teacher Education Lesson Plan Survey (2009-2013)

The aim of the project is to explore prospective teachers' mathematical pedagogical content knowledge (MPCK) within a Repertory Grid Survey and to support prospective teachers' development of professional competencies within this survey. This project is designed as a cross-sectional study with longitudinal components at the University of Technology Sydney and the TU Darmstadt.
We adapted the Repertory Grid Method and chose lesson plans as objects, which should be compared by the participants. Initially the participants were asked to focus their thoughts on the features of a "good" mathematics lesson, listing them in no particular order. We believed that this initial part of the survey would help them to get started with the analysis of the lesson plans that was important for those students who were in their first teacher education class. They then compared two lessons. The results of this comparison are documented in agrid, where the participants estimated the occurrence of the characteristics.
Within the project we can show, that students' perspectives on mathematics lesson plans changed in different ways: Some are more detailed in their lesson plan analysis, some change the focus of their analysis, some lose facets or foci, and some get more multifarious in their lesson plan comparison. These results are used to create an individual partly automated feedback, which is furthering participants' individual development of MPCK. This feedback was programmed in cooperation with the department of computer science (TU Darmstadt).

Partner: A. Prescott (University of Technology Sydney)

Contact: I. Bausch, R. Bruder

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Project: DisKoLaMa (2009-2012)

The goal of this project is the development and testing of instruments to measure diagnostic competences of (future) mathematics teachers at secondary schools (Gymnasium) and at vocational secondary schools (Berufliche Schulen). Furthermore, the aim is to describe individual diagnosing skills and competences of students and student teachers and to uncover their progress in developing these skills and competences. The measured objects

are diagnostic competences of processes and results of individual competence acquisition of students in mathematics lessons with a focus on "mathematical basic knowledge" and "problem solving competence". First of all, a model to measure diagnostic competence of (future) mathematics teachers with the elements of knowledge, action competence and meta competence will be developed and then put into practice in form of questionnaires and guided interviews. A part of the survey will be developed and tested in form of an online questionnaire. All instruments developed are to serve the uncovering of diagnostic competence of students wanting to become teachers at the beginning and end of their studies as well as for student teachers at the beginning and end of their practice teaching period. With this evaluation, a cross-sectional as well as a longitudinal look at things will unfold so that different developments will be observed. Competences will be measured at the TU Darmstadt of student beginners who want to become teachers in secondary schools for mathematics (general secondary schools and vocational) and with student trainees doing their practice teaching seminar in the Darmstadt area. The results of the questionnaires will be added to the competence portfolio of students becoming teachers and are meant to contribute to the self-assessment of students and student trainees. The evaluation results will form the basis for measures of targeted support and diagnosis competences for teacher education and continuing training. In addition, one can use the results to describe the respective effects for teacher education and continuing training. The results will be published on relevant national and international conferences.
`http://www.empirische-bildungsforschung-bmbf.de/zeigen.html?seite=8285`

Support: BMBF

Contact: H. Fey, R. Bruder

Project: COnceptual DIfficulties in the field of functional relationships (CODI)

The research project CODI addresses the development of a diagnostic tool which focuses students' conceptual difficulties in grade 8 and 9 in the field of functional relationships. In a first step the term learning difficulties has to be conceptualized. Therefore learning difficulties and especially misconceptions are embedded in the framework of the social historical activity theory. This learning theory gives special possibilities to describe the learning process and mechanisms of orientation when solving a given task.
Based on the project HEUREKO and a broad literature background typical learning difficulties will be operationalized by developing a test instrument which gives the possibility to uncover individual learning difficulties. One main focus is the diagnosis of special misconceptions because they are particularly stable and resistant to instruction. With the help of such a diagnostic tool, teachers are able to counteract learning difficulties and especially misconceptions, so that they are not intensified and will result in successful learning processes.
On the long term, mathematics teachers should have the chance to be supported by an online diagnostic tool, so that learning difficulties can be identified more easily. This adequate analysis of students' difficulties should in turn lead to individual support so that the identified difficulties and misconceptions will be removed.

Contact: R. Nitsch, R. Bruder

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Project: Knowing how to reflect on linear algebra at the level of secondary education

When focusing on competence orientation, one sometimes loses sight of subject-specific knowledge and skills as prerequisite for competence. However, it is known that subject-specific knowledge is the most important individual factor for successful learning processes. Different institutions such as universities or training companies complain about deficient pre-knowledge of high school graduates. Due to the aforementioned reasons, representatives of mathematical education sectors started to discuss about basic knowledge or basic competences in terms of minimum standards. The Didactic and Pedagogy Research Group is researching on this topic in different projects with the goal to develop a concept of mathematical basic knowledge and basic skills. The respective research is based on action theory. Mathematical basic knowledge and basic skills comprises all kinds of mathematical knowledge and skills, abilities as well as capabilities that exist on a long-term basis and independent of situations at the end of both secondary levels; especially without the use of any auxiliary means. The demands and requirements resulting from a pragmatic point of (vocational training) employers have to be complemented by subject-specific viewpoints and the educational viewpoints of schools.
In the German speaking research communities of didactics or pedagogy, an interesting construct is currently being discussed with the term "reflective knowledge". This construct allows a broadening of the basic knowledge and basic skills perspective with regard to educational demands. In this project, a concept of reflective knowledge will be developed and substantiated for the secondary level of high school in linear algebra used for the construction and selection of tasks that are especially suitable for the development of reflection. Basic actions will then be derived for these tasks concerning the necessary requirements. This way it will be possible to indicate the depth and quality in an operationalized form of the skills that are necessary for these basic actions.

Contact: O. Schmitt

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Project: Stationary States, Recurrence and Transience for Quantum Dynamics

Probabilistic Markovian behavior is described by semigroups of transition matrices or, more generally, by transition kernels. In quantum probability, this generalizes to semigroups of completely positive operators on the algebra of observables. As in classical probability, existence, uniqueness, and convergence to stationary states—states generalize probability distributions—are an important issue whenever one is interested in the long time behavior

of such a dynamics. For finite systems a Perron-Frobenius type theory is available, for infinite systems, notions of recurrence and transience become crucial.
In this project we introduce suitable quantum versions of the above notions and apply them to the above mentioned problems. Starting from a noncommutative version of the Riesz decomposition theorem we were able to develop a coherent approach to recurrence and transience. It leads to a classification of idempotent Markov operators, thereby identifying concretely the Choi-Effros product, and to an abstract Poisson integral. The paradigmatic case of semigroups on the algebra $\mathscr{B}(\mathscr{H})$ of all bounded operators on a Hilbert space was studied in more detail. These may be viewed as a quantum version of Markovian semigroups on countably many states. Presently, our interest focuses on expanding this theory to more general settings.

Partner: R. Gohm (Aberystwyth)

Contact: B. Kümmerer, A. Gärtner

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Project: Representations of Finitely Correlated States

A stationary Markov Chain on a finite set in probability theory permits two basically equivalent descriptions: Given a stochastic matrix with invariant probability distribution one can consider the induced stationary Markov measure on the path space or one can consider the induced stationary Markov process.
In noncommutative probability theory this equivalence breaks: There is no way of a canonical correspondence between noncommutative stationary Markov processes—Markov Dilations—and noncommutative stationary Markov measures—certain states on an infinite tensor product C*-algebra. This lack is due to non existence of needed conditional expectations which is a pure noncommutative phenomenon.

In this project, we succeed in constructing representations of a certain class of noncommutative Markov measures known as finitely correlated states using inductive limits of Hilbert spaces, C*-algebras and representations.
This techniques allow us to analyse some entanglement properties of the one side restriction of a pure finitely correlated state and, especially, determining its von Neumann entropy which would be impossible using only restrictions on finite dimensional subalgebras. We clarify the connection between aperiodic irreducibility of a pure transition operator, irreducibility of certain representations and thus purity of certain finitely correlated states.

Contact: B. Kümmerer, W. Reußwig

References

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Project: Quantum Control: Approach based on Scattering Theory for Noncommutative Markov Chains and Multivariate Operator Theory

The aim of this project is to explore genuinely non-commutative versions of control theory with a view toward direct applications to the emergent discipline of quantum control.
A basic idea of this project is to make use of recent developments in multivariate operator theory. While in classical operator theory a single operator is analysed, in multivariate operator theory the joint action of a family of operators is studied. These operators may not commute with each other. Nevertheless there are analogues to classical results in complex analysis such as the idea of multi-analytic operators. In fact, many of the operator results which are relevant for classical control theory can be extended to this setting. We develop these tools with applications to quantum control. Scattering theory for non-commutative Markov chains is a theory about open quantum systems with many connections to operator theory. Recently the wave operator occurring in this theory has been rewritten as a multi-analytic operator. On the other hand it is possible to interpret this theory as a version of open-loop control, for example it has been successfully applied to the preparation of states in a micromaser interacting with a stream of atoms.
Hence it is very natural to start here to develop the methods of multivariate operator theory as applied to the problems in quantum control. Once the bridge between quantum control and multivariate operator theory is understood in the specific directions described above we speculate that a considerable amount of related mathematics becomes available for engineering applications.

Partner: R. Gohm, J. Gough, C. Köstler, Aberystwyth University; H. Maassen, University of Nijmegen

Support: Engineering and Physical Sciences Research Council (EPSRC), GB.

Contact: B. Kümmerer

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Project: Propp Wilson Algorithms for Quantum Markov Chains

In the theory of Markov chains it is one of the major tasks to determine stationary probability distributions. Important applications are, e. g. to statistical physics or image analysis. For large state spaces stationary distributions can be determined only numerically by various Monte Carlo methods. They produce random samples distributed according to the unkown stationary distribution. The disadvantage of most such methods is that the samples are only approximately distributed like the required distribution; longer running time results in better approximation. Hence, the decision on the so called 'burn-in-period' is left to the user. In 1995 J. D. Propp and D. B. Wilson published the Coupling from the Past algorithm, which drew the most attention among the exact sampling algorithms. It reaches the target distribution in finite time almost surely and then stops automatically.
For quantum Markov chains – they are used in quantum information, quantum optics, or quantum statistical mechanics – such types of algorithms have hitherto been unkown. Due to the lack of path representations for such processes they have even been considered impossible by some authors.

Based on a quantum version of the idea of synchronizing words, we succeeded in developing a Coupling from the Past algorithm for aperiodic, irreducible quantum Markov chains. It can, in particularly, be applied to relevant open quantum systems from quantum optics such as the micro-maser.

Contact: B. Kümmerer, N. Sissouno

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[1] R. Gohm, B. Kümmerer, and T. Lang. Noncommutative symbolic coding. *Ergodic Theory and Dynamical Systems*, 26:1521 – 1548, 2006.

[2] N. Sissouno. *A Non-commutative Version of the Coupling from the Past Algorithm*. PhD thesis, TU Darmstadt, 2011.

Project: A Coupling Method for Quantum Markov Processes

In the theory of Markov processes it is important to obtain information on their long time behaviour. Markov processes with finite state space always have a stationary distribution and for irreducible aperiodic processes there are various ways to estimate the speed of convergence to the equilibrium distribution.
On an infinite state space, however, a Markov process in general does not admit a stationary distribution. In the recent decade the coupling method has established as a tool to investigate their asymptotic behaviour. In particular, the coupling inequality plays a major role for estimating the distance between two initial distributions after long times.
In this project we succeeded in developing coupling techniques for quantum or noncommutative Markov chains. In particular, a coupling inequality is derived for such processes. The lack of the notion of a diagonal in this setting drives us to find an approach different from the classical one. In particular, the commutant of an operator algebra and Tomita-Takesaki-Theory comes in. It may be interesting to note that our approach links couplings to the decay of entanglement of certain quantum states, a subject of great interest in quantum information.

Contact: B. Kümmerer, K. Schwieger

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Project: Measures of Entanglement and Norms on Tensor Products

It is one of the basic problems of quantum information to measure degrees of entanglement for quantum states.
A quantum system is described by a state on a Hilbert space, i. e. a non-negative trace class operator with trace one. For the description of composed quantum systems one has to use a state on the tensor product of the corresponding Hilbert spaces. For example, a tensor product of states describes a joining of independent quantum systems. Since the state space of a quantum system is a convex set one can consider the convex hull of the product states: The set of *separable states*. But not all states on the tensor product Hilbert space are separable. Such states are called *entangled*. Experiments show that only entangled states

behave truely quantum mechanically as they violate Bell's inequalities and can be used for quantum cryptography and quantum computation.
There exist various notions in the literature of how to measure the degree of entanglement: it should measure the usability of an entangled state for true quantum effects. But most of these notions are bound to bi-partite systems. Recently, W. Arveson used the maximal or projetive norm on tensor products to establish a universal measure of entanglement. In this project we compute Arveson's measure of entanglement for some interesting states on multipartite systems or give better bounds for it.

Contact: B. Kümmerer, F. Sokoli, W. Reußwig

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1.2.5 Logic

The research group in *Mathematical Logic and Foundations of Computer Science* represents the subject area of Mathematical Logic viewed as an applied foundational discipline between mathematics and computer science. Research activities focus on the application of proof theoretic, recursion theoretic, category theoretic, algebraic and model theoretic methods from mathematical logic to mathematics and computer science.
Beside classical mathematical logic (represented with proof theory, recursion theory and model theory) this involves constructive type theory, categorical logic, universal algebra, domain and lattice theory, finite model theory and complexity theory.
Within mathematics, a primary field of applications in the proof- and recursion-theoretic setting is the extraction of new information from proofs in classical mathematics (proof mining: Kohlenbach). This concerns qualitative aspects (e.g., independence of existence assertions from certain parameters) as well as quantitative aspects of computability and complexity of solutions, extraction of algorithms and bounds from proofs, and links with exact real arithmetic, computational mathematics (Kohlenbach, Streicher, Ziegler). Model theoretic investigations make intra-mathematical links with algebra and discrete mathematics, e.g. graphs and hypergraphs (Herrmann, Ihringer, Otto).
Concerning Logic in Computer Science and the mathematical foundations of computer science, major activities revolve around issues of semantics. On the one hand, this involves the mathematical foundation of the semantics and the logic of programming languages (Keimel, Streicher); on the other hand, logics and formal systems are investigated in the sense of model theoretic semantics, w.r.t. expressiveness and definability, with an emphasis on computational aspects (algorithmic and finite model theory, descriptive complexity: Otto). Besides specific application domains in computer science, as, e.g., verification, data bases and knowledge representation, there is work on foundational issues in the areas of computability and complexity (Ziegler), as well as type theory and category theory (Streicher).
Overall, the logic group forms an internationally well connected cluster of expertise, with a characteristic emphasis on the connections that mathematical logic has to offer, both w.r.t. to other areas within mathematics and w.r.t. to the "logic in computer science" spectrum.

A research group on *Formal Concept Analysis* focuses on graphical logic systems for concept analysis in knowledge acquisition and processing applications (Burmeister, Wille). Rooted in the *General Algebra and Discrete Mathematics* group (former AG1) this research is being pursued in particular in co-operation with the "Ernst Schröder Zentrum für Begriffliche Wissensverarbeitung e.V."

Project: The Expressive Power of Monadic Second-Order Logic and its Variants

We study the expressive power of various versions of monadic second-order logic. The focus is in three areas: (1) Extensions of monadic second-order logic by certain boundedness quantifiers. The ultimate goal is the satisfiability problem for the logic MSO $+ \mathbb{U}$. (2) An algebraic framework for recognisability of languages of infinite trees. Here we aim at effective characterizations for fragments of monadic second-order logic. (3) The expressive power of monadic second-order logic over certain classes of graphs. In particular, we try to characterize those classes where we can define a linear ordering in monadic second-order logic.

Partner: T. Colcomet (University of Paris Diderot (Paris VII)); B. Courcelle, D. Janin (University of Bordeaux 1).

Support: German Research Association (DFG).

Contact: A. Blumensath

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[3] A. Blumensath and B. Courcelle. Monadic second-order definable graph orderings. submitted.

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Project: New frontiers in proof mining

During the last decade a program of 'proof mining' evolved and has successfully applied to a number of areas of core mathematics. This program is concerned with the extraction of hidden finitary and combinatorial content from proofs that make use of highly infinitary principles and has turned out to be particularly successful in the context of abstract functional analysis and ergodic theory. In this project we extend the currently existing proof mining machinery to proof that use highly ineffective principles that have not been covered so far. This concerns e.g. proofs that make use of Banach limits and hence – for all what is known – some substantial use of the axiom of choice. In [1] we develop a method for eliminating such uses of Banach limits from strong convergence proofs in nonlinear analysis. We apply this method for the extraction of quantitative bounds from a proof of a nonlinear ergodic theorem in the context of CAT(0)-spaces due to Saejung. Another instance of this machinery is provided in [2] where we analyze the proof of a corresponding result in the context of Banach spaces with a uniformly Gâteaux differentiable norm due to Shioji and Takahashi.

Together with K. Schade we extended the work done in [1] to so-called modified Halpern iterations in CAT(0)-spaces (see [4]). Ongoing work (with D. Körnlein) deals with metastability bounds for the resolvent of nonexpansive and accretive operators in Hilbert and uniformly smooth spaces. In particular, we aim at a quantitative treatment of so-called sunny nonexpansive retracts.

Support: Kurt-Gödel-Society, John Templeton Foundation, DFG projects KO 1737/5-1 and KO 1737/5-2

Partner: L. Leuştean, Romanian Academy, Bucharest

Contact: U. Kohlenbach

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Project: Effective metastability in nonlinear ergodic theory

In this project we extract explicit effective rates of metastability (in the sense of Tao) for nonlinear generalizations of the von Neumann mean ergodic theorem due to Baillon and Wittmann. In the absence of linearity the strong convergence of the ergodic mean fails to hold in general while weak convergence is still true due to the famous Baillon nonlinear ergodic theorem. In [3] we extract a rate of metastability for the weak Cauchy property for Baillon's theorem in the Hilbert space case (based on a computational analysis of weak compactness from [2]). While strong convergence in general fails, there are important cases where it is still true, e.g. for odd operators (Baillon) or even more general operators satisfying a condition due to Wittmann. In this situation, an explicit primitive recursive rate of the metastability of the strong convergence is extracted in [4]. For related results obtained in this project, see [1]. Another important nonlinear generalization of the von Neumann theorem is again due to Wittmann who proved that a so-called Halpern iteration – which in the linear case coincides with the Cesàro mean from the mean ergodic theorem – strongly converges in Hilbert space. This is discussed in the project "New Frontiers in Proof Mining".

Support: German Science Foundation (DFG) as part of project KO 1737/5-1

Contact: U. Kohlenbach, P. Safarik

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Project: Term extraction and Ramsey's Theorem for pairs

This project studies with proof-theoretic methods the function(al)s provable recursive relative to Ramsey's theorem for pairs and the (strong) cohesive principle (COH). Our main result on (COH) is that the type 2 functionals provable recursive from $\mathrm{RCA}_0 + \mathrm{COH}$ are primitive recursive and that there is a proof-theoretic method to extract primitive recursive bounds from proofs that use COH. As a consequence we also obtain a new proof of the fact that over RCA_0 the principle COH is Π^0_3-conservative over RCA_0 (see [4]). In [1] it, moreover, is shown that COH is equivalent to a weak variant of the Bolzano-Weierstraß principle. This makes it possible to use our results to analyze not only combinatorial but also analytical proofs.
In [3] similar term extraction results are obtained for the 'chain antichain principle' which is stronger than COH and implies that every sequence of reals has a monotone subsequence.
For Ramsey's theorem for pairs and two colors (RT^2_2) we obtain ([4]) that the type 2 functionals provable recursive relative to RCA_0 are in T_1. This is the fragment of Gödel's system T containing only type 1 recursion — roughly speaking it consists of functions of Ackermann type. With this we also obtain a uniform method for the extraction of T_1-bounds from proofs that use RT^2_2.
An application of a use of RT^2_2 in core mathematics is given in [2] where it is shown that a certain generalized Banach contraction principle can be proven with RT^2_2 relative to a theory to which our conservation results apply.

Support: German Research Association (DFG) as part of project KO 1737/5-1

Contact: U. Kohlenbach, A. Kreuzer

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Project: Fluctuations, effective learnability and metastability in analysis

We investigate what kind of quantitative information one can extract under which circumstances from proofs of convergence statements in analysis. It turns out that from proofs using only a limited amount of the law-of-excluded-middle, one can extract functionals (B, L), where L is a learning procedure for a rate of convergence which succeeds after at most $B(a)$-many mind changes. This (B, L)-learnability provides quantitative information strictly in between a full rate of convergence (obtainable in general only from semi-constructive proofs) and a rate of metastability in the sense of Tao (extractable also

from classical proofs). In fact, it corresponds to rates of metastability of a particular simple form. Moreover, if a certain gap condition is satisfied, then B and L yield a bound on the number of possible fluctuations. This allows one to explain recent applications of proof mining to ergodic theory in terms of these results.

Support: German Science Foundation (DFG) as part of project KO 1737/5-1

Contact: U. Kohlenbach, P. Safarik

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Project: Computing common fixed points of families of maps

We use logical proof-mining techniques to extract an explicit effective and uniform bound on the rate of asymptotic regularity of an iteration schema involving a finite family of nonexpansive mappings. The results presented in this paper contribute to the general project of proof mining as developed by the second author as well as generalize and improve various classical and corresponding quantitative results in the current literature. More precisely, we give a rate of asymptotic regularity of an iteration schema due to Kuhfittig for finitely many nonexpansive mappings in the context of uniformly convex hyperbolic spaces. The bound only depends on an upper bound on the distance between the starting point and some common fixed point, a lower bound $1/N \leq \lambda_n(1-\lambda_n)$, the error $\epsilon > 0$ and a modulus η of uniform convexity. Our results generalize previous results due to the 2nd author (in the normed case) and L. Leuştean (in the hyperbolic case) for one map to the case of finitely many maps ([2]). Another topic concerns the strong convergence for a hybrid-type shrinking projection method in Hilbert space([1]).

Support: Higher Education Commission of Pakistan (HEC), German Research Association (DFG) as part of project KO 1737/5-1

Contact: M. A. A. Khan, U. Kohlenbach

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Project: Theory of Competitive Interactions

We are working on general guidelines to design e.g. economic or political systems. Said otherwise, our aim is to understand competitive interactions between agents or stakeholders in various settings and to design rules for them to result in behavior that (is not necessarily predictive but) satisfies certain desired properties. Beside experience and humanities, this understanding will come partly from the mathematical study of a limited number of general models, as opposed to a multitude of ad hoc models. The literature is full of toy examples, time has come for abstraction!
The theory under development uses traditional game theory as a starting point, but it shall be able to adjust to revolutions in other fields of knowledge, either by ensuring robustness

of the results regardless of the representation of the sociology/psychology/biology of the agents, whatever rationality or computability mean, and whether the world is discrete or continous, or by explaining why two different representations of the world yield two contradictory results.
To generalise traditional game theory in a relevant direction, one can invoke existing mathematical results. Especially, determinacy results are results from logic, set theory, or theoretical computer science that use a game-theoretic terminology to describe some abstract objects of interest. I have generalised many of these results (Borel determinacy, finite-memory determinacy of Muller games, positional determinacy of parity games, etc.) into proper game-theoretic results and I plan to do the same with e.g. Blackwell determinacy (from set theory) or Fraisse-Ehrenfreucht-like theorems (from model theory). This part of my project has given me and will give me a broader understanding of games in the spirit of what has been done since the 1930's, albeit in a more general setting. Since a few decades, though, two legitimate concerns have entered the realm of game theory by becoming internal to the models: Computation (informally since the 1950's and technically only later) and knowledge (since the 1960's).
Ultimately my objective is to be able to say, knowing the options of the agents and their mental abilities (w.r.t. awareness and computation), how the system will evolve and possibly stabilize. In particular, the fulfilled objective will enable computation (of some sort) of a best move (when relevant) and it will also guide the design of a system that gives the right incentives, such that the agents behave in a desired way. It is called mechanism design and relate to my objective stated at the first sentence of this document.

Partner: A. Pauly, Cambridge; Eurex Clearing, Frankfurt

Contact: S. Le Roux

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[1] S. Le Roux. Infinite nash equilibrium. *Logical Methods in Computer Science*. To appear.
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Project: Model Constructions and Model-Theoretic Games in Special Classes of Structures

This four-year project was successfully completed in 2011. Its emphasises was on the relationship between the model theory of well-behaved classes of structures, combinatorial techniques for model constructions within these classes, and the manageability of Ehrenfeucht-Fraïssé techniques, cf. [6, 8]. Among the key aspects of the game related model theoretic analysis are locality phenomena in the spirit of Gaifman's locality theorem.
Two main thematic tracks have emerged within this overarching project:
(A) The study of configuration graphs of pushdown systems (of first and second order, and with non-local link structure, as in nested trees or collapsible pushdown systems) through structural analysis and Ehrenfeucht–Fraïssé techniques. Alexander Kartzow's dissertation [5] and his publications [2, 3, 4] witness the decidability of first-order logic over interesting classes of finitely presented infinite structures, thus pushing the boundaries of first-order decidability.
(B) The investigation of qualified acyclicity in finite hypergraph constructions, based on combinatorial group-theoretic methods. The novel construction of finite Cayley groups

that satisfy much stronger acyclicity conditions than a lower bound on their girth in the usual sense have been obtained in [7]. These groups could be used in the constructions of finite hypergraph covers with what seems to be an optimal control of cycles in finite covers. Together with the Ehrenfeucht-Fraïssé analysis of such sufficiently acyclic and highly branching finite hypergraphs, this approach has led to the positive resolution of a long open characterisation of the expressive power of the guarded fragment of first-order logic in finite model theory. A different approach to hypergraph covers with qualified acyclicity properties in joint work with Georg Gottlob (Oxford) and Vince Barany in [1] generated a number of optimal decidability and complexity results concerning the guarded fragment and its interaction with conjunctive queries. These results are of interest both theoretically and for applications in database theory. Ramifications of the two entirely different techniques employed in these approaches and links with further potential applications (e.g. in the model theory of modal logics) are core elements in a new project proposal currently under review.

Support: DFG

Contact: M. Otto

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Project: Construction and Analysis in Hypergraphs of Controlled Acyclicity

This is a new DFG project, approved in 2012, which is based on results and new directions provided by the successful completion (in 2011) of its forerunner "Model Constructions and Model-Theoretic Games in Special Classes of Structures", see in particular [2, 1, 4]. Acyclicity conditions play an important role as tractability criteria in various settings of logic in computer science and of algorithmic model theory. Often, ideal forms of acyclicity

are available through a process of unfolding (e.g., of transition systems or game graphs into trees). Fully acyclic unfoldings are, however, typically unavailable in settings where only finite structures are admissible. For such applications, especially in the realm of finite model theory, the focus must therefore be on

- suitable relaxations of full acyclicity that can be realised in finitary coverings (partial unfoldings), and
- methods that make available in these relaxed scenarios the good algorithmic and model-theoretic properties that are familiar from fully acyclic unfoldings.

The new project puts the development of constructions and methods at the center with a view to a more systematic understanding and to extending the reach of corresponding model-theoretic techniques to further application domains.
At the level of basic research the project is geared to draw on logical and model-theoretic methods as well as on new connections with techniques from discrete mathematics (e.g., permutation groups, the combinatorics of graphs and hypergraphs, discrete geometry, combinatorial and algebraic methods). First major results have been reported in [3].

Support: DFG

Contact: M. Otto

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Project: Classical Realizability

In the last decade J.-L. Krivine introduced his realizability interpretation for various classical systems including Zermelo Fraenkel set theory [1]. Whereas most of the models so far were based on term models for λ-calculus with control I have recently studied a domain-theoretic model obtained by solving the domain equation $D \cong \Sigma^{D^\omega}$ in the category of coherence spaces. In the ensuing classical realizability model the type $\nabla(2)$ is infinite. I am trying to show that it is not Dedekind infinite because this would entail that the Axiom of Dependent Choice fails in this model which is a difficult open problem in the area.

Partner: A. Miquel (ENS Lyon)

Contact: T. Streicher

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Project: Homotopy Type Theory inside Realizability Models

The groupoid model introduced in [1] was the first model validating V. Voevodsky's *Univalence Axiom*. In my Habilitation Thesis from 1993 I constructed realizability models faithfully reflecting most of the intensionality phenomena of Intensional Type Theory (ITT). My aim is now to consider groupoid models inside realizability models in order to combine the advantages of both models.

Contact: T. Streicher

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Project: Problems Complete for the Blum-Shub-Smale Model

The Blum-Shub-Smale (BSS) Model is a generalization of the classical Turing machine from bits to rings and other structures. It extends the classical theory of computing and complexity and translates open questions such as P-versus-NP-versus-EXP to settings where the algebraic structure of the (usually continuous) underlying space both requires and allows for new proof methods. In particular, the class of decision problems NP-complete over the reals and the complex numbers is a promising field of research with currently only roughly 5 examples known complete for it – compared to 500 in the discrete case. We identify and establish new natural problems complete for BSS complexity classes.

Partner: C. Herrmann, TU Darmstadt; P. Scheiblechner, Hochschule Luzern

Contact: M. Ziegler, C. Herrmann

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Project: Computability and Complexity in Numerics

Recursive Analysis, as initiated by Alan Turing in his 1937 publication, combines the theory of (discrete) computation with numerical analysis in the sense of rational approximation to real numbers with arbitrarily prescribable absolute error. We delineate the border between computability and incomputability, and explore the inner structure of the former in both sound logical frameworks of descriptive and of computational complexity theory. That is, we classify practical problems and standard numerical tasks over the reals in terms of quantitative and qualtitative hierarchies such as Borel's, fragments of second order logic, and computational complexity $\mathrm{P} \subseteq \mathrm{NP} \subseteq \#\mathrm{P} \subseteq \mathrm{CH} \subseteq \mathrm{PSPACE} \subseteq \mathrm{EXP}$. Upper bounds here refer to algorithms in the strict sense of formally proven correct on a fully specified set of inputs with guaranteed worst-case running time; uniform lower bounds are derived by adversary arguments adapted from *Information-Based Complexity* (IBC).

Partner: K. Ambos-Spies, Universität Heidelberg; U. Brandt, TU Darmstadt; A. Karamura, University of Tokyo; U. Kohlenbach, TU Darmstadt; N. Müller, Universität Trier; M. Otto, TU Darmstadt; A. Pauly, Cambridge

Support: EU IRSES 294962; Royal Society Grant IE111233

Contact: M. Ziegler, C. Rösnick

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1.2.6 Numerical Analysis and Scientific Computing

The particular strength of the Numerical Analysis and Scientific Computing group is in the development of novel, efficient, and accurate numerical methods that are capable of tackling complex problems of practical interest. Our broad long-term goal is to provide good software for the solution of differential equations and optimization problems - one of the main modelling tools in science and engineering. We are currently engaged in the following specific application areas: computational medicine and meteorology, simulation and optimal control of gas and water networks, inverse problems, radiative transport, optical tomography, modelling and simulation of ion channels and nanopores, and computational biology.

Project: Adaptive Multilevel Methods for PDAE-Constrained Optimal Control Problems With Application to Radiative Heat Transfer

The main goal of this project is to develop a fully adaptive optimization environment, suitable to solve complex optimal control problems of practical interest, which are restricted by partial differential algebraic equations (PDAEs) and pointwise constraints on control and state. The environment relies on continuous adjoint calculus, coupling a fully space-time adaptive PDAE solver (e.g. Kardos [4]), highly efficient optimization techniques (e.g. a generalized SQP method [3]), and a multilevel strategy which tailors the grid refinement to the optimization progress. Controlling the inconsistencies caused by inexact reduction, the multilevel strategy ensures global convergence of the finite dimensional control iterates to a stationary point of the infinite dimensional problem.
Within this project, the environment is used to solve an optimal boundary control problem arising in glass manufacturing during the cooling process. The physical behavior of the cooling process is modeled by radiative heat transfer and simplified by spherical harmonics resulting in systems of partial differential algebraic equations. The performance of the environment and the results of the optimization are studied at basis of several models of different complexity in two and three spatial dimensions [2, 1].

Numerical experiments show that, together with the multilevel strategy, the coupling of continuous adjoint calculus with full space-time adaptivity has the great potential to solve complex optimal control problems of practical interest.

Partner: S. Bott, S. Ulbrich, C. Ziems

Support: German Research Association (DFG), priority program 1253

Contact: D. Clever, J. Lang, D. Schröder

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Project: Adjoint-based Control of Model and Discretization Errors for Gas and Water Supply Networks

The flow of gas through pipelines is of great interest in the engineering community. There are many challenges of running a gas transmission network. Various contracts have to be fulfilled, e.g. gas fed in by multiple suppliers has to be routed through the network while consumers' demands have to be met. The aim of operating a gas transmission network is to minimize the running costs. Those costs are mainly the running costs of compressor stations and contractual penalties. This leads to an optimal control problem on a network. Similar optimal control problems also occur for example in water supply networks.
While monitoring systems are already quite advanced, efficient simulation and optimization tools are only available to some extend. Of course, before considering optimization tasks, reliable simulation algorithms are essential. Since the application of coarse discretizations or simplified models is often adequate in many parts of the considered networks to resolve the dynamics in the daily operation of gas and water supply networks, information about the quality of the computed solutions is very important.
Within this project, we develop an algorithm to adaptively control model and discretization errors in simulations for gas and water supply networks with respect to a given quantity of interest using adjoint techniques.

Contact: P. Domschke, J. Lang

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Project: Domain-decomposition preconditioners for the Finite-Cell Method

The finite cell method is a framework that allows to utilize high order finite element methods on complicated geometries. The geometry and boundary conditions are taken into account by appropriate integration. The resulting linear systems are highly ill-conditioned and typically solved via direct solvers. In order to deal with large scal problems arising from applications in structural mechanics, we consider iterative solvers with additive Schwarz preconditioners based on overlapping domain decompositions. Mesh independent convergence can be proven under mild assumptions on the underlying geometry.

Partner: A. Düster, M. Joulaian; TU Hamburg-Harburg

Contact: H. Egger

Project: Numerical Methods for Optical Tomography

Optical Tomography is a non-invasive medical imaging technique that allows to probe biological tissue via near infrared light. For the simulation of light propagation, we consider high order Galerkin approximations and approriate preconditioned iterative solvers. The inverse problem is tackled by adequate regularization methods that allow to take into account a-priori information about the optical parameters in the object under investigation.

Partner: S. Arridge, UCL London

Contact: H. Egger, M. Schlottbom

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[1] S. Arridge, H. Egger, and M. Schlottbom. Preconditioning of complex symmetric linear systems with applications in optical tomography. Preprint, TU Darmstadt, 2012.

[2] H. Egger and M. Schlottbom. A mixed variational framework for the radiative transfer equation. 22:1150014, 2012.

[3] H. Egger and M. Schlottbom. On unique solvability for stationary radiative transfer with vanishing absorption. Preprint, TU Darmstadt, 2012.

Project: Discontinuous Galerkin Methods for Incompressible Flow

For the approximation of incompressible flow problems, we consider discontinous Galerkin approximations of high order on unstructured meshes. Such discretizations are well-suited for adaptivity and a stable treatment of the convective terms by upwind mechanisms. Particular emphasis is put on deriving stability estimates with explicitly known dependence on the polynomial approximation order. These allow for a systematic a-priori and a-posteriori *hp* error analysis on locally refined and non-conforming hybrid meshes.

Partner: C. Waluga, TU München

Contact: H. Egger

References

[1] H. Egger and C. Waluga. hp-analysis of a hybrid DG method for Stokes flow. *IMA J. Numer. Anal.*, 2012.

[2] H. Egger and C. Waluga. A hybrid mortar method for incompressible flow. *IJNAM*, 9:793–812, 2012.

[3] C. Waluga and H. Egger. An implementation of hybrid discontinuous Galerkin methods in DUNE. In A. Dedner, B. Flemisch, and R. Klöfkorn, editors, *Advances in DUNE*. Springer, 2012.

Project: Finite Element Methods for Corner Singularities

The regularity of solutions of elliptic partial differential equations on polygonal domains is limited by the maximal interior angle. Following an idea of Zenger et al, we investigate a modification of the finite element method in a vicinity of the singularity that allows to obtain optimal convergence in weighted norms. Also other important quantities like *stress intensity factors* can be computed with optimal accuracy.

Partner: B. Wohlmuth, TU München

Contact: H. Egger

References

[1] H. Egger, U. Rüde, and B. Wohlmuth. Energy-corrected finite element methods for corner singularities. Preprint, TU München, 2012.

Project: Unique Solutions for Prices in Dixit-Stiglitz and Eaton-Kortum Models of Trade

We consider the existence of the key vector of endogenous variables, namely (goods or factor) prices, in Dixit-Stiglitz-type or Eaton-Kortum-type new trade models with arbitrarily many countries. Most quantitative (calibrated or estimated) models rely on such type of models. Provided existence and uniqueness of prices, it can be shown that the vector of prices can be determined numerically. But general results on existence and uniqueness are not available to date.

Partner: P. Egger, ETH Zürich

Contact: H. Egger

Project: Stability estimates for the Raviart-Thomas projector

Polynomial approximation estimates play a key role in the a-priori and a-posteriori error analysis of finite element methods. We consider *hp* estimates of the Raviart-Thomas projector for simplicial and rectangular elements in standard an non-standard norms. Such estimates are required, e.g. for the error analysis of mixed formulations of elliptic problems, for the analysis of a-posteriori error estimators based on flux reconstruction, but also for the stability analysis of novel discretizations for incompressible flow problems.

Partner: A. Chernov, Universität Bonn

Contact: H. Egger

Project: Quality Assessment for Large-Eddy-Simulations

In numerical simulations of flow problems or other engineering models governed by systems of partial differential equations, mesh adaptivity has become a major feature securing

the quality of the solution of a simulation. For modeling turbulent flows with Large-Eddy-Simulations, locally large solution variations are best resolved by a high concentration of mesh points while in domains with less solution activity fewer mesh points are sufficient. We equip a common flow solver with a Mesh-Moving-PDE, which is able to redistribute grid points while keeping the data structure. So called monitor functions measure the importance of certain domains by user defined criteria and support the Mesh-Moving-PDE with the needed information where grid points are mostly desired. These criteria are usually physically motivated like the turbulent kinetic energy.
To compare these physically motivated monitor functions with mathematically motivated ones, we add adjoint-based information. For time averaged quantities of interest, we derived an adjoint-based a posteriori error estimator using a stationary adjoint equation. This new error estimator will help to improve mesh quality and also allows to focus on scalar quantities of interest, like for example drag and lift coefficients. Furthermore, a separation of the discretization and the modeling error is in the focus of our research, which will result in more accurate solutions for turbulent flows.

Partner: C. Hertel (TU Dresden), M. Schümichen (TU Dresden), J. Fröhlich (TU Dresden), Rolls-Royce Deutschland

Support: German Research Association (DFG) doctorate program GRK1344 “Instationäre Systemmodellierung von Flugtriebwerken”, Graduate School of Computational Engineering (CE).

Contact: M. Frankenbach, J. Lang

References

[1] C. Hertel, M. Schümichen, S. Löbig, J. Fröhlich, and J. Lang. Adaptive large eddy simulation with moving grids. *Theoretical and Computational Fluid Dynamics*, pages 1–25, 2012.

Project: Multiscale structure-functional modeling of musculoskeletal mineralized tissues

Musculoskeletal mineralized tissues (MMTs) are natural examples of materials that show unique and highly variable combinations of stiffness and strength. One of the striking features of MMTs is that this diversity of elastic function is achieved by only one common building unit, that is the mineralized collagen fibril, but variable structural arrangements at several levels of hierarchical organization. A profound understanding of the structure-function relations in MMTs requires both experimental assessment of heterogeneous elastic and structural parameters and theoretical modeling of the elastic deformation behavior. Multi-scale and multi-modal assessment of MMTs will be used to probe not only the microarchitecture, but also anisotropic linear elastic properties from the nanoscale to the macroscale. By combining experimental data obtained from MMTs at various length scales with numerical homogenization approaches in continuum mechanics, we hypothesize to gain new insight into self-assembly mechanisms, construction rules and physiological boundary conditions of MMTs.

Within this joint project we focus in Darmstadt on the development as well as efficient and reliable implementation of numerical homogenisation techniques. Together with the groups in Berlin and Paris we devise new mathematical models in order to aid the understanding of MMTs. The experimental assessment of MMTs is performed in Berlin and with external cooperation partners.

Partner: Prof. Dr. K. Raum (Charité Universitätsmedizin Berlin), Prof. Dr. Q. Grimal (Pierre-and-Marie-Curie University (Paris VI), France)

Support: DFG grants GE1894/3 and Ra1380/7

Contact: S. Tiburtius, A. Gerisch

References

[1] M. Granke, Q. Grimal, A. Saïed, P. Laugier, F. Peyrin, A. Gerisch, and K. Raum. Contributions of pore volume fraction and mineralized matrix elasticity to millimeter-scale cortical bone elastic coefficients. In C. Hellmich, M. H. Hamza, and D. Simsik, editors, *IASTED Biomedical Engineering, 15.-17.02.2012, Innsbruck, Austria*, pages 764–133. ACTA Press, 2012.

[2] Q. Grimal, K. Raum, A. Gerisch, and P. Laugier. A determination of the minimum sizes of representative volume elements for the prediction of cortical bone elastic properties. *Biomech Model Mechanobiol*, 10:925–937, 2011.

[3] K. Raum, Q. Grimal, P. Laugier, and A. Gerisch. Multiscale structure-functional modeling of lamellar bone. *Proceedings of Meetings on Acoustics*, 9:020005, 2011.

[4] D. Rohrbach, S. Lakshmanan, F. Peyrin, M. Langer, A. Gerisch, Q. Grimal, P. Laugier, and K. Raum. Spatial distribution of tissue level properties in a human femoral cortical bone. *Journal of Biomechanics*, 45:2264 – 2270, 2012.

Project: Numerical methods for time-dependent PDE problems from mathematical biology

Biological processes like the invasion of tissue by cancer cells, or the adhesion-driven reorganisation of tissue, or the cascade of steps in fracture healing can be modelled as time-dependent PDEs. For the reliable, efficient and accurate simulation of these models dedicated numerical schemes are required. We focus on general methods for taxis-diffusion-reaction systems and on particular schemes for the evaluation of the spatially nonlocal terms in models of cellular adhesion. In our approach we follow the method of lines with finite volumes in space and linearly-implicit methods in time.

Partner: M. Chaplain (University of Dundee, Scotland), L. Geris (University of Liége, Belgium)

Contact: A. Gerisch

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[2] L. Geris and A. Gerisch. Mathematical modelling of cell adhesion in tissue engineering using continuum models. In A. Gefen, editor, *Cellular and Biomolecular Mechanics and Mechanobiology*, volume 4 of *Studies in Mechanobiology, Tissue Engineering and Biomaterials*, pages 431–450. Springer Berlin Heidelberg, 2011.

[3] V. Peiffer, A. Gerisch, D. Vandepitte, H. Van Oosterwyck, and L. Geris. A hybrid bioregulatory model of angiogenesis during bone fracture healing. *Biomech Model Mechanobiol*, 10:383–395, 2011.

Project: Autumn School for High-School Pupils in Mathematical Modelling

40 pupils and 16 teachers and teacher students work together in 8 groups for one week. Each group has to solve a different problem from a different application. The problem

has to be transferred into a mathematical problem (modeling), it has to be solved and the solution has to be documented (report) and presented in a final talk. The pupils were in the last year before graduation an had been selected by a countrywide competition in mathematics. The aim is to further motivate these pupils for further egagement in mathmatics. The teacher should experience mathematics as an universal instrument for reasonable decisions in all parts of our live and supply them with authentic examples, so that they can act as multipliers and spread the knowledge about the importance of mathematics in a modern industrial community.

Contact: M. Kiehl

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[1] M. Kiehl. Bedeutung von Mathematik erfahrbar machen – Modellierungswochen für Schüler und Lehrer. To appear.

Project: Mathematical modeling integrated in the discussion of function classes

Mathematical modeling is a newly formulated requirement for the education in school. Nevertheless, there are very few hints, to tell the teacher, how they can meet these requirements. In this project we will develope a set of mini-projects, and prepare solutions and programming environments so that not much extra time is needed in class nor for preparation by the teacher. The projects should not only teach the basics of modelling, but also promote the understanding of mathematics as a universal tool and at the same time support a better an deeper understanding of functions and the meaning of their parameters and stimulate a critical handling with empirical results.

Contact: M. Kiehl

References

[1] M. Kiehl. Modellieren mit Funktionen im Rahmen der Curriculumsspirale. To appear.

Project: Mathematical models of the chemical evolution of t-RNA

Evolution as we know it today consists of an media (m-RNA) that can store information and preserve it over long time, because it is a very inert molecule, that does hardly react itself. It can also be copied (reproduction) with the chance of misstakes (mutation). Because m-RNA hardly reacts, a translation mechanism (t-RNA) is needed, that converts the information into very reactive molecules (proteins) that can help the compartment (cell), that also includes the information, to survive (selection) and so promote the spread of the according information. The question of how such a system could evolve leads to the classical dilemma of "which came first, the chicken or the egg?". In more detail, the question is, why should there be only a very special set of t-RNA, to translate special triplets of a m-RNA into a special sequence of amino acids, as long as there is no meaningful m-RNA and why should there be any m-RNA that might be meaningful, if it would be translated into a sequence of amino acids when using the right code, before there is a fixed set of t-RNA that provides with the according translation? In the project we develope models for this initial evolution process.

Contact: M. Kiehl

References

[1] M. Kiehl and F. Knapp. Fast computation of a realistic secondary structure of RNA by local minimization of the Zuker-free-energy inspired by models of the real folding process in vitro. To appear.

Project: Discrete-Continuous Optimization of Gas and Water Supply Networks

Today's demands in the management of gas and water supply networks require the close collaboration between industry and scientists from engineering and applied mathematics. The aim of this project is to tackle recent problems in gas and water management with state-of-the-art numerical methods and to develop new adapted algorithms.
The given tasks include the solution of hyperbolic partial differential algebraic equations on networks as well as discrete-continuous optimal control problems. The numerical methods for the solution of the underlying partial differential algebraic equations and continuous optimization problems are implemented in our software package ANACONDA. Discrete decisions can be (partially) given a-priori or determined via a penalization approach.

Partner: K. Klamroth (Universität Wuppertal), G. Leugering (Universität Erlangen-Nürnberg), A. Martin (Universität Erlangen-Nürnberg), M. Oberlack (TU Darmstadt), M. Ostrowski (TU Darmstadt), Hessenwasser GmbH & Co. KG, Siemens AG

Support: Federal Ministry of Education and Research (BMBF)

Contact: O. Kolb, J. Lang

References

[1] A. Martin, K. Klamroth, J. Lang, G. Leugering, A. Morsi, M. Oberlack, M. Ostrowski, and R. Rosen, editors. *Mathematical Optimization of Water Networks*, volume 162 of *International Series of Numerical Mathematics*. Birkhäuser Basel, 2012.

Project: Higher-order multirate methods for transient multi-physics problems

Many physical phenomena can be described by a set of coupled ordinary differential equations (ODEs) in time. A normal singlerate time integrator solves all ODEs with the same time step sizes, which are determined by taking all the components into account. This might produce very small time steps that also have to be applied to components with much less activity. The idea of multirate methods is to use different time step sizes for different components, depending on the individual activity of the solution, which means there will be a differentiation between active and latent components. The coupling can be managed by interpolation/extrapolation. Multirate methods using Rosenbrock-methods are well known in literature, but have the problem that due to the order reduction phenomenon of one step methods in the case of stiff problems, higher-order methods are difficult to obtain. To gain higher-order multirate methods the idea of this project is the development of multirate methods using two-step Peer-methods. Since for Peer-methods no order reduction was observed in the singlerate case, a similar behaviour in the multirate case is expected. Also stability investigations of multirate Rosenbrock- and multirate Peer-methods are part of this project.

Support: Graduate School of Computational Engineering, TU Darmstadt (DFG)

Contact: K. Kuhn, J. Lang

References

[1] A. Gerisch, J. Lang, H. Podhaisky, and R. Weiner. High-order linearly implicit two-step peer-finite element methods for time-dependent PDEs. *Appl. Numer. Math.*, 59:624–638, 2009.

[2] K. Kuhn and J. Lang. Comparison of the asymptotic stability for multirate Rosenbrock methods. submitted 2012 to Journal of Computational and Applied Mathematics.

Project: KARDOS - Software Package for Solving Nonlinear Evolution Problems

The code KARDOS was originally developed at ZIB Berlin to solve systems of non-linear mixed parabolic-elliptic partial differential equations by means of adaptive space and time discretizations. Linearly implicit one-step methods of Rosenbrock type are coupled with standard finite elements of various orders. KARDOS uses unstructured grids in one, two, and three space dimensions.
A large proportion of the current work is carried out in close collaboration with ZIB Berlin. Extensions that we are working on include: incorporation of computational fluid dynamics (CFD), electromagnetics, optimisation, uncertainty quantification and moving finite elements.
Although this software is mainly used for scientific and educational purposes, we are interested in cooperations with external organisations (industry, goverment research laboratories, etc) or other university departments (particularly engineering departments).

Partner: P. Deuflhard, B. Erdmann, R. Roitzsch (ZIB)

Contact: J. Lang

Project: W-methods for Optimal Control

We have developed W-methods of linearly implicit structure for the numerical approximation of optimal control problems within the first-discretize-then-optimize approach. Following the concept of transformed adjoint equations, we analyzed the approximation order and derived novel order that have to be satisfied by the coefficients of the W-methods so that the Taylor expansions of the continuous and discretize state and costate solutions match to order three. The W-methods are remarkably robust with respect to varying approximations of the Jacobian matrix. This allows for partitioning to treat stiff and nonstiff components more efficiently in the linear algebra. Most notable for the W-methods is their structural advantage when they are applied within a gradient approach to solve state and costate equations separately. Only a sequence of linear equations with one and the same system matrix has to be solved to compute the stages values. We expect that this property will become even more important for the numerical solution of large scale PDE-constrained optimal control problems.

Partner: J. Verwer (CWI, Amsterdam)

Support: German Research Association (DFG)

Contact: J. Lang

References

[1] J. Lang and J. Verwer. W-methods for optimal control. Preprint, TU Darmstadt, 2011.

Project: Stabilized Finite Elements for Transient Flow Problems

We proposed a way to circumvent artificial pressure oscillations for transient flow problems discretized with stabilized finite elements which may arise due to mesh changes for the projection. Instead of using the velocities of the previous time step in the right hand side of the new time level, a divergence-free projected velocity should be used. This projected velocity is the solution of a corresponding discrete Darcy problem with its own stabilization. It turns out that additional terms should be considered in the discrete equations in order to get a consistent scheme. We analyzed the corresponding Stokes system and proved bounded discrete pressure for arbitrary small time steps. The type of stabilization is quite general.

Partner: M. Braack, N. Taschenberger (Universität Kiel)

Contact: J. Lang

References

[1] M. Braack, J. Lang, and N. Taschenberger. Stabilized finite elements for transient flow problems on varying spatial meshes. *Computer Methods in Applied Mechanics and Engineering*, 253:106–116, 2012.

Project: Forward and Inverse Problems in Non-Linear Drift-Diffusion

Non-linear drift diffusion models are a specific class of partial differential equations. They appear in a large number of applications ranging from the dynamics of single molecules in an ion channel or the movement of cells up to the collective behaviour of animals or even humans. In their most general form these equations raise a large number of mathematical problems, such as whether there exists a solution (direct problem) or the determination of unknown parameters in the equation using measurements of a given solution (inverse problem). Due to the diversity of questions this project focuses on some numerical and analytical aspects as well as inverse problems related to these models with a special emphasis on their connection. We examine the inverse problem both analytically and numerically, which includes the development of robust numerical discretisations for the direct problem. Furthermore, we will consider an alternative geometric interpretation, yielding to the concept of gradient flows. This reformulation gives additional information about the solutions, which will help us to evaluate the numerical algorithms, cf. [1]. As a final step we shall apply these results to real data in the context of ion channels and nanopores.

Partner: Deutsche Forschungsgemeinschaft (DFG), The Daimler and Benz Foundation (PostDoc stipend)

Contact: J.-F. Pietschmann

References

[1] M. Burger, J.-F. Pietschmann, and M.-T. Wolfram. Identification of nonlinearities in transport-diffusion models for size exclusion. *UCLA CAM report*, 11-80, 2011.

Project: New mathematical methods and models for an improved understanding of synthetic nanopores

Synthetic nanopores are an important element in nanotechnology with applications in the medical and pharmaceutical industry. However, existing linear models, such as the

Poisson-Nernst-Planck equations, can only explain part of the experimental observations. Thus, in this project we will introduce new, nonlinear models including finite size effects. Continuing previous work, cf. [1, 2], we shall perform extensive numerical simulations and compare the results with experimental data from our collaborators, the Siwy research lab at the University of California, Irvine. In a second step, methods from the scope of inverse problem will be applied to reconstruct properties of the pore that cannot be observed experimentally. A prominent example is the surface charge inside the pore.

Partner: German Academic Exchange Service (DAAD), PPP-Project

Contact: J.-F. Pietschmann

References

[1] M. Burger, M. Di Francesco, J.-F. Pietschmann, and B. Schlake. Nonlinear cross-diffusion with size exclusion. *SIAM Journal on Mathematical Analysis*, 42(6):2842–2871, 2010.

[2] M. Burger, P. A. Markowich, and J.-F. Pietschmann. Continuous limit of a crowd motion and herding model: analysis and numerical simulations. *Kinet. Relat. Models*, 4(4):1025–1047, 2011.

Project: Global Error Estimation for Finite Element Methods for Parabolic Differential Equations

Modern solvers for partial differential equations of parabolic type gain in efficiency by adaptivly optimizing their grids based on local error control. However, the accuracy imposed by the user applies to the global error of the approximation. In this project we focus on efficient and reliable estimation and control of the global errors in finite element methods.
We estimate the global errors by solving linearized error transport equations. For global error control we use the property of tolerance proportionality. Due to the stiffness of appearing subproblems in the method of lines our strategies are based on the concepts of B-stability and B-convergence.

Partner: K. Debrabant (University of Southern Denmark, Odense)

Contact: A. Rath, J. Lang

References

[1] K. Debrabant and J. Lang. On global error estimation and control of finite difference solutions for parabolic equations. *ArXiv e-prints*, 2009.

Project: Unsteady Adaptive Stochastic Collocation Methods on Sparse Grids

This project incorporates uncertain quantities arising in nature or processes into numerical simulations. By doing so, computational results become more realistic and meaningful. Underlying mathematical models often consist of Partial Differential Equations (PDEs) with input data, that specify the describing system. If these input parameters are not explicitly known or subject to natural fluctuations, we arrive at PDEs with random parameters. We focus on random parameters that can be described by correlated random fields. A parametrization into finitely many random variables yields problems with possibly high dimensional parameter space, that has to be discretized beside the deterministic dimensions. To this end, we use adaptive, anisotropic stochastic collocation on sparse grids.

Similar to a Monte Carlo simulation, this approach decouples and hence parallelizes the stochastic problem into a set of deterministic problems. By means of fluid flow examples, we show impressively that the method is able to resolve a stochastic parameter space of up to $20-50$ dimensions. Moreover, we extend the adjoint approach to stochastic collocation methods in order to derive error estimates for stochastic quantities of interest.

Contact: B. Schieche, J. Lang.

Support: German Research Foundation (DFG): Graduate School of Computational Engineering, TU Darmstadt.

References

[1] B. Schieche. Adaptive stochastic collocation on sparse grids. In H.-D. Alber, N. Kraynyukova, and C. Tropea, editors, *Proceedings in Applied Mathematics and Mechanics*, pages 653–654. WILEY, Weinheim, 2012.

[2] B. Schieche and J. Lang. Adjoint error estimation for stochastic collocation methods. Preprint, TU Darmstadt, 2012.

[3] B. Schieche and J. Lang. Uncertainty quantification for thermo-convective poiseuille flow using stochastic collocation. *Int. J. Computational Science and Engineering*, to appear.

Project: Stability and consistency of discrete adjoint peer methods

In optimal control of differential equations there are essentially two approaches to generate an discrete optimality system. The first-optimize-then-discretize approach means that the continuous optimality system is discretized, wheras the first-discretize-then-optimize approach solves the optimality system generated from the discretized optimal control problem. It is advantageous in optimal control, if the two approaches are interchangeable. Therefore it is important that the discrete adjoint of a time discretization is consistent with the continuous adjoint equation.
Implicit peer methods are sucessfully applied in the numerical solution of stiff ordinary differential equations and time time-dependent partial differential equations. We derived additional consistency order conditions for constant stepsizes, such that the discrete adjoint method is consistent with the continuous adjoint. Furthermore, we analyzed the stability of the discrete adjoint method. Stable methods of order two and three with a consistent discrete adjoint were constructed and the theoretical order was tested on a selection of ODE test problems. It was shown that in terms of consistency order of the method and its discrete adjoint implicit peer methods can not be better than backward differentiation formulas.

Contact: D. Schröder, J. Lang

References

[1] D. Schröder, J. Lang, and R. Weiner. Stability and Consistency of Discrete Adjoint Implicit Peer Methods. *submitted to Journal of Computational and Applied Mathematics*, 2012.

Project: Reduced-order modeling of incompressible flow problems

Reduced-order models promise speed-up of orders of magnitude for applications where flow problems are solved multiple times for different parameters, under the condition that the solution can be represented by a linear combination of a small number of global basis functions. In this project, models based on the proper orthogonal decomposition (POD)

and the centroidal Voronoi tessellation (CVT) are explored as means of order reduction. The number of degrees of freedom necessary to compute flow fields accurately is increasing quickly with a rising Reynolds number, which makes direct numerical simulations of turbulent flows expensive in terms of computational cost. The large-eddy simulation (LES) tackles this problem by resolving only the larger scales of the flow and modeling the effect of the sub-grid scales, e.g. by introducing an artificial eddy viscosity. It is investigated how reduced-order models for the coherent structures of the flow field can be improved using LES modeling techniques.
Flow problems with uncertain boundary conditions are considered as another field of application for reduced-order models. The stochastic collocation on sparse grids is a standard method to solve such problems. The method relies on the numerical solutions of deterministic equations for a possibly large set of collocation points contained in a multi-dimensional parameter domain. The goal of the project is to save computational time by replacing full-order finite element computations with reduced-order computations at the collocation points.

Support: DFG Collaborative Research Centre (SFB) 568 “Flow and Combustion in Future Gas Turbine Combustion Chambers”, 2008-2011. DFG Cluster of Excellence (EXC) 259: “Center of Smart Interfaces”, 2012. DFG Schwerpunktprogramm (SPP) 1276: “MetStröm: Skalenübergreifende Modellierung in der Strömungsmechanik und Meteorologie”, 2012

Contact: S. Ullmann, J. Lang

References

[1] S. Ullmann and J. Lang. A POD-Galerkin reduced model with updated coefficients for Smagorinsky LES. In J. C. F. Pereira, A. Sequeira, and J. M. C. Pereira, editors, *Proceedings of the V European Conference on Computational Fluid Dynamics ECCOMAS CFD 2010*, Lisbon, Portugal, June 2010.

[2] S. Ullmann and J. Lang. POD and CVT Galerkin reduced-order modeling of the flow around a cylinder. In H.-D. Alber, N. Kraynyukova, and C. Tropea, editors, *Proceedings in Applied Mathematics and Mechanics*, pages 697–698. Wiley-VCH, 2012.

[3] S. Ullmann and J. Lang. POD-Galerkin modeling and sparse-grid collocation for a natural convection problem with stochastic boundary conditions. In *Sparse Grids and Applications*. Springer, 2013.

[4] S. Ullmann, S. Löbig, and J. Lang. Adaptive large eddy simulation and reduced-order modeling. In J. Janicka, A. Sadiki, M. Schäfer, and C. Heeger, editors, *Flow and Combustion in Advanced Gas Turbine Combustors*, pages 349–378. Springer, 2013.

1.2.7 Optimization

The research group **Optimization** consists of the groups **Algorithmic Discrete Mathematics**, **Discrete Optimization**, and **Nonlinear Optimization**, which cooperate closely. Mathematical Optimization considers the development, analysis, and application of efficient numerical methods for minimizing (or maximizing) a function under constraints. While Discrete Optimization studies mainly linear or convex problems involving integer variables, Nonlinear Optimization focuses on nonlinear problems with continuous variables. The research group covers both research topics in a comprehensive way and cooperates in particular in the challenging field of Mixed Integer Nonlinear Programming, which considers nonlinear optimization with mixed discrete-continuous variables.

Algorithmic Discrete Mathematics combines aspects of pure and applied mathematics. The group focuses on geometric combinatorics with links to graph algorithms, linear and integer programming, toric and tropical algebraic geometry and related areas.
We develop mathematical software for research in mathematics and beyond.

Discrete Optimization has become an important component in modern applied mathematics. Many problems from business and industry can be modeled as discrete optimization problems. The development of solution methods for these problems is the main focus of the group Discrete Optimization. This includes the development of mathematical models of real-world problems, the theoretical analysis (using methods mainly from graph theory, polyhedral combinatorics, and integer programming), and the design and implementation of fast algorithms as well as their evaluation in practice.
Experiences of the group are, for instance, in the following applied areas: public mass transportation (line planning, disruption management), energy optimization (gas transport), or optimization in mechanical engineering (truss topology optimization), see the projects for details.

Nonlinear Optimization is nowadays an important technology in applied mathematics, science, and engineering. Nonlinear optimization problems appear in many applications, e.g., shape optimization in engineering, robust portfolio optimization in finance, parameter identification, optimal control, etc. Nonlinear Optimization has emerged as a key technology in modern scientific and industrial applications. Challenging are in particular optimization problems with partial differential equations as constraints (PDE-constraints), for example, optimization problems for flows, transport problems, diffusion processes, wave propagation, or mechanical structures. An efficient solution of such problems requires highly developed optimization methods, which use modern adaptive multilevel techniques of scientific computing.
The research group Nonlinear Optimization considers the development, theory, implementation, and application of efficient algorithms for nonlinear optimization. Particular research topics are PDE-constrained optimization, large scale optimization, adaptive multilevel techniques, preconditioning, global optimization, and relaxation of discrete problems.

The research group Optimization is engaged among others in the Excellence Cluster EXC 259 *Center of Smart Interfaces*, the Graduate School (Excellence Initiative) GSC 233 *Computational Engineering: Beyond Traditional Sciences*, the Collaborative Research Center (SFB) 568 *Flow and Combustion in Future Gas Turbine Combustion Chambers*, the Collaborative Research Center (SFB) 666 *Integral Sheet Metal Design with Higher Order Bifurcations - Development, Production, Evaluation*, the Collaborative Research Center (SFB) 805 *Control of Uncertainties in Load Carrying Systems of Mechanical Engineering*, the LOEWE-Center *AdRIA: Adaptronik: Research, Innovation, Application*, the International Research Training Group IGK 1529 *Mathematical Fluid Dynamics*, and the German Research Foundation (DFG) Priority Programme SPP 1253 *Optimization with Partial Differential Equations*. In addition, the group has various industry partners, including cooperations with Open Grid Europe and Schenck.

Project: Adaptive Multilevel SQP-Methods for PDAE-Constrained Optimization with Restrictions on Control and State

The project is part of the DFG-Priority Program SPP 1253 “Optimization with Partial Differential Equations”.
We extend the adaptive multilevel SQP-method for control-constrained optimal control problems of Ziems and Ulbrich, see [3] or [5], to state-constrained optimal control problems governed by PDAEs. To this end, we combine the Moreau Yosida regularization with the adaptive SQP method. The refinement conditions and the penalty parameter update are modified specifically. We ensure that the regularized subproblems satisfy the assumptions of the adaptive SQP method and that the combined algorithm is well-posed. Based on the convergence theory for the Moreau Yosida regularization of Meyer and Yousept [4] and the SQP method of Ziems and Ulbrich [6] or [5], we deliver a new first order necessary optimality result for the output of the combined algorithm [1].
Additionally we include a reduced-order model based on POD combined with DEIM in the adaptive SQP method. This reduces the computational effort significantly.
The algorithm is implemented for an application in glass manufacturing by Clever, Lang and Schröder, see [2].

Partner: D. Clever, J. Lang and D. Schröder, TU Darmstadt

Support: Graduate School GSC 233: “Computational Engineering”

Contact: S. Bott, S. Ulbrich, J. C. Ziems

References

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Project: Adaptive Multigrid Methods for Fluid-Structure Interaction Optimization

Strong fluid structure coupling is part of many technical systems. The aim of this project is to develop an efficient adaptive multilevel algorithm to solve an optimization problem governed by Fluid-Structure Interaction (FSI).
This algorithm should combine modern techniques of PDE-constrained optimization, adaptivity and Fluid-Structure Interaction simulation. Since for elliptic as well as for parabolic partial differential equations an adjoint based Trust-Region SQP method has shown good results, we want to adapt this method. Thus we aim for an adjoint based algorithm that is able to refine the given grids (both the spatial and the temporal) adaptively during the optimization process.
The Fluid-Structure Interaction problem we consider as the constraint for the optimization

problem, is in the weak form of the FSI problem considered in an Arbitrary-Lagrangian-Eulerian (ALE) framework. The coupling of the two parts of the partial differential equation is performed via strong coupling.
Accordingly, the adjoint equation is considered in an ALE framework and in a strongly coupled way.

Partner: Graduate School GSC 233: "Computational Engineering"

Support: German Research Foundation (DFG)

Contact: S. Essert, M. Schäfer, S. Ulbrich

Project: Optimal Flow Control based on Reduced Models

Tollmien-Schlichting waves are responsible for the laminar-turbulent transition in a flat plate boundary layer. By damping these waves, a significant reduction of drag can be achieved. Motivated by an experiment conducted in the windtunnel at the institute SLA, the objective is to dampen Tollmien-Schlichting waves using a body force which is induced by a plasma actuator. These actuators induce a body force which leads to a fluid acceleration, so the velocity profile is changed next to the surface. By optimal control of the plasma actuator parameters it is possible to reduce or even cancel the Tollmien-Schlichting waves and delay the turbulence transition.
We use a Model Predictive Control (MPC) approach for the cancellation of Tollmien-Schlichting waves in the boundary layer of a flat plate. The model that predicts the next flow field in a time horizon, has to fulfill the Navier-Stokes equations. Instead of solving a high-dimensional system, a low-order model description is used to perform the optimization. The reduced-order model is obtained with a Galerkin projection and an appropriate basis. We use Proper Orthogonal Decomposition (POD) in which the basis function are generated from numerical solutions. The optimization of the control parameters is performed within the reduced system. The efficiency of the reduced-order controller is demonstrated for the damping of Tollmien-Schlichting waves by plasma actuators.

Partner: Institute of Fluid Mechanics and Aerodynamics (SLA), Institute of Numerical Methods in Mechanical Engineering (FNB)

Support: Graduate School GSC 233: "Computational Engineering"

Contact: J. Ghiglieri, S. Ulbrich

Project: Mathematical methods and models for the optimal combination of active and passive components in trusses

This project is part of the Collaborative Research Centre (SFB) 805 *Control of uncertainty of load carrying systems in mechanical engineering*. The project deals with the optimal design of mechanical trusses under uncertainty. Trusses are important in many applications (undercarriages of airplanes, bicycles, electrical towers, etc.) and are often overdimensioned to withstand given forces under several uncertainties in loadings, material and production processes. Active parts (e.g., piezo-elements) can react on these uncertain effects and reduce the dimension of trusses. The Collaborative Research Centre (SFB) 805 introduces new technologies to handle uncertainty in load carrying systems. The aim of this project is to find optimal combinations of active and passive parts in a mechanical truss under several types of uncertainty, e.g. uncertainty in loadings, material, production processes or malfunction of complete bars. Mathematically, this leads to mixed-integer nonlinear

semidefinite problems. For these kinds of problems, there exists no solvers that exploit the structure of the problem efficiently. Besides the development of an appropriate solver another focus lies in a mathematical handling of the upcoming uncertainties. For example, ellipsoidal and polyhedral sets will be used to integrate uncertainty in different loading scenarios. All of this includes interdisciplinary communication to mechanical engineers to achieve realistic models.

Partner: Collaborative Research Center (SFB) 805: "Control of Uncertainty of load carrying structures in mechanical engineering"; speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt)

Support: German Research Foundation (DFG)

Contact: K. Habermehl, S. Mars, M. Pfetsch, S. Ulbrich

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Project: Generation of Certificates for the Infeasibility of Technical Capacities

This project is part of the BMWi cooperative project "Investigation of the technical capacities of gas networks", in which six research partners, the gas transportation company Open Grid Europe, and the German Federal Network Agency (Bundesnetzagentur) are involved. The technical capacities determine bounds on the amount of gas that can be charged into or discharged from a gas network. Therefore, a central aspect is to compute the technical capacities.
In our sub-project, we want to determine certificates for the infeasibility of certain gas nominations. For the analysis of technical capacities one has to decide which requests can be handled by the network. If a certain nomination cannot be transported, one wants to know the reason why this nomination is infeasible. Thus a justification is required, i.e., a certificate that is easy to understand. This should be possible without the need for involved simulations or computations. We will concentrate on the development of methods to find such certificates and apply them to the analysis of technical capacities.

Partner: Zuse-Insitute Berlin, Universität Hannover, Universität Duisburg-Essen, HU Berlin, Universität Erlangen-Nürnberg, German Federal Network Agency (Bundesnetzagentur), Open Grid Europe

Support: German Federal Ministry of Economics and Technology (BMWi)

Contact: I. Joormann, M. Pfetsch

Project: FORNE

In this project, we deal with gas network optimization, together with our industrial partner Open Grid Europe (OGE). The goal is to provide tools for the mid to long term planning of gas networks. One main step deals with the question to decide whether a given amount of gas and given bounds on the pressure can be transported in a stationary gas network. Furthermore, the extension of the existing gas network topology is considered. We develop algorithms that provide solutions to the corresponding mixed-integer nonconvex, nonlinear optimization problems. The methods are tested on the real-world instances of OGE.

Partner: Zuse-Insitute Berlin, Universität Hannover, Universität Duisburg-Essen, HU Berlin, Universität Erlangen-Nürnberg, Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS) Berlin, Open Grid Europe

Contact: I. Joormann, M. Pfetsch

Project: `polymake`

The mathematical software system `polymake` provides a wide range of functions for convex polytopes, simplicial complexes, and other objects.
While the system exists for more than a decade it was continuously developed and expanded. The most recent version fundamentally changes the way to interact with the system. It now offers an interface which looks similar to many computer algebra systems. However, on the technical level `polymake` differs from most mathematical software systems: rule based computations, a flexible object hierarchy and an extendible dual Perl/C++ interface are the most important characteristics. There are interfaces to programs written in C, C++, Java, and Perl.
`polymake` is an open source software project. The current version 2.12 can be downloaded freely from `www.polymake.org`.

Partner: Ewgenij Gawrilow (TomTom N.V.) and the `polymake` team

Contact: M. Joswig

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Project: Symmetries in Linear and Integer Linear Programming

It is a known fact that many standard (integer) linear programming formulations of relevant problems in optimization exhibit a lot of symmetry. In this situation a standard branch-and-cut framework repeatedly enumerates symmetric solutions, and sometimes this renders such methods useless. To address these issues the last decade saw a number of approaches to devise algorithms specialized to symmetric optimization problems, see e.g. Ostrowski et al. [2].
We tackle the problem from a geometric and group theoretic view point. Basic properties of linear representations of finite groups can be used to reduce symmetric linear

programming to solving linear programs of lower dimension. Combining this approach with knowledge of the geometry of feasible integer solutions yields an algorithm for solving highly symmetric integer linear programs which only takes time which is linear in the number of constraints and quadratic in the dimension. We also extend this approach to integer linear programs that are symmetric with respect to products of groups.

Support: Studienstiftung des deutschen Volkes

Contact: M. Joswig, K. Herr

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Project: Optimization of process chains under uncertainty

The aim of this project is to determine optimal process chains, as well as mastering uncertainties which occur in process chains and process networks. Uncertainties e.g., occur when non-deterministic variations of geometry or material influence the strength of a stick in a stick system. Uncertainties also occur in form of imprecise sales-forecasts. These imprecisions have direct consequences on production techniques.
In the context of this subproject, optimal process chains for the production of devices are to be determined. We can examine various objectives for this purpose, e.g. the minimization of production costs subject to compliance with certain tolerances of quality. Another objective may be to maximize the profits under consideration of variations in the market. In the SFB 805, we find on various levels process chains flawed with uncertainties. The first task is to develop mathematical models that embrace the problems of practice. In this project, we assume that we can model the inherent uncertainties of process chains with the help of distributions over future random scenarios. A discretization of a distribution leads us to a model described by high dimensional mixed-integer linear programs. These programs have block-structured constraint-matrices, where blocks represent possible scenarios which are coupled via some decision variables. The number of scenarios can be reduced with the help of suited reduction methods so that the resulting mixed-integer program turns out to be manageable in many cases.
Additionally, approximation algorithms and heuristic procedures, which can work without constructing the enormously large stochastic programs, are to be examined. A more efficient description of the multi-stage stochastic problems can be exploited in these cases. The resulting slim problems are often PSPACE-hard, and have strong similarities to non-stochastic 2-person games. The aim, however, is to avoid an exponential blow up in the size of the input description as it occurs, when stochastic programs are transformed to their deterministic equivalents.

Partner: Collaborative Research Center (SFB) 805: “Control of Uncertainty of load carrying structures in mechanical engineering”; Speaker H. Hanselka (Department of Mechanical Engineering, TU Darmstadt)

Support: German Research Foundation (DFG)

Contact: T. Ederer, U. Lorenz

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Project: GOmputer: the GO machine

The ability to compete with humans in playing games, most prominently chess, has been a longstanding touchstone for machine intelligence. In 1997, IBM's chess machine Deep Blue defeated Garry Kasparov, the highest-rated chess player ever [1]. Since then, several chess machines have been developed that are able to compete with human top players; the world's strongest one presumably being our own development Hydra [2, 3]. In contrast, computer programs for the Asian board game GO are still rather weak, which is often attributed to GO's orders of magnitude greater complexity - in terms of possible board positions and moves. While cracking GO remains an open challenge [5], in the last years GO programs also began to serve as test beds for the evaluation of developments in areas such as game tree search, pattern recognition, and machine learning.
The GOmputer project aims at the investigation of novel algorithmic approaches for playing GO and the development of a parallelized and hardware-accelerated GO machine prototype. From our previous work and experience, especially the world's strongest chess machine Hydra, we know that the interplay of research and development efforts between game algorithms and modern parallel computing architectures is a necessity to achieve a competitive GO machine. On the longer term, this project should lay the foundation for the development of the world's strongest GO machine [4].
The proposed PhD project is co-supervised by Ulf Lorenz, TU Darmstadt, and Marco Platzner, University of Paderborn.

Partner: M. Platzner and L. Schäfers, Universität Paderborn

Support: Microsoft, Universität Paderborn

Contact: U. Lorenz

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Project: Uncertainties in the structure finding process of hydrostatic consumers

A present demand of hydrostatics in car power-trains is the minimization of losses for valve-controlled consumers. One strategy to achieve the goal is that the displacement controller avoids resistant losses. For cost and functional reasons this way is not satisfactory for all situations. The focus is now on the question how future valve controls will look like. Beyond the structure of the hardware, the question arises, how the used valves can be operated. An analysis of current operating strategies shows no systematics which control strategy is well fitting for which situation.
Thus the task is to find a hardware structure of valves of different types and a control algorithm for it such that losses are minimized under consideration of functionality, load profiles, demanded precision, energetic losses and costs.

Partner: P. Pelz, TU Darmstadt, Institut für Fluidsystemtechnik

Support: Collaborative Research Center (SFB) 805

Contact: U. Lorenz

Project: System optimization of the heating plant in the Darmstadtium

This is a pre-project for a larger project in cooperation with VDMA. Algorithmic optimization methods are used for the system design of heating plants and the current heating plant of the Darmstadtium is evaluated. Questions of the carrier in the Darmstadtium are: Is the wood heating boiler efficiently used? Does the hydraulic separator work as it should do? How should own heating and long-distance heating be mixed? Is the buffer storage intelligently used?

Partner: P. Pelz, TU Darmstadt, Institut für Fluidsystemtechnik

Support: VDMA

Contact: U. Lorenz

Project: Extension of mathematical Optimization Methods to solve PSPACE-complete Problems with the Help of Quantified Linear Programs

For classic optimization, it is assumed that the input of a problem is known before the computation starts. In practice, however, we are often in a situation where a part of the input data is afflicted with uncertainties or only estimations are known in advance. Many interesting optimization problems become PSPACE-complete as soon as even only most simple uncertainties are incorporated into the description of the input data. There are various approaches under research in the area of optimization under uncertainty. Relatively unexplored are the opportunities of quantified extensions of linear programs where some of the variables are universally quantified and the others extistentially. Such extended linear programs are called quantified linear programs (QLP). QLPs where the variables must be integer, are called quantified integer programs (QIP) and the QIP problem is PSPACE complete.
The aim of this research is to extend methods and insights of Mathematical Optimization such that they can be used to solve QIPs and QLPs. It is to be examined in how far QLPs and QIPs are useful tools in order to describe interesting problems from practice and in how far solution algorithms can be presented which lead to impressive results, in the same way as MIP-solvers have already shown for NP-complete problems of practice.

Support: German Research Foundation (DFG)

Contact: U. Lorenz, T. Opfer

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Project: Triangulations and other decompositions of lattice polytopes in toric and tropical geometry

Lattice polytopes are objects at a junction between combinatorics and algebraic geometry. The study of their triangulations, coarsest subdivisions, mixed subdivisions, and other decompositions is motivated by the mutual interaction between these fields as well as by applications in number theory, optimization, statistics, mathematical physics, and algorithmic biology.
Attacking fundamental open problems in this area requires to combine theoretical insight with algorithmic ingenuity and computer experiments. Specific topics addressed in this project include the following: unimodular triangulations of lattice polytopes (in particular, matroid polytopes), the relationship between smoothness and normality of a toric variety, combinatorial and geometric interpretations of h^*-polynomials, and symmetric lattice polytopes.

Partner: Priority Program 1489 “Algorithmic and Experimental Methods in Geometry, Algebra, and Number Theory”; speaker: W. Decker

Support: German Research Foundation (DFG)

Contact: M. Joswig, A. Paffenholz

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Project: Algorithmic Methods in Combinatorial Topology

Algorithmic problems are fundamental to low-dimensional topology; key examples include testing two spaces for topological equivalence, or identifying the topology of a space from a given triangulation. Although solutions to many such problems are known, the methods are often infeasibly slow, impractically complex, and difficult to implement. Central to many of these algorithms is the "projective solution space", a highdimensional polytope (analogous to a 3-D polyhedron or 2-D polygon) that encodes a large amount of topological information. Our primary goal is to study the structure of this polytope, yielding new insights into the difficulty of these algorithmic problems, and developing new algorithms

that allow these problems to be used effectively in practical experimentation. In particular, we will: - develop new algorithms to locate vertices of the polytope that hold particular topological significance; - develop a direct, efficient approach to determine the logarithmic limit set of the deformation variety, yielding significant geometric insights into the topological space under investigation; - gaining a clear understanding of the combinatorial complexity of the polytope, in particular the "admissible region" in which the most important topological information is located. Outcomes will include not only research papers, but also fast, accessible mathematical software for use by the wider research community. Such software is needed in practical applications of topology, such as DNA knotting and mathematical physics.

Partner: B. Burton (University of Queensland, Brisbane), S. Tillmann (University of Sydney)

Support: "Go8 Australia-Germany Joint Research Co-operation Scheme", German Academic Exchange Service (DAAD)

Contact: M. Joswig, A. Paffenholz

Project: Optimal control of switched networks for nonlinear hyperbolic conservation laws

The project is part of the DFG-Priority Program SPP 1253 "Optimization with Partial Differential Equations".
Its aim is the analysis of optimal control problems for hyperbolic balance laws on networks under modal switching, where the switchings are considered in the source terms as well as at boundary nodes and junctions. This type of problems arise for example in traffic flow models or in models for water and gas networks.
The main difficulty of the analysis of conservation laws stems from the fact that even in the case of a single scalar conservation law and smooth data the entropy solution usually develops shocks, which causes the solution operator not to be differentiable in the usual sense. However, encouraging progress has been achieved recently for the optimal control of conservation laws by using a generalized notion of differentiability (so called shift-differentiability). Switching between different modes may result in additional discontinuities in the solution, which is, however, quite natural in the context of entropy solutions.
The project focuses on the investigation of the existence of optimal controls, the differentiability properties of the reduced objective function w.r.t. the initial and boundary data, the node conditions (at junctions) and switching times as well as the corresponding sensitivity and adjoint equations.

Partner: G. Leugering, Universität Erlangen-Nürnberg

Support: German Research Foundation (DFG)

Contact: S. Pfaff, S. Ulbrich

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Project: Mixed-Integer nonlinear models in wireless networks

This project is part of the LOEWE Priority Program Cocoon (Cooperative Sensor Communication) supported by the LOEWE research initiative of the state of Hessen/Germany.
In this project we explore the utilization of mixed-integer optimization in wireless telecommunication networks. Typical for problems occurring in this context is the simultaneous consideration of continuous optimization variables e.g., like beamforming vectors and combinatorial aspects, like the assignment of base stations to mobile users.
Mathematical models are derived that account both for the requirements of the application and the solvability. Usually one has to deal with NP-hard problems in this context that cannot be solved by standard software. We investigate convex approximations as well as heuristics to derive reasonable good solutions. We use these approximations just as techniques like cutting plane generation aiming to solve the mixed integer nonlinear model of the original problem. The global optimal solution can also be used to evaluate heuristic and approximation approaches.

Partner: LOEWE Priority Program Cocoon (Cooperative Sensor Communication)

Contact: A. Philipp, S. Ulbrich

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Project: Efficient Numerical Multilevel-Methods for the Optimization of Gas Turbine Combustion Chambers

In the past few years, there has been a lot of development regarding the optimization of flows. This field of research is among the most challenging tasks from a numerical and also theoretical point of view. With todays computational power and algorithmic developments, the optimization of the flow and combustion in a gas turbine chamber is within reach. In this project, we tackle the task of efficient optimization with a sophisticated numerical code for flow solving, while combining them with state of the art optimization techniques. The basis for the numerical calculations is the parallel multi-grid flow solver FASTEST-3D, which has been developed in the past few years and has various flow and combustions models incorporated.
Via automatic differentiation, we obtain a linear system for the adjoint equations, with which the gradients for the optimization routines are obtained. This has already been done for various kinds of optimization problems including LES and RANS of unsteady three dimensional flows, heat transfer, and shape optimization.
For the optimization, a multilevel optimization environment has been implemented. Here,

one makes use of a hierarchical order of models describing a problem. Examples for these models are discretization levels or models with increasing physical fidelity.

Partner: Collaborative Research Center (SFB) 568: “Flow and Combustion in Future Gas Turbine Combustion Chambers”; speaker J. Janicka (Department of Mechanical Engineering, TU Darmstadt)

Support: German Research Foundation (DFG)

Contact: R. Roth, S. Ulbrich

Project: Optimal design and control of adaptronic systems

This project is part of the LOEWE-Center AdRIA, which is a collaborative reserach initiative of the Fraunhofer Institute for Structural Durability and System Reliability LBF, the TU Darmstadt and the Hochschule Darmstadt to create a leading international research center for adaptronic systems.
As part of the project "quiet office" we develop cost-effective system solutions to optimize the sound insulation in office buildings to the prototypical market for flat building elements (windows, facades, partition walls), building services (plumbing, heating and air conditioning), and office equipment (projector, printer, copier). The demonstrator "acoustic aquarium" provides an appropriate platform to interpret, implement and evaluate the approaches, methods and solutions for vibration reduction.
An FE model of the acoustic demonstrator was developed and approximated by model order reduction. Based on this model, a method for optimal placement of sensors and actuators is developed. Afterwards we deal with the optimization of controller parameters and the development of linear and nonlinear model predictive control (MPC) algorithms. With the MPC approach, we plan to reduce the noise and vibration by an online optimization method at the acustic demonstrator. The developed methods will be tested and compared with existing methods.

Partner: LOEWE-Center AdRIA: S. Herold

Contact: S. Ulbrich, C. Schäfer

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Project: Mathematical Programming in Robust Design

The presence of uncertainty is a prevalent characteristic in mechanical engineering which can lead to severe economical and safety consequences. This applies particularly to fields like lightweight design, e.g. aircraft construction, where high load-bearing capacity has to be combined with low weight and where system failure is not tolerable at any point.
As part of the Collaborative Research Centre (SFB) 805: “Control of uncertainty of load carrying systems in mechanical engineering” we want to find - for load carrying mechanical systems - the optimal robust design regarding uncertainty of parameters, e.g. material properties and loading scenarios, as well as uncertainty of the manufacturing quality.
This is achieved by simulation-based optimization of geometry, topology and the placement

of actuators, at which modern techniques of robust optimization are applied and extended. In particular we choose a worst-case approach to incorporate the existing uncertainty into our optimization model. This leads to a computationally intractable problem formulation since we consider nonlinear nonconvex objective functions and further employ complex PDE constraints in order to model the mechanical behaviour of the considered structures. Hence, this so-called robust counterpart is approximated by means of a second order Taylor expansion which is solved by an efficient SQP method.

Partner: Collaborative Research Centre (SFB) 805: "Control of uncertainty of load carrying systems in mechanical engineering"; Speaker H. Hanselka (Department of Mechanical Engineering, TU Darmstadt)

Support: German Research Foundation (DFG)

Contact: A. Sichau, S. Ulbrich

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Project: SPEAR – Sparse Exact and Approximate Recovery

The research project "SPEAR – Sparse Exact and Approximate Recovery" deals with the problem to recover a sparse solution of an underdetermined linear (equality) system. This topic has many applications and is a very active research area. It is located at the border between analysis and combinatorial optimization. The main goal of our project is to obtain a better understanding of the conditions under which (efficiently) finding such a sparse solution i.e., recovery is possible. Our project is characterized by both theoretical and computational aspects as well as the interplay of continuous and discrete methods.
The SPEAR project is a collaboration of the Research Group Optimization at the TU Darmstadt (since 2012, previously: Institute for Mathematical Optimization at the TU Braunschweig) and the Institute for Analysis and Algebra at the TU Braunschweig. The project is funded by a DFG research grant. Designated project period: 2011–2014.

Partner: D. A. Lorenz and C. Kruschel, TU Braunschweig

Support: German Research Foundation (DFG)

Contact: M. Pfetsch, A. Tillmann

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[3] M. E. Pfetsch and A. M. Tillmann. The computational complexity of the restricted isometry property, the nullspace property, and related concepts in compressed sensing. Preprint, TU Darmstadt, 2012.

[4] S. Wenger, M. Ament, S. Guthe, D. A. Lorenz, A. M. Tillmann, D. Weiskopf, and M. Magnor. Visualization of astronomical nebulae via distributed multi-gpu compressed sensing tomography. *IEEE Transactions on Visualization and Computer Graphics*, 18:2188–2197, 2012.

Project: Mathematical models and algorithms for an automated product development of branched sheet metal products

This project is part of the Collaborative Research Centre (SFB) 666 (Integral sheet metal design with higher order bifurcations - development, production, evaluation) and addresses the shape optimization of sheet metal products. There are two types of considered sheet metal products: Multi-chambered profiles and hydroformed branched sheet metal structures. For profiles, the goal is to find the optimal design of the profile-cross-sections. For this purpose, an integrated approach combining topology and geometry optimization is developed. Using branch and bound techniques, topological decisions are made where in each branch and bound node a nonlinear optimization problem has to be solved. As hydroformed parts can show arbitrary curvature, the geometry of those parts is parameterized by cubic B-spline surfaces. The product behavior is described by the three dimensional linear elasticity equations. To optimize the geometry optimization of the branched and hydroformed sheet metal products, PDE constrained optimization techniques are used. The arising nonconvex geometry optimization problem is solved with an algorithm using exact constraints and a globalization strategy based on adaptive cubic regularization. For decreasing the computational effort, multilevel-techniques are applied.

Partner: Collaborative Research Centre (SFB) 666: "Integral sheet metal design with higher order bifurcations - development, production, evaluation"; speaker P. Groche (Department of Mechanical Engineering, TU Darmstadt)

Support: German Research Foundation (DFG)

Contact: T. Göllner, H. Lüthen, M. Pfetsch, S. Ulbrich

References

[1] C. E. Ferreira, U. Günther, and A. Martin. Mathematical models and polyhedral studies for integral sheet metal design. *SIAM Journal on Optimization*, 22:1493–1517, 2012.

[2] T. Göllner, U. Günther, W. Hess, A. Martin, and S. Ulbrich. Topology and geometry optimization of branched sheet metal products. *Proceedings in Applied Mathematics and Mechanics*, 11:713 – 714, 2011.

[3] T. Göllner, U. Günther, W. Hess, M. Pfetsch, and S. Ulbrich. Optimierung der Geometrie und Topologie flächiger verzweigter Blechbauteile und von Mehrkammerprofilen. *Tagungsband 4. Zwischenkolloquium Sonderforschungsbereich 666, Hrsg. Peter Groche*, pages 15 – 24, 2012.

[4] T. Göllner, W. Hess, and S. Ulbrich. Geometry optimization of branched sheet metal products. *Proceedings in Applied Mathematics and Mechanics*, 12:619 – 620, 2012.

[5] P. Groche, H. Birkhofer, O. Bauer, T. Göllner, S. Gramlich, V. Kaune, F. Rullmann, and O. Weitzmann. Potenziale einer durchgängigen Produktentstehung - Nutzung technologieinduzierter Eigenschaften zur Entwicklung von Blechstrukturen. *Konstruktion*, 11/12-2012, 2012.

[6] P. Groche, W. Schmitt, A. Bohn, S. Gramlich, S. Ulbrich, and U. Günther. Integration of manufacturing-induced properties in product design. *Tagungsband 4. Zwischenkolloquium Sonderforschungsbereich 666, Hrsg. Peter Groche*, pages 15 – 24, 2012.

[7] W. Hess and S. Ulbrich. An inexact l1 penalty sqp algorithm for pde constrained optimization with an application to shape optimization in linear elasticity. *Optimization Methods and Software*, pages 1 – 26, 2012.

[8] O. Weitzmann, A. Schüle, T. Rollmann, R. Anderl, and T. Göllner. An object-oriented information model for the representation of free form sheet metal parts in integral style. *Tools and Methods of Competitive Engineering*, pages 725 – 738, 2012.

Project: Simulation-based optimization methods for the hydro-forming of branched structures

This project is part of the Collaborative Research Centre (SFB) 666 (Integral sheet metal design with higher order bifurcations - development, production, evaluation) and is concerned with the optimal control of the sheet metal hydro-forming. The sheet metal hydro-forming process is a complex forming process, which involves contact, friction, and plasticity to manufacture complexly curved sheet metals with bifurcated cross-section. Mathematically, this leads to a quasi-variational inequality. We want to find optimal controls for typical control variables, e.g., the time dependent blank holder force and the fluid pressure, by the use of simulation-based optimization methods. Our goal is to obtain a desired final configuration, taking into consideration relevant parameters for the production. On the one hand, we use derivative free optimization methods to solve the optimal control problem, where the commercial FEM-software ABAQUS is invoked for the simulations and, on the other hand, instantaneous optimization methods are under investigation. In this context model reduction techniques, e.g. Proper Orthogonal Decomposition, will be employed to achieve a suboptimal solution for the optimal control problem.

Partner: Collaborative Research Centre (SFB) 666: "Integral sheet metal design with higher order bifurcations - development, production, evaluation"; speaker P. Groche (Department of Mechanical Engineering, TU Darmstadt)

Support: German Research Foundation (DFG)

Contact: D. Koller, S. Ulbrich

References

[1] D. Koller and S. Ulbrich. Optimal control of hydroforming processes. *Proceedings in Applied Mathematics and Mechanics*, 11:795 –796, 2011.

[2] D. Koller and S. Ulbrich. Ableitungsfreie Optimierungsverfahren für die optimale Steuerung von wirkmedienbasierten Tiefziehprozessen. *Tagungsband 4. Zwischenkolloquium Sonderforschungsbereich 666, Hrsg. Peter Groche*, pages 41 – 48, 2012.

1.2.8 Stochastics

Research in the stochastics group is focused on mathematical statistics (i.e., on the mathematical analysis of randomly disturbed data) and on statistical mechanics with connections to the phsyical sciences.

We are interested in the theoretical analysis of methods of mathematical statistics, the study of interacting particle systems, interacting Brownian motions, phase transitions and critical phenomena. Furthermore we investigate applications in various fields of physics, science and engineering.

Specifically, we work on curve estimation (in particular nonparametric regression and nonparametric density estimation), spatial random permutations, and probabilistic methods in quantum theory. Furthermore, we study Monte Carlo methods for financial engineering, and applications of probability theory to the theory of Bose-Einstein condensation.

The members of the research group stochastics are involved in joint projects with colleagues working in probability and statistics, as well as from neighboring disciplines like econometrics, engineering sciences, physics, and psychology. Furthermore, we are carrying out research projects in applied stochastics with well-known industrial partners.

Project: Spatial random permutations and Bose-Einstein condensation

The theoretical understanding of the quantum phenomenon of Bose-Einstein condensation is one of the great unsolved problems of theoretical physics. It is well known that the quantum mechanical problem can be translated into a probabilistic one by using the Feynman-Kac formula. The result is a system of interacting spatial permutations, and the question to be answered is about a phase transition in the typical length of cycles, with the order parameter being the typical distance of two spatial points that will be mapped into each other by the permutation. Even though an understanding of the full probabilistic model is currently out of reach, there are various simplifications that should exhibit typical properties of the full model and are interesting in their own right. Moreover, these simpler models touch on many other current topics of statistical mechanics, such as motion by mean curvature, percolation or Schramm-Löwner evolution. The work in the research group is focused on understanding various of these aspects in simple cases, using both analytical and numerical methods.

Partner: D. Ueltschi (University of Warwick); T. Funaki (University of Tokyo)

Contact: V. Betz

References

[1] V. Betz and D. Ueltschi. Spatial random permutations and poisson-dirichlet law of cycle lengths. *Electronic Journal of Probability*, 16:41, 2011.

[2] V. Betz and D. Ueltschi. Spatial random permutations with small cycle weights. *Probab. Th. Rel. Fields*, 149:191–222, 2011.

[3] V. Betz, D. Ueltschi, and Y. Velenik. Random permutations with cycle weights. *Ann. Appl. Probab.*, 21:312–331, 2011.

Project: Enhanced binding through path integrals

The description of electrically charged matter coupled to its quantized radiation field has been an active and successful area of research in the past decade. One possible way to study the problem is to use path integrals, thus converting the problem into a probabilistic one. One particular area where this is promising is the study of the effective mass of coupled particles: as charged particles are surrounded by a cloud of photons, their mass is increased. Probabilistically, this leads to a non-Markovian modification of Brownian motion where in the diffusive scaling a functional central limit theorem to holds. The diffusion matrix is known to be smaller or equal to the one of the original Brownian motion, but is expected to be strictly smaller. This discrepancy, leading to a reduced expected mobility of the particle, corresponds exactly to the increased effective mass. The aim of the project is to quantify and prove the difference of the diffusion constants, and to apply it to models like the Nelson scalar field model where so far enhanced binding has not been shown.

Partner: E. Bolthausen (Universität Zürich)

Contact: V. Betz

References

[1] J. Lőrinczi, F. Hiroshima, and V. Betz. *Feynman-Kac-Type Theorems and Gibbs Measures on Path Space*. de Gruyter, 2011.

Project: Data-based optimal stopping via forecasting of time series

The problem of optimal stopping in discrete time is considered. The algorithm proposed uses techniques of forecasting of time series and is completely nonparametric in the sense that it is solely based on observations. It is shown that the expected gain of the corresponding stopping rule converges to the optimal value whenever the observations are drawn from a stationary and ergodic sequence. The algorithm is illustrated by applying it to the problem of optimal exercising an American option.

Contact: D. Jones

References

[1] D. Jones. Data-based optimal stopping via forecasting of time series. Preprint, TU Darmstadt, 2012.

[2] M. Kohler and H. Walk. On data-based optimal stopping under stationarity and ergodicity. To appear in Bernoulli 2013.

Project: Regression based Monte Carlo methods for pricing Bermudan options

In many applications of regression based Monte Carlo methods for pricing American options in discrete time parameters of the underlying financial model have to be estimated from observed data. In this project suitably defined nonparametric regression based Monte Carlo methods are applied to paths of financial models where the parameters converge towards true values of the parameters. For various Black-Scholes, Garch and Levy models it is shown that in this case the price estimated from the approximate model converge to the true price.

Contact: A. Fromkorth, M. Kohler

References

[1] A. Fromkorth and M. Kohler. On the consistency of regression based monte carlo methods for pricing bermudan options in case of estimated financial model. Preprint, TU Darmstadt, 2011.

Project: Weakly universally consistent static forecasting of stationary and ergodic time series via local averaging and least squares estimates

Static forecasting of stationary and ergodic time series is considered in this project, i.e., inference of the conditional expectation of the response variable at time zero given the infinite past. It is shown that the mean squared error of a combination of suitably defined localized least squares estimates converges to zero for all distributions where the response variable is square integrable.

Partner: H. Walk, Universität Stuttgart

Support: German National Academic Foundation

Contact: T. Felber, D. Jones, M. Kohler

References

[1] T. Felber, D. Jones, M. Kohler, and H. Walk. Weakly universally consistent static forecasting of stationary and ergodic time series via local averaging and least squares estimates. Preprint, TU Darmstadt, 2011.

Project: Fixed design regression estimation based on real and artificial data

In this project we study fixed design regression estimation based on real and artificial data, where the artificial data comes from previously undertaken similar experiments. A least squares estimate is introduced which gives different weights to the real and the artificial data. It is investigated under which condition the rate of convergence of this estimate is better than the rate of convergence of an ordinary least squares estimate applied to the real data only. The results are illustrated using simulated data and are used to estimate fatigue parameters.

Partner: A. Krzyzak, Concordia University (Montreal) and Collaborative Research Center 666

Support: German Research Association (DFG)

Contact: T. Felber, D. Jones, M. Kohler

References

[1] D. Furer, M. Kohler, and A. Krzyzak. Fixed design regression estimation based on real and artificial data. Preprint, TU Darmstadt, 2012.

Project: Estimation of a density using real and artificial data

Let X, X_1, X_2, ... be independent and identically distributed R^d-valued random variables and let $m : R^d \to R$ be a measurable function such that a density f of $Y = m(X)$ exists. Given a sample of the distribution of (X, Y) and additional independent observations of X we are interested in estimating f. We apply a regression estimate to the sample of (X, Y) and use this estimate to generate additional artificial observations of Y. Using these artificial observations together with the real observations of Y we construct a density estimate of f by using a convex combination of two kernel density estimates. It is shown that if the bandwidths satisfy the usual conditions and if in addition the supremum norm error of the regression estimate converges almost surely faster towards zero than the bandwidth of the kernel density estimate applied to the artificial data, then the convex combination of the two density estimates is L_1–consistent. The performance of the estimate for finite sample size is illustrated by simulated data, and the usefulness of the procedure is demonstrated by applying it to a density estimation problem in a simulation model.

Partner: L. Devroye, McGill University (Montreal) and Collaborative Research Center 805

Support: German Research Association (DFG)

Contact: T. Felber, M. Kohler

References

[1] L. Devroye, T. Felber, and M. Kohler. Estimation of a density using real and artificial data. Preprint, TU Darmstadt, 2012.

Project: Nonparametric estimation of a latent variable model

In this project a nonparametric latent variable model is estimated without specifying the underlying distributions. The main idea is to estimate in a first step a common factor analysis model, where a block structure of the underlying matrix is assumed. In a second step nonparametric regression is used to analyze the relation between the latent variables. Theoretical results concerning consistency of the estimates are proven, and the finite sample size performance of the estimates is illustrated by applying them to simulated and real data.

Partner: A. Kelava, Institut für Psychologie, TU Darmstadt

Contact: M. Kohler

References

[1] A. Kelava, M. Kohler, and D. Weinbender. Nonparametric estimation of a latent variable model. Preprint, TU Darmstadt, 2012.

Project: Empirical comparison of nonparametric regression estimates on real data

The performance of nine different nonparametric regression estimates is empirically compared on ten different real data sets. The number of data points in the real data sets varies between 7900 and 18000, where each real data set contains between 5 and 20 variables. The nonparametric regression estimates include kernel, partitioning, nearest neighbor, additive spline, neural network, penalized smoothing splines, local linear kernel, regression trees and random forests estimates. The main result is a table containing the empirical L_2 risks of all nine nonparametric regression estimates on the evaluation part of the different data sets. The neural networks and random forests are the two estimates performing best. The data sets are publicly available, so that any new regression estimate can be easily compared with all nine estimates considered in this paper by just applying it to the publicly available data and by computing its empirical L_2 risks on the evaluation part of the data sets.

Partner: F. Padberg and A. Richter, Hessisches Statistisches Landesamt

Support: HMWK

Contact: M. Kohler

References

[1] D. Jones, M. Kohler, A. Krzyzak, and A. Richter. Empirical comparison of nonparametric regression estimates on real data. Preprint, TU Darmstadt, 2012.

Project: Adaptive density estimation based on real and artificial data

Let X, X_1, X_2, ... be independent and identically distributed R^d-valued random variables and let $m : R^d \to R$ be a measurable function such that a density f of $Y = m(X)$ exists. The problem of estimating f based on a sample of the distribution of (X, Y) and on additional independent observations of X is considered. Two kernel density estimates are compared: the standard kernel density estimate based on the y-values of the sample of (X, Y), and a kernel density estimate based on artificially generated y-values corresponding to the additional observations of X. It is shown that under suitable smoothness assumptions on f and m the rate of convergence of the L_1 error of the latter estimate is better than that of the standard kernel density estimate. Furthermore, a density estimate defined as convex combination of these two estimates is considered and a data-driven choice of its parameters (bandwidths and weight of the convex combination) is proposed and analyzed.

Partner: A. Krzyzak, Concordia University (Montreal) and Collaborative Research Center 805

Support: German Research Association (DFG)

Contact: M. Kohler

References

[1] M. Kohler and A. Krzyzak. Adaptive density estimation based on real and artificial data. Preprint, TU Darmstadt, 2012.

[2] M. Kohler and A. Krzyzak. Optimal global rates of convergence for interpolation problems with random design. Preprint, TU Darmstadt, 2012.

Project: CUSUM Monitoring of Serially Dependent Processes of Counts

Real-world count data processes usually show serial dependence, which has to be considered while designing control charts for monitoring such processes. Cumulative sum (CUSUM) control charts are widely considered in research and practice, because they are known to be sensitive already to small changes in the process model compared to the given in-control scenario. Our project aims to develop CUSUM charts for count data processes with different types of dependence structure (e. g., AR(1)-like dependence), different types of marginal distribution (e. g., equi- or overdispersed), and concerning different types of process changes (e. g., mean shifts). We considered the upper- and two-sided CUSUM charts for the equidispersed Poisson INAR(1) model. We also analyzed the effect of violations of model assumptions and of estimated (instead of true) parameters. Concerning counts with overdispersion, we developed CUSUM charts for overdispersed counts as stemming from an INARCH(1) process. Currently, we are working on CUSUM charts based on different types of residuals (designed for diverse out-of-control scenarios).

Partner: M. C. Testik, Hacettepe University, Ankara

Contact: C. H. Weiß

References

[1] C. H. Weiß and M. C. Testik. The Poisson INAR(1) CUSUM Chart under Overdispersion and Estimation Error. *IIE Transactions*, 43(11):805–818, 2011.

[2] C. H. Weiß and M. C. Testik. Detection of Abrupt Changes in Count Data Time Series: Cumulative Sum Derivations for INARCH(1) Models. *Journal of Quality Technology*, 44(3):249–264, 2012.

[3] P. Yontay, C. H. Weiß, M. C. Testik, and Z. P. Bayindir. A Two-Sided CUSUM Chart for First-Order Integer-Valued Autoregressive Processes of Poisson Counts. *Quality and Reliability Engineering International*, 29(1):33–42, 2013.

Project: Statistical Inference for Binomial AR(1) Processes

The binomial AR(1) model is a counterpart to the Gaussian AR(1) model for a process of binomial counts. Because of its intuitive structure, it applies well to many real-world situations. We develop approaches for estimating the two model parameters p and ρ and analyze the stochastic properties of the resulting estimators. For analyzing their asymptotic behaviour, we use results from the large sample theory of finite-state Markov chains, while the analysis of finite-sample properties requires simulations. Currently, we work on an extension of the binomial AR(1) model and diagnostic procedures for the case of extra-binomial variation, and we develop tests for the goodness-of-fit of the marginal distribution and the autocorrelation structure.

Partner: H.-Y. Kim, Korea University, Seoul

Contact: C. H. Weiß

References

[1] C. H. Weiß and H.-Y. Kim. Binomial AR(1) Processes: Moments, Cumulants, and Estimation. *Statistics*, 2011. To appear.

[2] C. H. Weiß and H.-Y. Kim. Parameter Estimation for Binomial AR(1) Models with Applications in Finance and Industry. *Statistical Papers*, 2012. To appear.

Project: Count Data Time Series and Metapopulation Models

We establish a connection between a class of chain-binomial models of use in ecology, epidemiology and binomial autoregressive processes. We started our project by first focussing on two types of chain-binomial model, extinction-colonisation and colonisation-extinction models, which can be related to the binomial AR(1) model in the case of density-independence. As an application, we can take advantage of estimation approaches already established for this type of model. Furthermore, we consider the relation to the Gaussian AR(1) model. Currently, we worked on generalized models that allow for forms of density dependence. This approach allows to develop new time series models for marginal distributions showing under- or overdispersion compared to the binomial distribution.

Partner: P. Pollet, University of Queensland

Contact: C. H. Weiß

References

[1] C. H. Weiß and P. K. Pollett. Chain Binomial Models and Binomial Autoregressive Processes. *Biometrics*, 68(3):815–824, 2012.

Project: Modeling and Analysis of Categorical Time Series

While methods for analyzing and modeling real-valued time series have found much research interest in the past, only few articles consider categorical time series, i. e., time series with a range of finitely many and unordered categories. The project aims at developing new models for such time series, and, in particular, at providing tools for analyzing categorical time series. These include approaches for estimating characteristics like marginal dispersion or types of serial dependence. Current research tasks are to analyze the (asymptotic) stochastic properties of such estimators and to develop goodness-of-fit tests.

Contact: C. H. Weiß

References

[1] C. H. Weiß. Empirical Measures of Signed Serial Dependence in Categorical Time Series. *Journal of Statistical Computation and Simulation*, 81(4):411–429, 2011.

[2] C. H. Weiß. Generalized Choice Models for Categorical Time Series. *Journal of Statistical Planning and Inference*, 141(8):2849–2862, 2011.

[3] C. H. Weiß. Rule Generation for Categorical Time Series with Markov Assumptions. *Statistics and Computing*, 21(1):1–16, 2011.

[4] C. H. Weiß. Continuously Monitoring Categorical Processes. *Quality Technology & Quantitative Management*, 9(2):171–188, 2012.

Project: Modeling and Diagnosing Overdispersion in Count Data Time Series

We consider the compound Poisson INAR(1) model for AR(1)-like counts, where the overdispersion of the observations is caused by the overdispersion of innovations. For such CPINAR(1) processes, explicit results are derived for joint moments, for the k-step-ahead distribution as well as for the stationary distribution. It is argued that a CPINAR(1) process is strongly mixing with exponentially decreasing weights. This result is utilized to design a test for overdispersion in INAR(1) processes and to derive its asymptotic power function.
Currently, we adapt our approach to the INARCH(1) family, where the overdispersion is due to an appropriate conditioning mechanism. While the Poisson INARCH(1) model has an equidispersed conditional distribution, additional overdispersion can be generated by choosing an overdipersed conditional distribution. We develop statistics for diagnosing such additional overdispersion and analyze their asymptotic distributions.

Partner: S. Schweer, Universität Heidelberg

Contact: C. H. Weiß

1.3 Memberships in Scientific Boards and Committees

Hans-Dieter Alber

- GAMM
- DMV
- ISIMM
- Auswahlausschuss des Bundeswettbewerbs Mathematik
- Vertrauensdozent der Studienstiftung

Volker Betz

- Fellow in the EPSRC Peer Review College

Dieter Bothe

- Designated member of the ProcessNet committee Computational Fluid Dynamics
- Designated member of the ProcessNet committee Multiphase Flows
- Designated member of the ProcessNet committee Mixing Processes
- Member of the DMV
- Member of the DECHEMA

Regina Bruder

- Member of the international group for PME (Psychology of Mathematics Education)
- Member of the group "‘Arbeitskreis Vergleichsuntersuchungen"’ of the GDM (Organization for Didactics of Mathematics)
- Member of the ISTRON - group in Germany

– Member of the group "“Nationale Standards für die Abiturprüfung in Mathematik"”

Jan H. Bruinier

– Associate Member of the Pohang Mathematics Institute (PMI), Postech, Korea

Reinhard Farwig

– Deutsche Mathematiker-Vereinigung

– International Research Training Group on Mathematical Fluid Mechanics Darmstadt-Tokyo (IRTG 1529)

– Cluster of Excellence: Smart Interfaces - Understanding and Designing Fluid Boundaries

– Scientific Committee of UNIFEPRESS (University of Ferrara)

Alf Gerisch

– European Society of Mathematical and Theoretical Biology

– Gesellschaft Deutscher Naturforscher und Ärzte e.V.

– Society of Industrial and Applied Mathematics

Vassilios Gregoriades

– Member of the American Mathematical Society

– Member of the Deutsche Vereinigung für Mathematische Logik und für Grundlagenforschung der Exakten Wissenschaften

Roland Gunesch

– American Mathematical Society

– European Mathematical Society

– Mathematical Association of America

– Society of Industrial and Applied Mathematics

– Deutsche Mathematiker-Vereinigung

– Deutsche Physikalische Gesellschaft

– Mathematische Gesellschaft Hamburg

– Verein für Talentförderung Mathematik Hamburg

Michael Joswig

– Scientific Advisory Board: “Oberwolfach References on Mathematical Software”

Martin Kiehl

– Chairman of the supervisory board of: Zentrum für Mathematik, Bensheim

Ulrich Kohlenbach

- President of 'Deutsche Vereinigung für Mathematische Logik und Grundlagen der exakten Wissenschaften (DVMLG)' (until 2012)
- Vice President of the Association for Symbolic Logic (ASL), since Jan. 2013
- Member of Standing Committee 'Logic in Europe' of the Association for Symbolic Logic (ASL)
- Member of Executive Committee of the Association for Symbolic Logic (ASL)
- Speaker of 'Fachgruppe Logik' of the DMV (until 2012)
- Corresponding member of "Wissenschaftliche Gesellschaft an der Johann Wolfgang Goethe-Universität Frankfurt am Main"
- Member of Advisory Board of Springer book series 'Theory and Applications of Computability Theory'

Jens Lang

- Member of board of directors of the research centre Computational Engineering, TU Darmstadt, since 2004
- Member of board of deans of the DFG Graduate School of Excellence, TU Darmstadt, since 2008
- Member of the DFG Cluster of Excellence Smart Interfaces: Understanding and Designing Fluid Boundaries, TU Darmstadt, 2008 - 2012
- Member of the DFG Graduate School of Excellence Energy Science and Engineering, TU Darmstadt, since 2012

Marc Pfetsch

- Scientific Program Commitee for the CPAIOR 2012 conference, Nantes

Steffen Roch

- American Mathematical Society
- Auswahlausschuss Bundeswettbewerb Mathematik

Stefan Ulbrich

- Scientific Program Commitee for the OMS 2012 conference, Chania
- Scientific Program Commitee for the SIAM OP12 conference, Darmstadt
- Organizing Commitee for the SIAM OP12 conference, Darmstadt
- Organizing Commitee for the GAMM 2012 conference, Darmstadt
- Member of the IFIP Technical Committee TC 7, WG 7.2 "Computational Techniques in Distributed Systems", since 2003

– Member of GAMM Activity Group “Optimization with PDE constraints”, since 2008

– Member of GAMM Activity Group “Computational Science and Engineering”, since 2012

– Member of SIAM Activity Group “Optimization”, since 2003

Martin Ziegler

– Speaker of IANUS: Interdisziplinäre Arbeitsgruppe Naturwissenschaft und Sicherheit

1.4 Awards and Offers

Awards

Regina Bruder: Besondere Verdienste in der akademischen Lehre (Vereinigung der Freunde der TU Darmstadt e.V.), April 29, 2011

Pia Domschke: Ruth-Moufang-Price (Fachbereich Mathematik, TU Darmstadt), May 25, 2011

Sarah Drewes: Ruth-Moufang-Preis (Fachbereich Mathematik, TU Darmstadt), May 25, 2011

Robert Haller-Dintelmann: Sonderpreis für engagierte Lehre des Fachbereichs Mathematik

Karl Heinrich Hofmann: Elected Fellow of the American Mathematial Society, 2012

Priska Jahnke: Second award for the best teaching, FU Berlin, July 2011

Daniel Körnlein: Datenlotsen-Preis

Ulrich Kohlenbach: Gödel Research Prize Fellowship 2011. Personal cash award of 100,000 EUR

Burkhard Kümmerer: Athene Preis für Gute Lehre des Fachbereichs Mathematik 2012

Christian H. Weiß: Young Statistician’s Award of ENBIS, 2011

Martin Ziegler: Athene Sonderpreis für interdiszplinäre Lehre

Jan Carsten Ziems: Preis für hervorragende wissenschaftliche Leistungen (Vereinigung der Freunde der TU Darmstadt e.V.), April 27, 2012

Offers of Appointments

Jan H. Bruinier: Professorship (W3) for Mathematics, Universität Duisburg-Essen

Priska Jahnke: Akademische Rätin (A13/A14), Universität Augsburg

Michael Joswig: Professorship (W3), TU Berlin

Stefan Ulbrich: Professorship (W3) for Algorithmic Optimization, HU Berlin

Christian H. Weiß: Professorship (W2), Helmut-Schmidt-Universität, Hamburg

Irwin Yousept: Professorship (W2, 5 years) for Applied Mathematics , RWTH Aachen

2 Teaching

Teaching of Mathematics in our department can be divided into three categories: teaching in mathematical degree programmes, specific teaching activities for future mathematics teachers (in secondary education), and teaching mathematics to students in the sciences and engineering subjects (often described as 'service teaching'). Each of these teaching activities has its own characteristics in terms of mathematical content and style as well as in terms of specific regulations of corresponding degree schemes.

2.1 Degree Programmes in Mathematics

There are currently three mathematics programmes: the Diplom programme in mathematics (being discontinued), the Bachelor programme in mathematics (since 2007) and the Master programme in mathematics (since 2005). The current Bachelor programme incorporates the old Bachelor programme "Mathematics with Computer Science". The following table shows the enrolement numbers over the last 8 years:

Students in Mathematics programmes

Programme	2005	2006	2007	2008	2009	2010	2011	2012
Diplom	750	760	571	443	341	260	151	90
Bachelor (incl. MCS)	230	207	264	363	502	624	674	629
Master	1	7	16	25	41	68	141	189
Teacher (secondary)	213	233	267	297	363	410	417	396

The sum total of the student numbers in our Diplom, Bachelor and Master programmes remains roughly at the same level over the years, but there are some special circumstances to explain some of the variations. Among these are the abolishment of student fees ("Studienguthabengesetz") with the beginning of the academic year 2008/09, the nearly two-fold increase in students finishing school in Bavaria (2011) and Baden-Württemberg (2012) caused by the transition from 13 to 12 school years, the last conscription calls in Germany in 2011, and the introduction of an aptitude test ("Eignungsfeststellungsverfahren") for our Bachelor and Teacher programmes from the academic year 2011/12. In 2012, it was also decided to discontinue enrolement of beginners in the summer semester, and as of the summer of 2013 we do not offer enrolement for freshers in our Bachelor programme in a summer semester.

New enrollments

Programme	2005	2006	2007	2008	2009	2010	2011	2012
Diplom	183	194	75					
Bachelor	54	31	114	167	235	277	275	173
Master	1	6	11	18	22	36	58	68
Teacher (secondary)	50	59	80	80	104	116	72	55

Looking at the number of students who turned up for their courses, it seems that the introduction of the aptitude test has a stronger effect on our Teaching programme than on our Bachelor programmes. We suspect that in both tracks it largely discourages some of the more weakly motivated students from applying, and especially those who might not have the intention to pursue university studies seriously.

With the start of the Master programme in mathematics, accredited and started in the year 2005, and with the Bachelor programme in mathematics, accredited and started in the year 2007, the department completed the implementation of the Bologna Accord. The new programme structure replaces the Diplom programme and incorporates the previous Bachelor programme "Mathematics with Computer Science". With the academic year 2011/12, the study regulations for the Bachelor and Master programmes were modified, and the corresponding accreditations were successfully renewed until September 30, 2017. Due to the interdependencies between our Bachelor programme and our Teaching programme, also the study regulations for the latter had to be revised (with effect from the academic year 2012/13).

The main aspects in the design of the current programme structure could be described as both modern and conservative at the same time. A more detailed look at both programmes resolves this apparent contradiction. They combine proven and tested components of the Diplom programme with new aspects such as modularization and a credit point system. The new programme retains the idea that mathematics should be studied together with a minor, which is typically a subject in which mathematics is applied. The standard choice of a minor can be one of computer science, economics, physics and chemistry, and further subjects are available upon application. If students choose the option "Mathematics with Economics" (available both for Bachelor and Master), their minor is a combination of economics and computer science.

The Bachelor programme has a duration of 6 semesters and finishes with a Bachelor thesis on a mathematical topic. A unique feature of our Bachelor programme are the optional bilingual courses. Both options "Mathematics" (with arbitrary minor) and "Mathematics with Economics" can be studied as a bilingual programme since 2009. According to a survey during the orientation week in the winter semester 2012/13, about 32 % among the 115 Bachelors students interviewed expressed the objective of obtaining the bilingual certificate.

Graduates of the Bachelor programme have the option of taking up a job or continuing their studies in a Master programme. This can be the Master programme at our department, at a different university or even a Master programme in a different area based on their education in mathematics.

Our Master programme has a duration of 4 semesters. It is centred on two in-depth specializations or focus areas within mathematics or, alternatively, one focus area in mathematics and one in a cognate subject in which mathematics is applied (such as computer science, economics, physics or chemistry). The mathematical specializations (Vertiefungsrichtungen) are offered by the research groups in the department. Beside the two focus areas (at 18 CP each), there is room for additional courses in mathematics, minors and general studies. The topic of the Master thesis is selected in one of the two focus areas; in the case of a combination with an extra-mathematical focus area, the topic of the Master thesis may be chosen from that other subject but has to be related to mathematics.

Graduates of the Bachelor programme (incl. MCS)

Term	Total	Female students	Duration ≤ 7 semesters
Summer 2011	36	17	29
Winter 2011/12	27	13	20
Summer 2012	40	9	23

Graduates of the Master programme

Term	Total	Female students	Duration ≤ 5 semesters
Summer 2011	5	3	3
Winter 2011/12	5	2	3
Summer 2012	15	3	12

Graduates in Education for Secondary Schools

Term	Total	Female students
Summer 2011	17	15
Winter 2011/12	12	8

International exchange

Many students choose to study for a year at a university abroad, typically in their third year. The department provides general information (online and through an annual information event) as well as individual advice for students who plan a year abroad and also maintains contacts with various popular destinations abroad. Students who return from a year abroad are encouraged to share their experiences through short summaries with informal advice on the departmental web pages. Close cooperation between the students and the department ensures that students can transfer their credits from abroad into their study programme in Darmstadt. This helps to avoid negative effects on the overall duration of studies.

Academic year	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12
Erasmus places	27	34	30	35	35	36	38	49
Erasmus outgoers	18	21	14	14	15	12	11	20
Further outgoers	15	12	16	11	13	9	8	13
Incomers	8	9	8	3	4	3	2	5

2.2 Teaching for Other Departments

Students in almost all study programmes of this university have to take at least one course in mathematics. The department teaches students in the engineering sciences (mechanical, electrical, civil engineering, material sciences), in computer science, the natural sciences (chemistry, physics, biology, geology), economics, the liberal arts, social sciences and in architecture.

Service teaching comprises courses of a variety of different formats. There are large lecture courses providing a solid foundation in mathematics covering subjects such as basic analysis (calculus), differential equations, numerical methods and stochastics. For instance, there is a four semester cycle for students of Electrical Engineering, with 4 hours of lectures and 2 hours of exercise groups per week. There are also smaller courses, concentrating on special areas in mathematics used in particular disciplines, as, for instance, our one-semester statistics courses for students in Biology or the social sciences.

Service courses, no. participants, winter semester 2012/13
(Source: TUCaN, 13.02.2013.)

Darstellende Geometrie	583
Höhere Mathematik I	83
Mathematik I für Bauwesen	1017
Mathematik I für Elektrotechnik	713
Mathematik I für Informatik	604
Mathematik I für Maschinenbau	797
Mathematik III für Bauwesen	738
Mathematik III für Elektrotechnik	582
Mathematik III für Maschinenbau	981
Mathematik und Statistik für Biologie	151
Statistik I für Human- und Sozialwissenschaft	166
Statistik I für Wirtschaftsingenieurwesen	580

It is one of the principles of this university that the department of mathematics is responsible for the teaching of mathematics across all subjects that require mathematics in their education. The importance of this aspect of our teaching activities is also borne out in the university's KIVA initiative, which among other aspects emphasises the critical role of mathematics education in the early phases of university studies in the sciences and engineering disciplines. Among our efforts to strengthen the basis for this mathematical education, the department has set up optional extra learning platforms under the name of "Treffpunkte Mathematik", which serve to give extra support to students in the large mainstream mathematics lecture courses. One of the guiding ideas in these activities is the attempt to provide auxiliary training and to improve the motivation of students from those other subjects through problems that relate mathematics better with themes from the own subjects. Participation and student evaluations for these extras show this approach to be a success.

2.3 Characteristics in Teaching

As in previous years, the efforts of the department of mathematics were rewarded in the "CHE-Hochschul Ranking Mathematik". According to the results published in April 2012, the department of mathematics again holds one of the top positions among all universities in Germany, with excellent rates especially for "IT infrastructure" (1.6), "scientific publications" (1.7) and "research funding". Good rates were also obtained for "mentoring by the lecturers" (1.9) and "overall course situation" (2.0). This success also reflects the emphasis on teaching methods at the department of mathematics. Our aim in teaching is to encourage and motivate students to actively pursue the understanding of the taught material. The learning of mathematics is an intellectual activity equally supported by classroom teaching, by individual work and study, and by team work, both with and without direct supervision.

Lectures present mathematical content and methods through personal presentation; the systematic development and exposition of the material in the lectures is intended to stimulate the students' mathematical intuition. Lectures are complemented by exercise groups, and by additional tutorials during the first year. The time ratio between classroom lectures and exercises is 2:1.

In exercise classes, students work on problems and topics from the lecture with the support of a tutor and they are encouraged to present and discuss solutions to homework problems. Students are also expected to work on weekly sets of homework problems and to submit their solutions to their tutors for marking in order to obtain feedback. In 2011/12 the department has implemented a new format for tutorials in the first year, which are provided as an additional learning platform besides exercise groups. Here teaching assistants hold classroom sessions devoted to the review of current material from the lecture classes, current and past problems from the exercises, further examples, basic problems and illustrations, or to filling gaps in students' basic understanding. Regarded as an optional extra rather than as a mandatory part of the course, these tutorials are offered on a weekly alternating basis for the two main first-year courses (Analsyis and Linear Algebra). Overall, all these activities are meant to support learning and to give students ample opportunity to improve and to test their knowledge and understanding.
Exercise groups and homework activities also form an integral part of most of the more advanced lecture courses, including those at Master level. In the course of the re-accreditation in 2011/12, the department decided to strengthen the Master programme with its rich spectrum of focus areas to choose from, by giving firmer guarantees as to the concrete choices of specialization areas that would be available to any cohort of Master students in the upcoming three years. The department also committed itself to devote any extra teaching capacity that was freed through the termination of freshers' enrolment in the summer semester to a corresponding strengthening of the Master programme. Among other changes this has enabled us to allow for a larger number of teaching assistants to be employed in exercises for Master level courses. These measures are meant to make our Master programme even more competitive through its quality of teaching, greater reliability and impressive variety across a considerable breadth of research areas – both to retain our own Bachelor students and to attract new Master students from elsewhere.

Moreover, the department supports students in their learning experience by the following measures:

- the organisation or exercises and tutorials typically lies in the hands of experienced teaching assistants
- newly recruited tutors and student demonstrators undergo a dedicated training programme (which serves as an example of good practice in the context of the KIVA project, where similar ideas are being tested in other departments' teaching)
- exercise groups are limited to a size of 20 students in the first year and 25 students from the second year onwards
- we provide an open learning environment with small learning groups
- all teaching staff offer weekly consultation hours for individual help and support
- the department provides altogether 12 student rooms (open access and reserved) with about 160 places for students to meet in learning groups, to work on their thesis or to prepare for their final exams

- the Mathematics Learning Center (Lernzentrum Mathematik) is staffed during opening hours by an assistant or professor, available to answer questions; in addition textbooks and up-to-date material for the current teaching courses are provided
- there are 32 places for reading and studying in the departmental library (towards the end of 2012, this departmental library was incorporated into the new central university library)
- the department has three open access computer labs (with a total of 43 Linux machines) and two reserved computer labs (with a total of 15 Linux machines)

2.4 E-Learning/E-Teaching in Academic Training

E-Learning is present in the department of mathematics in teaching and research. In 2011-2012 our department received around 270,000€ funds from the TU Darmstadt (QSL, elc) for E-Learning projects to improve teaching, 150,000€ funds for research projects in the field of game based learning and for the evaluation of blended learning courses for active teachers in the field of didactics of mathematics. Prof. Dr. Regina Bruder is the reference person for E-Learning in our department and she is a member of the scientific advisory board of the elc (e-learning center TU Darmstadt).

Research and research-based development

An instrument for registering effects of courses from the point of view of participating teachers was redeveloped and used in the context of a project funded by the Kultusministerium Hessen (Ministry of Education) which evaluated online training courses for teachers.
The research projects TELPS and PEDALE (for more information, see “research projects” (Didactics of Mathematics) give students support for their individual assessment. Based on the innovation of these two projects, students receive subject-specific, content-based digital feedback for their homework. Both projects were also published internationally. Further research on Feedback-Based Quality Improvement in E-Learning funded by the German Research Foundation (DFG) covering technology enhanced diagnosis and learning in mathematics education was started with a DFG-scholarship. Within this work, a cooperation with the working group Serious Games at TU Darmstadt was established.
In the German-Japanese postgraduate programme, “Mathematical Fluid Dynamics” (IRTG 1529), the weekly seminar presentations were transferred via video to Tokyo (Waseda University) so that all participants could benefit from the seminar, regardless of place and time.
In connection with the VEMA project (cooperation between TU Darmstadt (Bruder, Bausch), Universität Paderborn (Biehler) and Universität Kassel (Koepf) and Universität Lüneburg (Hochmuth), some new E-Learning elements, e.g. for self-regulation in cooperation with psychologists (Dr. Bellhäuser) and for training of basic school knowledge in mathematics with initial differentiation, were developed for the preparatory math courses for new students.
Since 2009, the preparatory course has been presented online via Moodle each winter semester for nearly 800 new students of departments Mathematics, Civil Engineering, Mechanical Engineering and Computer Science.

http://www3.mathematik.tu-darmstadt.de/fb/mathe/startseite/studienanfaengerinnen-und-anfaenger/mathematikvorkurs.html.
VEMA project homepage:
http://www.mathematik.uni-kassel.de/~vorkurs/Willkommen1.html

E-Learning/E-Teaching

The majority of all professors are already using digital content in different formats and communication via E-Mail or Newsletter. About 90% of all professors use their own websites or a Moodle-platform for presenting digital content. An increase of different lecture recordings in the last two years took place in mathematics as well: Prof. Jahnke recorded her lectures: WS 2011/2012: Math I (Mechanical Engineering), Math III (Civil Engineering)
SoSe 2012: Math II (Mechanical Engineering)
WS 2012/2013: Math I (ET), Math III (Civil Engineering)
The recordings of the lecture were made available in Moodle. The discussion forum was also used extensively.
During the winter semester 2012/2013, grading for tutorials also took place with Moodle which helped tutors and lecturers very much.
Prof. Farwig recorded his lectures Math I and II for ETiT during the winter semester 2011/2012 and summer semester 2012 with Windows Journal on the laptop. The lectures were transmitted with video and audio simultaneously to another lecture hall. During the winter semester 2012/2013, the lecture for ETiT was recorded with the professor writing on the chalk board. All recordings were made accessible for all students in Moodle. The entire technical and software equipment was provided by the elc.
Prof. Kohler recorded his stochastics lectures again and presented them on the mathematical homepage of the elc in the OpenLearnWare section.
Dr. Gunesch recorded his lecture Differential Geometry when working on the chalk board (WS 2012/2013) and presented his experience on the khdm-conference 2013 in Paderborn.
In some courses E-Learning elements are also just being tried out: During the lecture “Formal Foundations of Computer Science I+II” in the summer semester with 450 students, Prof. Ziegler also did a mini quiz online in addition to the weekly exercises at home and in class where the answers could be found by looking into the script. An online discussion forum was also used:
http://www3.mathematik.tu-darmstadt.de/evs/947
This resulted in a higher level of preparation when students went to the exercises.
The acquisition of software skills in special mathematical tools in the study of mathematics has been taken for granted for several years. The research group Numerical Analysis and Scientific Computing supports these aims with an attractive proposal:
http://numawww.mathematik.tu-darmstadt.de/, (see also Software, numawww).

dikopost: Digital Competence Portfolio for Students

From 2010 to 2013, the dikopost project was launched with Prof. Regina Bruder as head and under the leadership of the Center for Teacher Education (ZfL). It is a project to support academic teaching and learning using digital portfolios. One of its aims is to

present a platform for all students studying at the TU Darmstadt, while emphasising the importance of E-Portfolio use for students studying to become a teacher. For dikopost Mahara is the used platform, which will also work well with Moodle in the future. The pilot project runs for two years on QSL funds with a budget of 250,000 € and will be implemented in the elc and HDA for sustainable use. For this purpose, the project was extended for another year with corresponding funding.
In December 2010, there were more than 300 registered users who used the E-Portfolio in courses or on their own. In January 2013, 1290 users were registered. This winter semester, 27 courses are using a digital portfolio. As of March 2013, more than 780 tests or oral examinations based on E-portfolios taken by students. Several international and national publications explain the design and show effects of the project dikopost.
The goal of dikopost is to develop course concepts where the use of an E-Portfolio helps students to learn, reflect and showcase their competences and learning outcomes.
More information can be found here:
`http://www.zfl.tu-darmstadt.de/dikopost_projekt/dikopost_begruessung.de.jsp`
The current link to Mahara can be found here:
`http://wwwdid.mathematik.tu-darmstadt.de/mahara/artefact/internal/`

Blended learning for further training

The use of blended learning concepts is an important trend in further training for teachers. Based on the results of research projects, five online programmes as half-year-courses for further education were presented on the learning platform "MOODLE" `http://www.prolehre.de`. About 50 teachers got a certificate for their course in 2011 and 2012.
For additional support, `http://www.madaba.de` a database for exercises with about 50 new tasks and `http://www.problemloesenlernen.de` a platform for authentic materials, and an interchange of experience of teachers were developed and used. There are about 2000 active users on the platform madaba.

2.5 Student Body (Fachschaft)

Officially, the students at the department of mathematics are represented by the five people forming the “Fachschaftsrat”. This board is elected once a year during the university elections. However, since there usually is more work to be done than five people can handle, there are many more students participating actively in the Students’ Union. Moreover, some of them are members of university-wide committees such as the Senate or the University Assembly.
We, the Students’ Union, regard ourselves as representatives inside and outside the maths department for all math students. As such, all students are invited to talk to us in order to tell us about problems or suggestions they might have. Furthermore, we organise a lot of orientation events for students and secondary school students throughout the year. Finally, a student’s life does not only consist of attending lectures and exercises, so we additionally offer some extra-curricular activities.
As part of our activities we appoint the student representatives in the committees of the department. Some of us are members of the “Fachbereichsrat” (another important board consisting of professors, assistants and students, elected during the university elections) and its committees, like the committee for learning and studying, the library committee

and many more. The evaluation and quality control of teaching done at the department are two of our main objectives. We think that it is essential to hear and consider students' opinions regarding these areas because they are the ones directly affected. We also support the improvement and development of courses and studying in general, a point which every student should be concerned about naturally. We are working on those subjects together with Students' Unions from other departments and with the university administration.
Concerning orientation events, we organise the orientation week for the first semester students, which takes place at the beginning of each semester. During the semester, there is an orientation colloquium for the students in their first two years, which is meant to give them an impression of what the work in the research groups usually is about (meant to support the decision on a thesis subject). After finishing their first two years, students attend another orientation event, the "Introduction to Advanced Studies" (*Einführung ins Hauptstudium*), giving them more information about the research groups, the relevant regulations and much more.
Not all of these events take place in the maths department. University-wide orientation events for secondary school students are also part of our work. There we cooperate with the student counsellors.
However, not all our activities concern purely study-related topics. The organisation of games evenings, music evenings, as well as the traditional Christmas party of the department are examples of what we do to help students socialize among themselves.
We hope that this rather brief introduction helps give an impression of our work.

3 Publications

3.1 Co-Editors of Publications

3.1.1 Editors of Journals

Hans-Dieter Alber

- *Mathematical Methods in the Applied Sciences* (Member of the editorial board)
- *Asymptotic Analysis* (Member of the editorial board)
- *Demonstratio Mathematica* (Member of the editorial board)
- *Journal of Multiscale Modelling* (Member of the editorial board)

Dieter Bothe

- *International Journal of Multiphase Flows* (Editorial Advisory Board)
- *Nonlinear Analysis: Real World Applications* (Editorial Board)

Regina Bruder

- *mathematik lehren* (Associate Editor)

Jan H. Bruinier

- *Forum Mathematicum* (Editor)
- *Annali dell'Università di Ferrara* (Editor)

Reinhard Farwig

- *Annali dell'Università di Ferrara, Sez. VII., Sci. Mat.* (Editorial Board)
- *Mathematica Bohemica* (Editorial Board)

Matthias Hieber

- *Journal Mathematical Fluid Mechanics* (Editor)
- *Advances Differential Equations* (Editor)
- *Evolution Equations and Control Theory* (Editor)

Karl Heinrich Hofmann

- *Journal of Lie Theory* (Editor and Journal Secretary)
- *Semigroup Forum* (Honorary Editor)

Michael Joswig

- *Advances in Geometry* (Member of the Editorial Board)
- *Beiträge zur Algebra und Geometrie* (Member of the Editorial Board)

– *Electronic Geometry Models* (Managing Editor)

Klaus Keimel

– *Order* (Associate Editor)

– *Beiträge zur Algebra und Geometrie* (Associate Editor)

Ulrich Kohlenbach

– *Annals of Pure and Applied Logic* (Coordinating Editor)

– *Notre Dame Journal of Formal Logic* (Associate Editor)

– *Mathematical Logic Quarterly* (Associate Editor)

– *Computability* (Associate Editor)

Michael Kohler

– *AStA Advances in Statistical Analysis* (Associate Editor)

Jens Lang

– *Applied Numerical Mathematics* (Editor)

Martin Otto

– *The Bulletin of Symbolic Logic* (Editor)

Ulrich Reif

– *Journal of Approximation Theory* (Associate Editor)

– *Computer Aided Geometric Design* (Associate Editor)

Werner Schindler

– *Journal of Cryptographic Engineering* (Associate Editor)

Thomas Streicher

– *Applied Categorical Structures* (Associate Editor)

Stefan Ulbrich

– *Journal of Optimization Theory and Applications* (Associate Editor)

– *Optimization Methods and Software* (Regional Editor Europe)

– *SIAM Journal on Optimization* (Associate Editor)

– *Asymptotic Analysis* (Associate Editor)

3.1.2 Editors of Proceedings

Hans-Dieter Alber

– *Themenheft: Mathematical problems in solid mechanics. GAMM-Mitteilungen 34,1 (2011), 8-139* (jointly with P. Neff)

– *Proceedings of Applied Mathematics and Mechanics (PAMM) 12,1 (2012), 1-834* (jointly with N. Kraynyukova, C. Tropea)

Reinhard Farwig

– *Proceedings of Conference at CIRM, Luminy, May 2011* (jointly with Jiri Neustupa (Prague), Patrick Penel (Toulon))

Martin Kiehl

– *Proceedings on Mathematische Modellierung mit Schülern – Die Projekte der Modellierungswoche, 9.-14.10.2011, Weilburg*

– *Proceedings on Mathematische Modellierung mit Schülern – Die Projekte der Modellierungswoche, 14.-19.10.2012, Fuldatal*

Ulrich Kohlenbach

– *Proceedings of Logic Colloquium 2007, Cambridge University Press 2010* (jointly with F. Delon, P. Maddy, F. Stephan)

– *Proceedings of Logic Colloquium 2011, to appear as special issue of APAL* (jointly with K. Ambos-Spies, J. Bagaria, E. Casanovas)

Werner Schindler

– *Constructive Side-Channel Analysis and Secure Design - COSADE 2012, Springer* (jointly with Sorin Huss)

3.1.3 Editors of a Festschrift

Matthias Hieber

– *Parabolic Problems: The Herbert Amann Festschrift, 2011* (jointly with Joachim Escher, Patrick Guidotti, Piotr Mucha, Jan W. Prüss, Yoshihiro Shibata, Gieri Simonett, Christoph Walker and Wojciech Zajaczkowski)

Stefan Ulbrich

– *Constrained Optimization and Optimal Control for Partial Differential Equations, Birkhäuser Verlag, 2012* (jointly with S. Engell, A. Griewank, M. Hinze, G. Leugering, R. Rannacher, V. Schulz, M. Ulbrich)

3.2 Monographs and Books

[1] W. Arendt, C. Batty, M. Hieber, and F. Neubrander. *Vector-valued Laplace transforms and Cauchy problems, 2nd edition*. Birkhäuser/Springer Basel, 2011.

[2] R. Bruder and W. Weiskirch. *CAliMERO - Computer-Algebra im Mathematikunterricht. Band 7: Methodische und didaktische Handreichung*.

[3] R. Bruder and W. Weiskirch. *CAliMERO - Computer-Algebra im Mathematikunterricht. Band 8: Methodische und didaktische Handreichung*.

[4] R. Bruder and W. Weiskirch. *CAliMERO - Computer-Algebra im Mathematikunterricht. Band 9: Arbeitsmaterialien für Schülerinnen und Schüler*.

[5] R. Bruder and W. Weiskirch. *CAliMERO - Computer-Algebra im Mathematikunterricht. Band 9: Methodische und didaktische Handreichung*.

[6] K. H. Hofmann and S. A. Morris. *The Structure of Compact Groups, 3rd Revised and Augmented Edition*. Walter DeGruyter, Berlin, 2013.

[7] M. Joswig and T. Theobald. *Polyhedral and algebraic methods in algorithmic geometry*. Springer, 2013.

[8] J. Lőrinczi, F. Hiroshima, and V. Betz. *Feynman-Kac-Type Theorems and Gibbs Measures on Path Space*. de Gruyter, 2011.

[9] U. Lorenz, T. Ederer, C. Juretzka, T. Opfer, M. Utz, and S. Weber. *Maple: Eine Einführung in das Computer-Algebra-System*. RRZN, 2011.

[10] A. Martin, K. Klamroth, J. Lang, G. Leugering, A. Morsi, M. Oberlack, M. Ostrowski, and R. Rosen. *Mathematical Optimization of Water Networks*, volume 162 of *International Series of Numerical Mathematics*. Birkhäuser, 2012.

[11] S. Roch, P. Santos, and B. Silbermann. *Non-commutative Gelfand Theories. A Tool-kit for Operator Theorists and Numerical Analysts*. Springer, 2011.

[12] M. Ulbrich and S. Ulbrich. *Nichtlineare Optimierung*. Mathematik Kompakt. Birkhäuser, Basel, 2012.

[13] C. H. Weiß. *Mathematica – Eine Einführung*. RRZN Hannover, 2011.

3.3 Publications in Journals and Proceedings

3.3.1 Journals

[1] E. Abele, M. Haydn, T. Hauer, U. Lorenz, and T. Ederer. Unsicherheitsoptimierte Prozesskette bei der Bohrungsfeinbearbeitung. *wt Werkstatttechnik online*, 101:730–736, 2011.

[2] H.-D. Alber. A model for brittle fracture based on the hybrid phase field model. *Continuum Mechanics and Thermodynamics*, 24,4:391–402, 2012.

[3] H.-D. Alber and N. Kraynyukova. A doubly nonlinear problem associated with a mathematical model for piezoelectric material behavior. *ZAMM*, 92,2:141–159, 2012.

[4] H.-D. Alber and P. Zhu. Interface motion by interface diffusion driven by bulk energy: justification of a diffusive interface model. *Continuum Mechanics and Thermodynamics*, 23,2:139–176, 2011.

[5] H.-D. Alber and P. Zhu. Solutions to a model with Neumann boundary conditions for phase transitions driven by configurational forces. *Nonlinear Analysis: Real World Applications*, 12,3:1797–1809, 2011.

[6] H.-D. Alber and P. Zhu. Comparison of a rapidely converging phase field model for interfaces in solids with the Allen-Cahn model. *Journal of Elasticity*, 2012.

[7] C. Albert, H. Raach, and D. Bothe. Influence of surface tension models on the hydrodynamics of wavy laminar falling films in volume of fluid-simulations. *International Journal of Multiphase Flow*, pages 66–71, 2012.

[8] C. Alfes. Parity of the coefficients of Klein's j-function. *Proc. Amer. Math. Soc.*, accepted.

[9] C. Alfes, K. Bringmann, and J. Lovejoy. Automorphic properties of generating functions for generalized odd rank moments and odd Durfee symbols. *Math. Proc. Cambridge Philos. Soc.*, 151(3):385–406, 2011.

[10] C. Alfes and T. Creutzig. The mock modular data of a family of superalgebras. *Proc. Amer. Math. Soc.*, accepted.

[11] C. Alfes and S. Ehlen. Twisted traces of CM values of weak Maass form. *J. Number Theory*, accepted.

[12] C. Alfes, M. Jameson, and R. J. Lemke Oliver. Proof of the Andrews-Alder Conjecture. *Proc. Amer. Math. Soc.*, 139(1):63–78, 2011.

[13] F. Ali Mehmeti, R. Haller-Dintelmann, and V. Régnier. Multiple tunnel effect for dispersive waves on a star-shaped network: an explicit formula for the spectral representation. *J. Evol. Equ.*, 12(3):513–545, 2012.

[14] M. Allman, V. Betz, and M. Hairer. A chain of interacting particles under strain. *Stoch. Proc. Appl.*, 121:2014–2042, 2011.

[15] V. Andasari, A. Gerisch, G. Lolas, A. P. South, and M. A. J. Chaplain. Mathematical modeling of cancer cell invasion of tissue: biological insight from mathematical analysis and computational simulation. *J. Math. Biol.*, 63:141–171, 2011.

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3.5 Reviewing and Refereeing

3.5.1 Reviewing

Stephan Ehlen: Mathematical Reviews, Zentralblatt

Reinhard Farwig: Mathematical Reviews

Walter Freyn: Zentralblatt

Matthias Geissert: AMS Reviews

Karsten Grosse-Brauckmann: Mathematical Reviews

Michael Joswig: Zentralblatt

Ulf Lorenz: Mathematical Reviews

Steffen Roch: Mathematical Reviews

Irwin Yousept: Mathematical Reviews

3.5.2 Refereeing

René Bartsch: Quaestiones Mathematicae, Rostocker Mathematisches Kolloquium

Dieter Bothe: Chemical Engineering Science, Chemical Engineering Journal, Chemie Ingenieur Technik, Comm. on Pure and Applied Analysis, European Journal of Mechanics - B/Fluids, International Journal of Heat and Mass Transfer, International Journal of Multiphase Flow, Industrial & Engineering Chemistry Research, Journal of Computational Physics, Physics of Fluids, SIAM Journal on Mathematical Analysis, SPE Journal, Zeitschrift für Angewandte Mathematik und Physik (ZAMP)

Regina Bruder: Journal für Didaktik der Mathematik; Journal mathematik lehren; DFG; Journal: Teacher Development; The International Journal on Mathematics Education

Jan H. Bruinier: DFG, NSF (USA), NSERC (Kanada), Invent. Math., Ann. of Math., Acta Math., Journal of the AMS, Math. Ann., Duke Math. Journal, Crelle, Advances in Mathematics, Compositio Mathematica, etc.

Herbert Egger: Applicable Analysis, Applied Mathematics Letters, Applied Numerical Mathematics, Computers and Mathematics with Applications, Inverse Problems, Inverse Problems in Imaging, Mathematics and Computers in Simulation, Numerical Algorithms, Numerische Mathematik, SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing

Stephan Ehlen: Forum Mathematicum

Reinhard Farwig: Acta Mathematica, Annali dell'Università di Ferrara Sez. VII Sci. Mat., Archiv der Mathematik, Archive for Rational Mechanics and Analysis, Discrete and Continuous Dynamical Systems-S, Electronic J. Differential Equations, Indiana Univ. Math. J., J. Differential Equations, J. Mathematical Fluid Mechanics, Mathematical Methods in the Applied Sciences, Mathematische Annalen, Proceedings American Mathematical Society, Nonlinear Analysis, Nonlinearity, Topological Methods in Nonlinear Analysis

Walter Freyn: Journal of Lie theory

Alf Gerisch: Applied Mathematics Letters, Bulletin of Mathematical Biology, Discrete and Continuous Dynamical Systems–B, PLoS ONE, Research Foundation – Flanders (Fonds Wetenschappelijk Onderzoek – Vlaanderen, FWO), SIAM Multiscale Modeling and Simulation, Journal of the Royal Society Interface

Vassilios Gregoriades: Archive for Mathematical Logic

Karsten Grosse-Brauckmann: Computer Aided Geometric Design, Discrete and Computational Geometry

Robert Haller-Dintelmann: Advances in Differential Equations, Analysis and Applications

Priska Jahnke: Forum Mathematicum, Mathematische Zeitschrift, Advances in Mathematics, FWF - Der Wissenschaftsfond

Michael Joswig: International J. Combin., J. Combin. Th. (Series A), European J. Combin., J. Algebra, Discrete Comput. Geometry, J. Alg. Combin., Linear Algebra Appl., Computational Geometry: Theory and Application, Journal of Mathematics, Math. of Computation, An. Stiint. Univ. Ovidius Ser. Mat., FPSAC 2011, EUROCOMB11

Klaus Keimel: Proceedings of the American Mathematical Society, Journal of the London Mathematical Society, Acta Mathematica Sinica, Journal of Algebra and its Applications, Communications in Algebra, Topology and its Applications, European Science Foundation (ESF), Cech Science Foundation (GACR), Order, Mathematica Bohemica, Hacettepe Journal of Mathematics, Annals of Pure and Applied Logic, Journal of Logic and Algebraic Programming, Journal of Logic in Computer Science, Theoretical Computer Science, Mathematical Structures in Computer Science.

Martin Kiehl: Jugend forscht

Ulrich Kohlenbach: Annals of Functional Analysis, Annals of Pure and Applied Logic, Mathematical and Computer Modelling, Mathematical Logic Quarterly, Nonlinear Analysis, Notre Dame Journal of Formal Logic, Transactions AMS

Michael Kohler: Computational Statistics, IEEE Transactions on Systems, Journal of Machine Learning Research, Journal of Nonparametric Statistics, Man and Cybernetics Part C, Mathematical Problems in Engineering, Metron - International Journal of Statistics, Statistics, Statistics and Probability Letters

Oliver Kolb: Workshop on Computational Optimization, Modelling and Simulation within ICCS 2011 and ICCS 2012

Burkhard Kümmerer: Journal of Functional Analysis, Communications in Mathematical Physics, Journal of Operator Theory, Journal of Statistical Physics, Journal of Mathematical Analysis and Applications, Journal of Mathematical Physics.

Jens Lang: Applied Numerical Mathematics, Combustion Theory and Modelling, Journal of Physics A: Mathematical and General, Inverse Problems, Computing and Visualization in Science, International Journal of Hyperthermia, International Journal for Numerical Methods in Fluids, Transactions on Mathematical Software, Journal of Computational Physics, Computational and Applied Mathematics, IMA Journal of Numerical Analysis, Mathematics of Computation, SIAM Journal Numerical Analysis, SIAM Journal Scientific Computing

Andrew Linshaw: Communications in Mathematical Physics, Journal of Algebra, Journal of Geometry and Physics, Journal of Physics A: Mathematical and Theoretical, SIGMA: Symmetry, Integrability and Geometry: Methods and Applications.

Ulf Lorenz: Theoretical Computer Science (TCS), Advances in Computers and Games (ACG), European Symposium on Algorithms (ESA), Parallel Processing Letters, Transactions on Computational Intelligence and AI in Games, International Conference on Uncertainty in Mechanical Engineering, International Journal of Computer Games, DFG, NWO

Martin Otto: Annals of Pure and Applied Logic, Logica Universalis, Journal of the ACM, ACM Transactions on Computational Logic, Journal of Logic and Computation, Archive for Mathematical Logic, Information Processing Letters, Theoretical Computer Science, Logical Methods in Computer Science, Logic and Computational Complexity, Mathematical Foundations of Computer Science, IEEE Symposium on Logic in Computer Science, International Conference on Automata, Languages and Programming, Symposium on Theoretical Aspects of Computer Science, Advances in Modal Logic, Computer Science Logic, IEEE Symposium on Foundations of Computer Science, Foundations of Software Science and Computation Structures, Foundations of Software Technology and Theoretical Computer Science, DFG, South Africa National Research Foundation

Andreas Paffenholz: Journal of Combinatorial Theory A, Journal of Algebraic Combinatorics, International Mathematical Research Notices

Marc Pfetsch: CPAIOR 2012, Discrete Applied Mathematics, European Journal of Operations Research, Journal of Symbolic Computation, Mathematical Programming Computation, Networks, OR Letters

Jan-Frederik Pietschmann: Proceedings of the Royal Society A

Ulrich Reif: CAGD, Computer Aided Design, Computer Graphics Forum, International Journal of Computer Mathematics, Jaen Journal on Approximation, Journal of Approximation Theory, Numerical Methods for Partial Differential Equations, SIGGRAPH 2011, SIGGRAPH 2012

Steffen Roch: Complex Variables Elliptic Equations, J. Assoc. Arab Univ. Basic Appl. Sciences, J. Math. Anal. Appl., J. Spectral Theory, Math. Computation, Math. Meth.

Appl. Sciences, Numer. Algor., Operator Theory: Adv. Appl., Operators Matrices, Topology Appl., book project at Springer

Jürgen Saal: Nonlinear Analysis Series B: Real World Applications, SIAM Journal of Mathematical Analysis, Discrete and Continuous Dynamical Systems Series A and Series S, Applied Mathematics Letters, Nonlinear Differential Equations and Applications, Journal of Evolution Equations, Bulletin of the Brazilian Mathematical Society

Nils Scheithauer: Communications in Mathematical Physics, Journal für die reine und angewandte Mathematik, Journal of Lie Theory, The Ramanujan Journal

Werner Schindler: Journal of Cryptographic Engineering, CT-RSA 2012, Eurocrypt 2012

Thomas Streicher: Theoretical Computer Science, Mathematical Structures in Computer Science, Annals of Pure and Applied Logic

Stefan Ulbrich: Computational Optimization and Applications, Inverse Problems, Mathematical Programming, Mathematics of Computation, Optimization and Engineering, Optimization Methods & Software, SIAM Journal on Control and Optimization, SIAM Journal on Optimization, SIAM Journal on Scientific Computing

Christian H. Weiß: Advances in Statistical Analysis, Applied Stochastic Models in Business and Industry, Arabian Journal for Science and Engineering, ASTIN Bulletin – The Journal of the International Actuarial Association, Communications in Statistics – Simulation and Computation, Communications in Statistics – Theory and Methods, Computational Statistics, Computational Statistics and Data Analysis, Empirical Economics, IIE Transactions, IIE Transactions on Healthcare Systems Engineering, Journal of Agricultural, Biological, and Environmental Statistics, Journal of Applied Statistics, Journal of Mathematical Analysis and Applications, Journal of the Royal Statistical Society, Series B, Mathematical and Computer Modelling, Quality Technology & Quantitative Management, Statistical Modelling: An International Journal, Statistical Papers

Irwin Yousept: Computational Optimization and Applications (COAP), Journal of Optimization Theory and Applications (JOTA), Mathematical Methods in the Applied Sciences, Systems and Control Letters, Mathematical and Computer Modelling of Dynamical Systems, Acta Applicandae Mathematicae

Martin Ziegler: Theory of Computing Systems, Logical Methods in Computer Science, Mathematical Structures in Computer Science, Journal of Logic and Analysis, Jugend Forscht, Annals of Pure and Applied Logic, Applied Mathematics and Computation, Logic in Computer Science, Entropy

3.6 Software

polymake: *Software for Geometric Combinatorics*
polymake started out as a tool for the algorithmic treatment of convex polyhedra. By now it also deals with toric varieties, tropical polytopes, and other objects. The

software is jointly developed by the polymake team, lead by Ewgenij Gawrilow (TomTom) and Michael Joswig. For more information, see www.polymake.org

Contributors at TU Darmstadt: Benjamin Assarf, Roberto Henschel, Katrin Herr, Silke Horn, Michael Joswig, Katja Kulas, Andreas Paffenholz, Benjamin Schröter

ANACONDA: *Solving Hyperbolic Partial Differential Algebraic Equations on Networks*
ANACONDA is a software package to solve hyperbolic partial differential algebraic equations on networks. Particularly, it is designed to solve simulation and optimal control tasks for gas and water supply networks. The software is jointly developed by Oliver Kolb, Björn Geißler and Antonio Morsi (all TU Darmstadt).

KARDOS: *Solving Time-Dependent Partial Differential Equations*
KARDOS is a software package to solve partial differential equations in one, two and three space dimension adaptively in space and time. The software is jointly developed by Bodo Erdmann, Rainer Roitzsch (both ZIB) and Jens Lang, TU Darmstadt. For more information, see www.zib.de

SDP Package for SCIP: *Solving MISDPs using SCIP*
The SDP Package is a plug-in for the branch-and-bound framework SCIP for solving general MISDPs, see www.opt.tu-darmstadt.de/~smars/scip_sdp.html.

Contributor at TU Darmstadt: Sonja Mars

SCIP: *Software for Solving Constraint Integer Programs*
SCIP is a framework for solving constrained integer programs and performing branch-cut-and-price. It allows total control of the solution process and the access of detailed information. SCIP is also currently one of the fastest non-commercial mixed integer programming (MIP) solvers. It is developed together with the Zuse Insitute Berlin and the University of Erlangen-Nürnberg. For more information, see scip.zib.de

Contributor at TU Darmstadt: Marc Pfetsch

donlp2: *Solving general smooth nonlinear optimization problems, version October 2012*
Donlp2 is a software for the solution of general nonlinear programming problems. Different versions exist concerning the programming language (strict f77, f90, C99), the user interface and some options (for example elimination of redundant linear equality constraints and an interfacing known as "reverse communication"). Donlp2 is free for research, whereas commercial use requires licensing by TU Darmstadt. In the period under review the technique of taking numerical gradients has been revised. Four commercial licenses have been sold during this period and 57 academic licenses were given. For more information contact the author spellucci(_at_)mathematik.tu-darmstadt.de or see http://www.mathematik.tu-darmstadt.de/fbereiche/numerik/staff/spellucci/DONLP2/index.html

numawww: *Interactive computing exercises for numerical methods and continuous optimization*
Numawww is a cgi/html-based computing device for general numerical methods and methods of continuous optimization. It may be used for exercises during a numerical methods course, as a self teaching aid or even as a small scale computing

device, requiring minimal knowledge of programming. Each application comes with predefined test cases which can be used without programming knowledge at all. In the period under review the English version became fully operable. This version has been extended by 9 newly implemented methods and some other implementations were completely redesigned. There were about 6000 visits in 2011 and 12000 visits in 2012. Numawww meanwhile attracts attention internationally. For more information see `numawww.mathematik.tu-darmstadt.de`

Contributor at TU Darmstadt: Peter Spellucci

ISAL1: *Infeasible-Point Subgradient Algorithm for Basis Pursuit*
ISAL1 is a subgradient algorithm employing adaptive approximate projections for solving the basis pursuit problem, i.e., finding a minimum-l1-norm solution to an underdetermined linear equation system. For more information, see `http://wwwopt.mathematik.tu-darmstadt.de/spear/`

Contributor at TU Darmstadt: Andreas M. Tillmann

L1-Testset: *A set of test instances for L1-Minimization*
L1-Testset consists of 548 basis pursuit instances consisting of the constraint data (matrix and right hand side vector), a known unique optimal solution, and various data-specific parameters, constructed for the purpose of a unified solver comparison for basis pursuit problems. For more information, see `http://wwwopt.mathematik.tu-darmstadt.de/spear/`

Contributor at TU Darmstadt: Andreas M. Tillmann

ipfilter: *An NLP Solver based on a primal-dual interior-point filter algorithm*
ipfilter is a state-of-the-art solver for nonlinear programming problems (defined by the minimization of an objective function in a feasible region defined by equality and inequality constraints).
See `http://www.mat.uc.pt/ipfilter/`

Contributor at TU Darmstadt: Stefan Ulbrich

4 Theses

4.1 Habilitations

2011

van den Berg, Benno, *Categorical semantics of constructive set theory* (Thomas Streicher)

2012

Kyed, Mads, *Time-Periodic Solutions to the Navier-Stokes Equations* (Matthias Hieber)

4.2 PhD Dissertations

2011

Brandenburg, Christian, *Adjoint-Based Adaptive Multilevel Shape Optimization based on Goal-Oriented Error Estimators for the Instationary Navier-Stokes Equations* (Stefan Ulbrich)

Domschke, Pia, *Adjoint-Based Control of Model and Discretization Errors for Gas Transport in Networked Pipelines* (Jens Lang)

Fromkorth, Andreas, *Konsistenz regressionsbasierter Monte-Carlo-Verfahren zur Optionsbewertung mit geschätzten Modellen* (Michael Kohler)

Gaspar, Jaime da Gama, *Proof interpretations: theoretical and practical aspects* (Ulrich Kohlenbach)

Hansel, Tobias, *Fluid flows around moving obstacles: Non-autonomous rotation and fluids with variable density* (Matthias Hieber)

Hartmann, René, *Subdivision Surfaces C^2-schemes and generalized control nets* (Ulrich Reif)

Heidrich, Matthias, *Conditional Value-at-Risk Optimization for Credit Risk Using Asset Value Models* (Stefan Ulbrich)

Hofmann, Eric Ferdinand Wilhelm, *Automorphic Products on Unitary Groups* (Jan Hendrik Bruinier)

Kartzow, Alexander, *First-Order Model Checking on Generalisations of Pushdown Graphs* (Martin Otto)

Köhne, Matthias, *L^p-Theory for Incompressible Newtonian Flows in Weakly Singular Domains subject to Energy Preserving Boundary Conditions* (Dieter Bothe)

Kolb, Oliver, *Simulation and Optimization of Gas and Water Supply Networks* (Jens Lang)

Mars, Andreas, *On the topology and geometry of Kac-Moody groups* (Ralf Gramlich)

Petri, Birgit, *Perioden, Elementarteiler, Transzendenz – Kurt Hensels Weg zu den p-adischen Zahlen* (Regina Bruder)

Riechwald, Paul Felix, *Very Weak Solutions to the Navier-Stokes Equations in General Unbounded Domains* (Reinhard Farwig)

Sissouno, Nada, *Multivariate Splineapproximation auf Gebieten* (Ulrich Reif)

Sissouno, Nadiem, *A Non-commutative Version of the Coupling from the Past Algorithm* (Burkhard Kümmerer)

Witzel, Stefan, *Finiteness Properties of Chevalley Groups over the Ring of (Laurent) Polynomials over a Finite Field* (Ralf Gramlich)

2012

Böhm, Ulrich, *Modellierungskompetenzen langfristig und kumulativ fördern. Tätigkeitstheoretische Analyse des mathematischen Modellierens als Lerngegenstand in der Sekundarstufe I* (Regina Bruder)

Felber, Tina, *Universell L^1-konsistente Schätzung der Dichte der Fehler in einem Regressionsmodell und einer stationär ergodischen Zeitreihe* (Michael Kohler)

Götz, Dario, *Three topics in fluid dynamics: Viscoelastic, generalized Newtonian, and compressible fluids* (Matthias Hieber)

Henkel, Daniel, *Pointwise Approximation of Coupled Ornstein-Uhlenbeck Processes* (Klaus Ritter)

Horn, Silke, *Tropical Oriented Matroids and Cubical Complexes* (Michael Joswig)

Hövel, Martin, *Automorphe Formen mit Singularitäten auf dem hyperbolischen Raum* (Jan Hendrik Bruinier)

Jones, Daniel, *Optimales Stoppen und das Static Forecasting Problem* (Michael Kohler)

Kreuzer, Alexander, *Proof mining and combinatorics - Program extraction for Ramsey's theorem for pairs* (Ulrich Kohlenbach)

Kulas, Katja, *Combinatorics of Tropical Polytopes* (Michael Joswig)

Nesensohn, Manuel, *L^p-theory for a class of viscoelastic fluids with and without a free surface* (Matthias Geißert)

Plehnert, Julia, *Constant Mean Curvature Surfaces in Homogeneous Manifolds* (Karsten Große-Brauckmann)

Rolland, Guillaume, *Global existence and fast-reaction limit in cross effects* (Dieter Bothe / Michel Pierre)

Roth, Rolf, *Multilevel Optimization of Turbulent Flows by Discrete Adjoint Techniques* (Stefan Ulbrich)

Sauer, Martin, *Existence and Uniqueness Results for Randomly Forced Generalized Newtonian Fluids* (Wilhelm Stannat)

Schieche, Bettina, *Unsteady Adaptive Stochastic Collocation Methods on Sparse Grids* (Jens Lang)

Schulz, Raphael, *Spatial Asymptotic Profile in Geophysical Fluid Dynamics* (Reinhard Farwig)

Schwieger, Kay, *A Coupling Method for Quantum Markov Processes* (Burkhard Kümmerer)

4.3 Diplom Theses

2011

Alex, Tristan, *Minimale Graphen in Riemannschen Faserungen* (Karsten Große-Brauckmann)

Aronava, Lina, *Robuste Portfolio-Optimierung basierend auf gemeinsam ellipsoiden Unsicherheitsmengen* (Stefan Ulbrich)

Assarf, Benjamin, *Auswirkungen von Gaps im Sequence Alignment Problem auf Tightspans* (Michael Joswig)

Ayat, Abdelhamid, *The implementation of algorithms for parameter estimation and optimal experimental design using Matlab and Chebfun* (Stefan Ulbrich)

Bednarek, Marei, *Gültige Ungleichungen aus mehreren Zeilen des Simplextableaus* (Marco Lübbecke)

von Below, Lorenz, *H^∞-Kalkül für Familien von sektoriellen Operatoren* (Matthias Geißert)

Betz, Thomas, *Optimale Steuerung elastoplastischer Verformungsprozesse* (Christian Meyer)

Bolchoun, Alexandre, *Pseudomonotone Operatoren und Existenztheorie zu einem Phasenmodell* (Hans-Dieter Alber)

Brandau, Roland, *Integriertes Modell der Profiloptimierung zur Herstellung von Mehrkammerprofilen* (Stefan Ulbrich)

Breunig, Eva Maria, *Systematische Untersuchung dreifach periodischer Flächen konstanter mittlerer Krümmung mit Hilfe der Konjugierten-Methode* (Karsten Große-Brauckmann)

Bruse, Florian, *Ein modallogischer Ansatz für Lindströmsätze für schwache Logiken* (Martin Otto)

Caspar, Roland, *Auffalten von orthogonalen Bäumen* (Alexander Martin)

Dietz, Nadine, *Pricing American Options using GARCH Models and regression-based Monte Carlo Methods* (Michael Kohler)

Dittmann, Christoph, *Succinctness and expressitivity of certain modal logics over S5 structures* (Martin Otto)

Erdene, Zambaga, *Evaluation and Extension of Confidence Estimators for Optical flow* (Stefan Roth / Wilhelm Stannat)

Funk, Katharina, *Verschiedene Ansätze zur mathematischen Optimierung von Wasserversorgungsnetzen* (Ulf Lorenz)

Furer, Dmytro, *Optimale Parameterwahl bei der Bewertung von Amerikanischen Optionen mit Hilfe von GARCH-Modellen und regressionsbasierten Monte-Carlo-Verfahren unter Verwendung von nichtparametrischer Regression* (Michael Kohler)

Gomez Rodriguez, Jose Fabio, *Forecasting German Recessions: An Application on Markov Regime Switching Models* (Jens Krüger / Michael Kohler)

Guo, Zhihong, *Numerical estimation of model parameters for a detailed industrial robot dynamics* (Oskar von Stryk / Martin Kiehl)

Hamann, Sebastian Carsten, *Adaptive All-But-One Lossy Trapdoor Functions and their Applications* (Johannes Buchmann)

Hartmann, Benjamin, *Erzeugung von 3-dimensionalen Polytypen und Triangulierungen durch Projektion höher dimensionaler Polytypklassen* (Michael Joswig)

Hübsch, Florian Andreas, *Die First-Jump- Approximation von Levy-Prozessen* (Klaus Ritter / Wilhelm Stannat)

Jin, Lihui, *Vergleichende Darstlellung von Schadensreservierung bei lang anhaltenden Schadensabwicklungen* (Michael Kohler)

Kascha, Matthäus, *Creditibility-Theorie* (Michael Kohler)

Kaspar, Larissa, *Metrikbasierte anisotrope Gitterverfeinerung* (Jens Lang)

Keim, Oliver, *Incorporating Convex Hulls into an Algorithmic Approach for Territory Design Problems* (Alexander Martin)

Krug, Matthias, *Optimales Ausüben von Amerikanischen Optionen in diskreter Zeit im Falle von GARCH-Modellen* (Michael Kohler)

Lehmann, Nora, *Optimierung der Baustellenplanung im Schienenverkehr* (Marco Lübbecke)

Markert, Melanie Heidrun, *Robuste Optimierung aktiver Stabwerke mittels polyedrisch-elliptischen Unsicherheitsmengen sowie nichtlinearer Semidefinierter Programmierung* (Stefan Ulbrich)

Mayer, Sebastian, *Multilevel-Rank-1 Lattice Rules for Infinite-Dimensional Integration Problems* (Klaus Ritter)

Meinlschmidt, Hannes, *Optimal control of the thermistor problem* (Robert Haller-Dintelmann / Christian Meyer)

Mönkehues, Stephan, *SWIFFt-Modifikationen, Korrektur von Operm5* (Johannes Buchmann)

Mücke, Patrick William, *3D Surface Reconstruction from Multi-Resolution Depth Maps* (Ulrich Reif)

Muth, Sebastian, *Topologieabhängige robuste Optimierung aktiver Stabwerke mittels MISDP* (Stefan Ulbrich)

Nagel, Markus, *Das Transmission Line Problem aus Sicht der Diskreten Optimierung* (Ulf Lorenz / Martin Ziegler)

Niederhöfer, Florian, *Zeitintegrationsverfahren höherer Ordnung in der Molekulardynamik* (Jens Wackerfuß / Jens Lang)

Opfer, Thomas, *Entwicklung eins exakten rationalen dualen Simplex-Lösers* (Martin Ziegler / Ulf Lorenz)

Palapies, Lars, *Über die Fortsetzung von L-Reihen aus der Theorie vektorwertiger Modulformen zur Weildarstellung* (Jan Hendrik Bruinier)

Pausch, Matthias, *Ein Konsistenzresultat zur Schätzung von Geschwindigkeitsfeldern mit Hilfe von multivariaten Smoothing-Splines* (Michael Kohler)

Philipp, Anne, *Anwendung von Verfahren der Nichtlinearen Semidefiniten Programmierung auf die Robuste Optimierung von aktiven Stabwerken* (Stefan Ulbrich)

Rauch, Bernhard, *Solving indefinite quadratic problems by combining QP-convexification techniques with a new interior-point-based primal heuristic* (Stefan Ulbrich)

Redeker, Esther Karin Maria, *Die Schätzung des Driftparameters in stochastischen Volatilitätsmodellen* (Wilhelm Stannat)

Roos, Stefanie, *Analysis of Routing on Sparse Small-Word Topologies* (Thorsten Strufe)

Roth, Martina, *Demand and Capacity Balancing – Ein Modell zur flugbasierten Komplexitätsbetrachtung* (Stefan Ulbrich)

Rozenberg, Dimitri, *Robuste Conditional Value-at-Risk Portfoliooptimierung* (Stefan Ulbrich)

Schad, Adrian, *Solutions to the Broadcasting Problem* (Stefan Ulbrich)

Schäfer, Carsten, *Modell-prädikative Regelung zur aktiven Dämpfung von elastischen Systemen* (Stefan Ulbrich)

Schermuly, Claudia, *Modellierung und Anwendung zur Dekomposition von Graphen* (Michael Joswig)

Schneider, Jan, *Schwache Approximation Lévy-Prozess getriebener stochastischer Differentialgleichungen* (Klaus Ritter)

Schröder, Dirk, *Adaptive Multilevel-Verfahren für das Thermistor-Problem* (Jens Lang)

Schulze, Moritz, *Expanding Branch and Bound for binary integer programs with a pseudo-boolean solver and a SAT based presolver* (Alexander Martin)

Seeger, Jens, *Geometrieoptimierung verzweigter Blechbauteile* (Stefan Ulbrich)

Siagam, Eric Salvador, *Robust Portfolio Optimization: A Conic Programming Approach* (Stefan Ulbrich)

Steglich, Friederike, *Automorphismen von Gittern* (Nils Scheithauer)

Steigerwald, Martin Josef, *Planung von gekoppelten Strom-, Gas- und Wärmenetzen* (Alexander Martin)

Steplavage, Martin Frank, *Konvergenzrate des Galerkin-Verfahrens für eine Klasse von stochastischen elliptischen Differentialgleichungen* (Klaus Ritter / Jens Lang)

Tischhauser, Gundula Elfi, *Modellierung und Simulation von Netzwerken hyperbolischer Erhaltungsgleichungen* (Stefan Ulbrich)

Vrzina, Miroslav, *Ends of Constant Mean Curvature in* $\mathbb{H}^2 \times \mathbb{R}$ (Karsten Große-Brauckmann)

Wagner, Tobias, *Integriertes Modell und Algorithmus der Profiloptimierung zur Herstellung von Mehrkammerprofilen* (Stefan Ulbrich)

Weiden, Patrick, *Fully Homomorphic Encryption: Overview and Cryptanalysis* (Johannes Buchmann)

Weider, Katrin, *Die Anwendung der Topologischen Ableitung in der Strukturoptimierung* (Stefan Ulbrich)

Wojciechowski, Philipp, *Generalisierte Multilevel SQP-Methoden für PDE-beschränkte Optimierung mit Modellen reduzierter Ordnung* (Stefan Ulbrich)

Wu, Xiping, *Pricing American Options by regression based Monte Carlo Methods using Interaction Models based on Splines* (Michael Kohler)

Zeng, Dequan, *Linear Model-Predictive Control of Cooperative Multi-Vehicle for Time-Dependent* (Oskar von Stryk / Stefan Ulbrich)

Zhao, Ying, *On data-based optimal stopping under stationarity and ergodicity* (Michael Kohler)

2012

Bott, Stefanie, *Adaptive Multilevel SQP-Verfahren für zustandsrestringierte Optimierung mit partiellen Differentialgleichungen* (Stefan Ulbrich)

Brückmann, Volker, *MINLP zur Topologieoptimierung verzweigter Kohlenstoffnanoröhrchen – Modellierung, Implementierung mit GAMS und Berechnung* (Jens Wackerfuß / Stefan Ulbrich)

Brück, Sascha, *Development and analysis of a Discountinous Galerkin method on staggered grids for high frequency problems* (Erion Gjonaj / Jens Lang)

Do, Phuong Thao, *Robuste Portfolio-Optimierung mit Value-at-Risk als Risikomaß* (Stefan Ulbrich)

Dogruel, Selim, *Revisiting and Tailoring auction theory for Eurex Clearing* (Stephane Le Roux)

Fischer, Tobias, *Konstruktion von dünn besetzten Sensing Matrizen* (Marc Pfetsch)

Geier, Sascha, *Multilevel Monte Carlo Methoden in der stochastischen Optimierung mit Anwendung auf High Frequency Trading* (Stefan Ulbrich)

Heid, Florian, *Credit Valuation Adjustment – Modellierung und Simulation des Kreditausfallrisikos von Portfolio mit OTC-Derivaten des Kontrahenten* (Hans-Dieter Alber / Stefan Ebenfeld)

Herzwurm, André, *Multilevel Monte Carlo Algorithms for Free Energy Computation* (Klaus Ritter)

Hinz, Bianca, *Dichteschätzung ausgehend von realen und künstlich erzeugten Daten unter Verwendung des Nächsten-Nachbar-Schätzers* (Michael Kohler)

Holstein, Paul, *Bewertung von exotischen Optionen mithilfe von Momenten und einer SDP-Relaxation unter Berücksichtigung verschiedener Systeme* (Stefan Ulbrich)

Hornschuch, Marian, *Multivariate-based identification and signature schemes with additional properties* (Johannes Buchmann)

Jakob, Manuel, *Methodology for Site Selection for Route-Based Traffic Network Optimizations and Relative Costs of Implementation: Numerical Studies* (Alexandre Bayen (Berkeley), Stefan Ulbrich)

Kaier, Anton, *Kalibrierung der Quelle-Ziel-Nachfragematrix auf Basis von Querschnittszähldaten im Öffentlichen Verkehr* (Stefan Ulbrich)

Kim, Evgenia, *Back-Door Equity Financing: The issue of Commerzbank's Conditional mandatory exchangeable notes* (Dirk Schiereck / Michael Kohler)

Kohlleppel, Laura, *Myopisches Verhalten und Karriereanreize* (Volker Nitsch / Stefan Ulbrich)

Kremer, Dominik, *Spezielle Minimalflächen in homogenen Räumen* (Karsten Große-Brauckmann)

Kresse, Björn, *Optimale Steuerung von hyperbolischen Erhaltungsgleichungen auf Netzwerken* (Stefan Ulbrich)

Kriha, Nils, *Parallelisierung in der algorithmischen Geometrie* (Michael Joswig)

Kunkel, Annette, *Eine dynamische Methode zur Berechnung von Nash-Gleichgewichten in nicht-kooperativen n-Personen-Spielen* (Werner Krabs)

Macht, Christina, *Regularisation of the Problem of Static Elastoplasticity with Kinematic Hardening* (Christian Meyer / Stefan Ulbrich)

Meffert, David, *Ein Transference Principle für unbeschränkte Gruppen und Funktionalkalküle auf UMD-Räumen* (Robert Haller-Dintelmann)

Omland, Steffen, *Multilevel algorithms using scrambled digital nets* (Klaus Ritter)

Pesch, Joana, *Ein Algorithmus für kardinalitätsbeschränkte quadratische Optimierungsprobleme mit Anwendung auf die Portfoliooptimierung* (Stefan Ulbrich)

Schneider, Moritz, *Evolutionary Games and Population Genetics in Discrete Time* (Werner Krabs)

Schüssler, Daniel, *Algorithmische Bestimmung der Haken-Eigenschaft bei 3-Mannigfaltigkeiten* (Michael Joswig)

Schulz, Despina, *Optimierung von koalitionssicheren Fingerprint Algorithmen* (Werner Schindler / Stefan Katzenbeisser)

Stammler, Sebastian, *Coefficients of Eisenstein series associated with lattices and Heegner divisors* (Jan Hendrik Bruinier)

Ströter, Laura, *Bewertung Amerikanischer Optionen mittels kleinsten-Quadrate-Splineschätzern bei unbeschränkter Auszahlungsfunktion* (Michael Kohler)

Trippel, Florian, *Pricing of Bermudan options using least-squares estimates with complexity penalties* (Michael Kohler)

Walter, Michael, *Eine konvexitätsbasierte Homotopiemethode für Nonlinear Model Predictive Control* (Stefan Ulbrich)

Walter, Stefan, *Grundlagen des optimalen Stoppens unter Ergodizität und Stationarität* (Michael Kohler)

Weigel, Jens Wolf, *Zur Analyse von 2-Spieler Nullsummenspielen in Extensivform am Beispiel von Leduc Holdem* (Werner Krabs)

Weigt, Till Sebastian, *Numerische Simulation zu Kubatur-Algorithmen auf dem Wiener Raum* (Andreas Rößler)

Zentgraf, Christopher, *How consolidation changes the risk profile of the business software industry* (Dirk Schiereck / Michael Kohler)

Zhao, Zilong, *Stabilität in Räuber–Beute–Modellen* (Werner Krabs)

Zhou, Rui, *Credit Portfolio Optimization based on Conditional Value at Risk and Merton's Model* (Stefan Ulbrich)

4.4 Master Theses

2011

Bauer, Astrid, *Aufgabensets als binnendifferenzierendes Element im Mathematikunterricht der Fachoberschule* (Regina Bruder)

Blank, Stefan, *Didaktische Planung, Organisation und Durchführung einer Elektrotechnik-Arbeitsgemeinschaft an der Justin-Wagner-Gesamtschule in Roßdorf für das Schuljahr 2011/2012. Nähere Betrachtung der Komponenten eines Elektrofahrzeuges sowie des öffentlichen Stromnetzes. An Modellen (Elektro-Motoren aus dem Modellbau) führen die Schüler Experimente durch und bauen mit Steckbrettern diverse elektronische Schaltungen auf.* (Gerhard Faber)

Chakarova, Elica Emilova, *Eine Heuristik zur Unterstützung der Ladeplanung bei Fluggesellschaften am Beispiel der Lufthansa Cargo AG* (Marco Lübbecke)

Chakoute Mepipyou, Aristide Briand, *Optimale Steuerung auf einem Strassennetzwerk* (Stefan Ulbrich)

Endres, Thomas, *Erstellen eines Drehbuches für eine Kompetenzorientierte digitale Lernumgebung* (Regina Bruder)

Grünewald, Theo, *Testbasierte Rückmeldung zur diagnostischen Kompetenz im Lehramtsstudium (Mathematik)* (Regina Bruder)

Hasch, Alva Theresa, *Eignet sich selbstgesteuertes Lernen für "leistungsschwache" Jugendliche?* (Josef Rützel)

Horcicka, Michael, *Anwendung der Theorie und Verfahren der nichtlinearen Optimierung in der Teilchentherapie* (Christian Meyer)

Jochum, Steffen, *Erstellung und Evaluierung einer Selbstlernumgebung zum Thema "Drehen" für Auszubildende in den Berufen Industriemechaniker/in und Feinmechaniker/in im Kontext des Lernfeldkonzept* (Stephan Kösel)

Kenmoe, Steve Charlie, *Optimal exercising of American options in discrete time* (Michael Kohler)

Kuete Ngougning, Meguy, *Optimal exercising of American options in discrete time-measurement problems* (Michael Kohler)

Lux, Sabine, *Klingende Mathematik – Mathematik durch Musik erleben* (Burkhard Kümmerer)

Mrazek, Ralf, *Verantwortungsvoller Umgang mit Bildung im Schulalltag* (Tim Unger)

Odathuparambil, Sonja, *Effiziente Auswertung von Subdivisionsflächen* (Ulrich Reif)

Peng, Jing, *Insider Trading in Continuous Time* (Wilhelm Stannat)

Ruiner, Inga, *Lehrerteamarbeit als Herausforderung der Lernfeldimplementierung im Fachbereich Körperpflege* (Stephan Kösel)

Werner, Fabian, *Discriminant forms and Hecke operators* (Nils Scheithauer)

Winter, Bianca, *Mathematische Optimierungsmethoden für die Konferenzplanung* (Ralf Borndörfer)

Wolf, Markus, *Lernprojekt zum Einstieg in die Photovoltaiktechnik* (Gerhard Faber)

2012

Achard, Dominique, *Wahl des optimalen Designs zur Schätzung der Dehnungswöhlerlinie mittels Simulation* (Michael Kohler)

Beierlein, Christian, *Bewertung Amerikanischer Optionen auf Dividenden abwerfende Aktien mittels regressionsbasierter Monte-Carlo-Verfahren und Kleinste-Quadrate-Schätzern bei unbeschränkter Auszahlungsfunktion* (Michael Kohler)

Bernhardt, Bert, *Eine Selbstlernumgebung zur Integralrechnung in der Fachoberschule* (Regina Bruder)

Bott, Ann-Kathrin, *Obere Schranken für Amerikanische Optionen in diskreter Zeit im Falle von stationären und ergodischen Daten* (Michael Kohler)

Burkholz, Rebekka, *Stochastische FitzHugh-Nagumo Systeme* (Wilhelm Stannat)

Buttler, Jens Erik, *Berechnung von Nash-Gleichgewichten von Spielen in Normalform basierend auf Replicator Dynamics* (Werner Krabs)

Egert, Moritz, *The Riesz transform for elliptic systems* (Robert Haller-Dintelmann)

Ewald, Tobias, *Parametrisierung von Dreiecksnetzen über Mannigfaltigkeiten* (Ulrich Reif)

Garthe, Timo, *Rekonstruktive Kompetenzdiagnostik in Prüfungsgesprächen der Facharbeiterprüfungen* (Ralf Tenberg)

Groschwitz, Pascal, *Bildung fürs Leben: Über den Beitrag, den Hessencampus zum Konzept der "Employability" leistet* (Stephan Kösel)

Gürbüz, Nalan, *Motivation für Mathematik im Berufskolleg: Eine empirische Studie unter Einbeziehung des sozialen Hintergrundes* (Regina Bruder)

Houdek, Simone, *Binnendifferenzierende Elemente zur Einführung in die Differentialrechnung in der FOS* (Regina Bruder)

Hufler, Tobias Holger, *L-Funktionen zu Hecke-Charakteren* (Jan Hendrik Bruinier)

Kontny, Markus Matthias, *Neues Verfahren zur Schätzung der Dehnungs-Wöhler-Linien* (Michael Kohler)

Lebisch, Lukas, *Density estimation in the finite information model* (Michael Kohler)

Lippert, Roman, *Untersuchung des "Recoverable Robustness" Konzepts zur Bewältigung von Unsicherheiten in Fahrplänen des Schienenverkehrs* (Malte Fliedner / Stefan Ulbrich)

Lohfert, Jan-Hendrik, *Diversifikationseffekte in Asset Allocation, Kapitalallokation und Risikotragfähigkeitsanalyse: MaRisk-konforme Modelle und empirische Fundierung* (Stefan Ulbrich)

Lulev, Hristo, *Exposure-Management und Optimale-Hedingstrategie* (Stefan Ulbrich)

Merkel, Claudia, *Lernumgebung zu kontextbasiertem Basiskönnen in den Bildungsgängen zur Berufsvorbereitung* (Regina Bruder)

Möller, Sven, *Zur Klassifikation automorpher Produkte singulären Gewichts* (Nils Scheithauer)

Müller, Florian, *Schätzung der Ableitung einer Regressionsfunktion als Inversenproblem* (Michael Kohler)

Nangue Ngangwa, Reynaud, *Analyse von Kleinste-Quadrate Neuronale-Netze-Schätzern bei Vorliegen von Messfehlern in der unabhängigen Variablen* (Michael Kohler)

Nordheim, Jens Christoph, *Konzeption und Implementierung eines Algorithmus zur numerischen Integration auf getrimmten Würfeln* (Ulrich Reif)

Ott, Marcel, *Der demographische Wandel und seine Auswirkungen auf die berufliche Bildung im Odenwaldkreis* (Josef Rützel)

Pacheva, Boryana Dimitrova, *Controlling in öffentlichen Verwaltungen und Non-Profit-Organisation – am Beispiel von Schulen* (Reiner Quick / Regina Bruder)

Plutz, Ferdinand, *Ingenieurpädagogik in der beruflichen Fachrichtung Fertigungstechnik mit dem Zweitfach Informationstechnik* (Anerkennung)

Razavi, Sarah, *Entwurf einer Spannbetonbrücke ohne Betonstahl, Abdichtung und Fahrbahnbelag* (Anerkennung)

Rexius, Alexander, *Selbstlernumgebung zu Wachstum und Veränderungen* (Regina Bruder)

Sauer, Jens, *Informationsflusssicherheit in Systemen mit zwei Prozessoren* (Heiko Mantel)

Sauer, Jonas, *Very Weak Solutions of the Stationary Stokes Equations in Unbounded Domains of Half Space Type* (Reinhard Farwig)

Schade, Katharina Clara, *Proof Mining for Halpern Iterations in CAT(O) spaces* (Ulrich Kohlenbach)

Schneider, Katrin, *Selbstreguliertes Lernen und personenorientierte Methoden in der Benachteiligtenbildung* (Josef Rützel)

Vock, Sebastian Erik, *Analyse der Abhängigkeiten zwischen Key Performance Areas und Key Performance Indicators* (Stefan Ulbrich)

Weinbender, Dennis, *Derivation and Implementation of a Nonparametric Estimate in the Context of a Latent Variable Model* (Michael Kohler)

Wolf, Melanie, *Druckstabilisierung bei adaptiver Diskretisierung der Stokes Gleichung* (Jens Lang)

Yomba Ngangwa, Gerard, *Nichtparametrische Schätzung bedingter Verteilungen* (Michael Kohler)

4.5 Staatsexamen Theses

2011

Bauer, Eva Adriane, *Binnendifferenzierender Mathematikunterricht aus Schülersicht – Klasse 7 und 8 – Ergebnisse des Projektes MABiKOM* (Regina Bruder)

Bayer, Maria, *Zur Entwicklung von Planungskompetenz von Mathematik-Lehramtsstudierenden* (Regina Bruder)

Buchert, Maike, *Entwicklung einer Lernumgebung zur Förderung der Darstellungswechsel Funktionaler Zusammenhänge* (Regina Bruder)

Feldt, Nora, *Selbst reguliert mathematische Kompetenzen erwerben mit einem binnendifferenzierenden Aufgabenformat* (Regina Bruder)

Fissel, Sonja Kristin, *Lerngelegenheiten für mathematisches Argumentieren ab Klasse 9* (Regina Bruder)

Guse, Sebastian, *Eine Lernumgebung zur Diagnose von Fehlvorstellungen in funktionalen Zusammenhängen* (Regina Bruder)

Haas, Fabienne Christine, *Eine Lernumgebung zu Darstellungswechseln zwischen Graph und Gleichung bei funktionalen Zusammenhängen* (Regina Bruder)

Karl, Angela, *Eine digitale Lernumgebung zu Folgen und Reihen für das Aufgabenpraktikum online* (Regina Bruder)

Kompter, Astrid, *Fehlvorstellungen zu Darstellungswechseln bei funktionalen Zusammenhängen im Projekt HEUREKO* (Regina Bruder)

Konrad, Denise, *Zur Entwicklung von Blütenaufgaben und der Ergebnisreflexion* (Regina Bruder)

Kornetzky, André, *Entwicklung eines veranstaltungsbegleitenden Forenmoduls für das Aufgabenpraktikum online* (Regina Bruder)

Lakenbrink, Sven, *Im historischen Kontext Begründen und Beweisen lernen* (Regina Bruder)

Lisin, Katharina, *Itemkonstruktion zu Darstellungswechseln bei quadratischen Zusammenhängen* (Regina Bruder)

Losert, Ann-Katrin, *Ergebnisse des Modellprojektes zu einem binnendifferenzierenden Mathematikunterricht (MABIKOM) in Klasse 8* (Regina Bruder)

Löw, Fabian, *Auswertung der Längsschnittstudie CALiMERO Klassen 7 bis 10* (Regina Bruder)

Müller-Pompetti, Simone, *Eine Pilotstudie zur Nutzung von Darstellungswechseln funktionaler Zusammenhänge im Projekt "HEUREKO"* (Regina Bruder)

Nitsch, Renate, *Messung diagnostischer Kompetenz durch Aufgabenanalysen im Lehramtsstudium Mathematik* (Regina Bruder)

Osterwinter, Lea Christine, *Langfristiger Kompetenzaufbau im mathematischen Problemlösen in Lernumgebungen zur Geometrie* (Regina Bruder)

Schmidt, Maike, *Ergebnisse des Modellprojektes MABIKOM zu einem binnendifferenzierenden Mathematikunterricht in Klasse 6* (Regina Bruder)

Schwebel, Miriam, *Modellierung coexistierender Symbionten und Parasiten* (Martin Kiehl)

Schweier, Stefan, *Längsschnittanalyse zum Projekt "MABIKOM" in Klasse 7/8* (Regina Bruder)

Tempel, Andrea, *Ergebnisse des Modellprojektes MABIKOM zu einem binnendifferenzierenden Mathematikunterricht in Klasse 10* (Regina Bruder)

Wesp, Timo, *Langfristiger Kompetenzaufbau zum mathematischen Argumentieren* (Regina Bruder)

Will, Britta Erika, *Eine digitale Lernumgebung mit spielerischen Elementen zu Darstellungswechseln bei funktionalen Zusammenhängen* (Regina Bruder)

Wondra, Tetyana, *Umgang mit Unendlichkeit bei Leibniz, Newton und im heutigen Mathematikunterricht.* (Burkhard Kümmerer)

2012

Bott, Sebastian, *Projektions- und Rekonstruktionsmethoden für dreidimensionale Objekte* (Martin Kiehl, Regina Bruder (Zweitgutachter))

Braun, Isabella, *Längsschnittlicher Vergleich der Leistungstets im Projekt MABiKOM in der Klassenstufe 7* (Regina Bruder)

Dudek, Justine Maria, *Zur Qualitätssicherung binnendifferenzierender Lernmaterialien für den Mathematikunterricht* (Regina Bruder)

Graf, Carolin, *Längsschnittlicher Überblick über die Ergebnisse auf Schülerebene im Projekt MABiKOM* (Regina Bruder)

Heuck, Felix, *Entwicklung eines Drehbuchs für ein digitales Mathematik-Lernspiel für die Jahrgänge 7-8* (Regina Bruder)

Jacksteit, Nadine, *Entwicklung einer Lernumgebung zur Aussagenlogik für die Sekundarstufe I* (Regina Bruder)

Kallenbach, Anne, *Eine Lernumgebung zum mathematischen Problemlösen in Klasse 7/8* (Regina Bruder)

Karg, Melanie, *Ergebnisse binnendifferenzierenden Mathematikunterrichts in Klasse 5 im Projekt MABiKOM* (Regina Bruder)

Krings, Daniel, *Förderung selbstregulierten Lernens im Mathematikvorkurs VEMINT-DA* (Regina Bruder)

Leismann, Sophia, *Analyse von typischen Schülerfehlern im Themenfeld funktionaler Zusammenhänge* (Regina Bruder)

Müller, Daniel, *Analyse eines Diagnoseinstrumentes am Ende der Sekundarstufe I* (Regina Bruder)

Roder, Ulrike, *Diagnose von Lernschwierigkeiten bei linearen Funktionen* (Regina Bruder)

Sauer, René, *Von Folgen zu Differentialgleichungen im Analysisunterricht in der gymnasialen Oberstufe* (Regina Bruder)

Sauter, Sven, *Ein digitales Lernmodul zu Funktionen mit zwei Veränderlichen* (Regina Bruder)

Schaaf, Anne Christine, *Zur Entwicklung von Schülerleistungen im Projekt MABiKOM in der Klassenstufe 9* (Regina Bruder)

Schulze, Christiane, *Lernpotenzial eines interaktiven Whiteboards im Mathematikunterricht* (Regina Bruder)

Schützkowski, Katrin, *Untersuchung zum Einfluss verschiedener Lernstile auf die Beurteilung von mathematischen Online-Lernspielen* (Regina Bruder)

Szymanski, Stefanie, *Zum Einsatz des 3D-Tools GeoGebra 5.0 im Mathematikunterricht der Sekundarstufe II* (Regina Bruder)

Weber, Ann-Katrin, *Entwicklung von Lernumgebungen zur Förderung der mathematischen Argumentationskompetenz* (Regina Bruder)

4.6 Bachelor Theses

2011

Arikan, Cennet, *Zur Charakterisierung des optimalen Portfolios* (Wilhelm Stannat)

Barbehön, Janine, *Optimierung von Materialströmen* (Ulf Lorenz)

Bauer, Rachel, *Optimierung dreidimensionaler Spaltprofile* (Stefan Ulbrich)

Berst, Milena, *Der Kern und seine Anwendungen in der kooperativen Spieltheorie* (Werner Krabs)

Biehl, Johanna, *Modellierung des Dynamic Graph Reliability Problems und Lösungsansätze* (Ulf Lorenz)

Börner, Susanne, *Aggregation of Market Risk* (Michael Kohler)

Burg, Daniela, *Regressionsbasierte Monte-Carlo-Verfahren zur Bewertung Amerikanischer Optionen unter Verwendung von additiven Modellen basierend auf Splines* (Michael Kohler)

Burkhardt, Sina, *Ein Branch-and-Price-Algorithmus für Graphenfärbung* (Marco Lübbecke)

Dalinger, Alexander, *Galoisdarstellungen elliptischer Kurven* (Nils Scheithauer)

Debski, Piotr, *Korrelationsangriffe gegen Stromchiffren* (Werner Schindler)

Egert, Moritz, *Barenblatt´s solution to the porous medium equation* (Robert Haller-Dintelmann)

El Bansarkhani, Rachid, *Solving Lattice Problems with Voronoi Cells* (Johannes Buchmann)

Feldman, Yulia, *Zu Barriereoptionen im Cox-Ross-Rubinstein Modell* (Wilhelm Stannat)

Fischer, Michael Helmut, *Das Haar-Integral* (Reinhard Farwig)

Fujara, Nicola Sophia, *A New Homomorphic Cryptosystem with a Double Trapdoor Decryption Mechanism* (Johannes Buchmann)

Gally, Tristan, *Tikhonov Regularisierung für das inverse Problem der Optionsbepreisung im Dupire-Modell* (Wilhelm Stannat)

Gong, Bo, *Automorphic L-functions and theta series* (Jan Hendrik Bruinier)

Hanst, Maleen, *Die Gruppenstruktur glatter Kubiken* (Nils Scheithauer)

Heßler, Katrin, *L-Reihen und Anwendungen* (Nils Scheithauer)

Hildmann, Valentina, *Lawson-Algorithmus* (Ulrich Reif)

Hojny, Christopher, *Über verteilungsinvariante Risikomaße* (Wilhelm Stannat)

Klepsch, Johannes, *Der Preis einer Asiatischen Option im Black-Scholes Modell* (Wilhelm Stannat)

Knauf, Konstantin, *Zur Bewertung Asiatischer Zinsoptionen im CIR-Modell* (Wilhelm Stannat)

Kopp, Sonja, *Effiziente Gradienten- und Hesse-Matrix Berechnung bei gradientenbasierten numerischen Optimierungsverfahren angewandt auf atomistische molekulare Simulation* (Martin Kiehl)

Lamano, Stefano, *On the approximation of the Black-Scholes Model* (Wilhelm Stannat)

Lübbers, Jan Erik, *Kalibierung der Volatilität in einem Black-Scholes-Modell mittels Maximum Entropy Regularisierung* (Wilhelm Stannat)

Lupp, Daniel Paul, *A Simple Proof of the Kronecker-Weber Theorem* (Nils Scheithauer)

Mack, Julia Katharina, *Negative Kreise in gerichteten Graphen und konvexe Hüllen* (Michael Joswig)

Manasieva, Evgeniya, *Performance Analyse und Optimierung von Videoload-Bannern* (Michael Kohler)

Miller, Katja, *On the stochastic analysis of Integrate-and-Fire models* (Wilhelm Stannat)

Miteva, Velizara Mitkova, *Pricing of American Options by regression-based Monte Carlo methods using local polynomial kernel estimates* (Michael Kohler)

Nattler, Stefanie, *Zum Gefangenendilemma und dessen Bewältigung* (Werner Krabs)

Neis, Ilona, *Optimierung spaltprofilierter Blechprofile hinsichtlich thermodynamischer Eigenschaften* (Stefan Ulbrich)

Niel, Lisa Jannic, *Finite Elemente Theorie für lineare elliptische partielle Differentialgleichungen* (Christian Meyer)

Nietz, Sandra, *Drei-Personennullsummenspiele* (Werner Krabs)

Opitz, Sebastian, *Vector valued modular forms for the Weil representation* (Jan Hendrik Bruinier)

Petermann-Habich, Tina, *Entfaltung 3-dimensionaler Polytope* (Michael Joswig)

Räsch, Sascha Andreas Boris, *Two-dimensional circulation-preserving fluid simulation with discrete exterior calculus* (Andre Stork)

Rausch, Lea, *Input-Optimierung eines hashbasierten Signaturverfahrens* (Ulf Lorenz)

Reiser, Thomas, *Optimierte Produktionsplanung für einen Stabwerkdemonstrator* (Ulf Lorenz)

Reiß, Kristina, *Congruent Numbers and Elliptic Curves* (Jan Hendrik Bruinier)

Ruhmann, Iris, *Kanonische Darstellungen kohärenter Risikomaße* (Wilhelm Stannat)

Schäfer, Helge, *Bochner-Räume* (Reinhard Farwig)

Schäfer, Sven Oliver, *Minkowskischer Gitterpunktsatz* (Ralf Gramlich)

Schmid, Stefan, *Mordell´s Theorem* (Nils Scheithauer)

Schmitt, David Gleb, *Regressionsschätzung durch lokale Mittelung mit Implementierung in R angewandt in der Finanzmathematik* (Michael Kohler)

Schmitt, Michael Johann, *Anwendungen der Second-Order Cone Programmierung* (Stefan Ulbrich)

Schwagenscheidt, Markus, *Topologische Grundlagen der Distributionentheorie und eine Fundamentallösung der Poisson-Gleichung in* $\mathbb{R}^3$ (Robert Haller-Dintelmann)

Seehaus, Arne, *Revolutionen in der Mathematik: Wissenschaftstheoretische Standpunkte* (Martin Ziegler)

Siebert, Sandra Maria, *Berechenbarkeitstheorie: Church-Turing-Hypothese und Asimovs Robotergesetze* (Martin Ziegler)

Sowadzki, Claudia, *Die Geometrie der Modulgruppe und ihre Präsentierungen* (Ralf Gramlich)

Stahl, Sebastian, *Randomisierte Pivotstrategien auf einfachen Polytopen* (Michael Joswig)

Stinson, Felix, *Robuste Portfoliooptimierung mit Conditional-Value-at-Rok als Risikomaß* (Stefan Ulbrich)

Theuer, Katharina, *Modellierung von Zinskurven im Heath-Jarrow-Morton Modell* (Wilhelm Stannat)

Tropp, Christopher, *H^p-Räume und ihre Dualräume* (Reinhard Farwig)

Utz, Marlene Luka, *Optimierung in einem virtuellen Warmwalzwerk auf der Simulationsplattform TOPSU* (Ulf Lorenz)

Völz, Fabian, *Kernbasierte Gewinnaufteilungen balancierter kooperativer n-Personen Spiele* (Werner Krabs)

Walter, Philipp, *Gemischt-ganzzahlige Optimierung am Beispiel von Losgrößenproblemen* (Marco Lübbecke)

Zettler, Julia, *Der Rieszsche Darstellungssatz* (Reinhard Farwig)

2012

Alex, Jerome, *Mittlere Krümmung von Polyedrischen Flächen* (Karsten Große-Brauckmann)

Bahrampour, Bardiya, *Halbgruppen-Theorie für nichtautonome Cauchy-Probleme* (Matthias Geißert)

Barz, Garret, *Regressionsbasierte Monte-Carlo-Verfahren zur Bewertung amerikanischer Optionen unter Verwendnung des Kernschätzers* (Michael Kohler)

Bazzurro Apolant, Andres, *Method of compensated compactness applied to a one-dimensional nonlinear hyperbolic equation* (Hans-Dieter Alber)

Bergner, Arnold, *Homotopy method for ℓ_1-minimization* (Marc Pfetsch)

Bitterlich, Julian, *Data structures and efficient algorithms for power series in exact real arithmetic* (Martin Ziegler)

Brechtel, Joachim Gerhard, *Universal consistency of the kernel density estimate* (Michael Kohler)

Buck, Johannes Jeremias, *The class number formula for quadratic number fields* (Nils Scheithauer)

Christ, Christina, *Estimation of a Density from Contaminated Data* (Michael Kohler)

Christoffer, Frauke, *Polytope aus Teilgraphen mit Fokus auf serien-parallelen Graphen* (Michael Joswig)

Deiseroth, Björn, *Secure Efficient Operations on Non-Integer Values* (Stefan Katzenbeisser)

Diehl, Jasmin, *Polytope aus Teilgraphen mit Fokus auf vollständig bipartite Graphen* (Michael Joswig)

Dittmann, Moritz Christopher, *An automorphic form of singular weight on $O_{3,2}(\mathbb{R})$* (Nils Scheithauer)

Dück, Viktor, *Der T-Wert eines kooperativen Spiels* (Werner Krabs)

Fath, Anna-Franziska, *Der Satz von Whitney-Graustein* (Karsten Große-Brauckmann)

Fehr, Victoria, *Sophisticated Public-Key Encryption – An elementary introduction to Functional Encryption* (Michael Wüstner)

Fitzke, Michael, *Panjer-Algorithmus und kollektives Risikomodell* (Michael Kohler)

Frenzel, David, *An existence theorem to a phase field model for the evolution of the shape of a solid body* (Hans-Dieter Alber)

Friske, Felix, *Algebraische Gruppen über den p-adischen Zahlen* (Rafael Dahmen)

Fritzsche, Linda, *Empirischer Vergleich von Verfahren nichtparametrischer Regressionsschätzung mit realen Daten (mit Programmierteil)* (Michael Kohler)

Gerny, Friedrich, *Empirischer Vergleich des Smoothing-Spline-Regressionsschätzers und des Partitionenschätzers anhand realer Daten* (Michael Kohler)

Gossmann, Alexej, *On disjunction and numerical existence properties of extensions of Heyting arithmetic* (Ulrich Kohlenbach)

Grabiec, Anna, *Ein Strukturorientierter Vorwärtsmodus des Automatischen Differenzierens und dessen Implementierung im MATLAB* (Stefan Ulbrich)

Grasser, Tim, *Energy-Preserving Integrators for Fluid Animation with Discrete Exterior Calculus on Two-Dimensional Meshes* (Andre Stork)

Hadzhiivanova, Nikoleta, *A pi@-calculus based Semantics for S-BPM Processes* (Max Mühlhäuser)

Hameister, Martin, *Standortoptimierung unter Unsicherheit* (Ulf Lorenz)

Hansmann, Matthias, *Numerische Berechnung von Optionspreisen im Heston Modell* (Wilhelm Stannat)

Hoffmann, Dustin Ralf, *Regression-based Monte Carlo methods for pricing American options based on the partitioning estimate* (Michael Kohler)

Hoffmann, Gerhard, *Implementation of McEliece using quasi-dyadic Goppa codes* (Johannes Buchmann)

Hofmeister, Christina, *Optimale Tests bei monotonen Dichtequotienten* (Michael Kohler)

Isufaj, Fatima, *Das Polyeder der negativen Flüsse* (Michael Joswig)

Jankoski, David, *Graph theoretic approach to network resilience* (Thomas Strufe)

Janocha, Daniel, *Schwache Lösung des allgemeinen Stokes-Problems* (Hans-Dieter Alber)

Kemler, Sandra Karina, *Anwendung des Biting Lemmas auf ein Variationsproblem der nichtlinearen Elastizitätstheorie* (Hans-Dieter Alber)

Knapp, Fabian, *Effiziente Ermittlung der RNA Sekundärstruktur durch lokale Optimierung auf Basis der freien Energie nach Zuker* (Martin Kiehl)

Knobloch, Eduard, *Die Zhang und Donoho Kriterien zur Rekonstruktion via ℓ_1-Minimierung* (Marc Pfetsch)

Köster, Thorben, *Komplexe Dynamische Systeme* (Bálint Farkas)

Kreiß, Alexander, *Existence Theory for one-dimensional Models of Viscoplasticity – Monotone Operators* (Hans-Dieter Alber)

Lenhart, Patric, *Fairness in Cooperative Game Theory* (Werner Krabs)

Lenz, Lukas, *Bewertung Amerikanischer Basket Optionen mit Hilfe von Bäumen* (Michael Kohler)

Lettmann, Michael, *Vorkonditionierung bei der iterativen Lösung linearer Gleichungssysteme* (Alf Gerisch / Jens Lang)

Lukassen, Axel Ariaan, *Stückweise kubische Rekonstruktion und deren Gradient von linearen Finite Element-Approximationen auf einer Triangulierung* (Alf Gerisch / Jens Lang)

Maasz, Manuel, *Optimality of the one-sided Gauß-Test* (Michael Kohler)

Matos Ribeiro, Patrick, *(Semi-) Fredholmoperatoren und das essentielle Spektrum* (Reinhard Farwig)

Mian, Walid Ahmed, *Der Riemannsche Abbildungssatz in mehrfach zusammenhängenden Gebieten* (Reinhard Farwig)

Müller, Sabrina, *Die Bewertung von Zinsderivaten in Short Rate-Modellen* (Wilhelm Stannat)

Münd, Alexander, *Optimale Regularität des Laplace-Operators auf konvexen Gebieten* (Jürgen Saal)

Neumann, Eike Frederic, *Parametrised Complexity of Functionals on Spaces of Real Functions* (Martin Ziegler)

Nockemann, Julian, *Von nicht-kooperativer zu kooperativer Spieltheorie* (Werner Krabs)

Nowak, Daniel, *Integrierte Klassifikation von Hyperebenen und Merkmal-Auswahl* (Marc Pfetsch)

Orlova-Klug, Elena, *Anwendung von Szenarioreduktion auf RQLP´s* (Ulf Lorenz)

Penner, Alexander, *Dualraum des Hardy-Raumes H^1 auf der komplexen Kreisscheibe* (Reinhard Farwig)

Prenzer, Charlotte, *Empirical Comparison of Nonparametric Regression Estimates. The k-NN and the Random Forest Estimator* (Michael Kohler)

Rasheva, Zlatka Ignatova, *Feature Detection within 3D-Face Recontruction* (Ulrich Reif)

Ristl, Konstantin, *Optimierung des Conditional Value-at-Risk von Portfolios mit diskreten Gewichten* (Stefan Ulbrich)

Ritter, Christian Peter, *Regressionsbasierte Monte-Carlo-Verfahren zur Bewertung amerikanischer Optionen unter Verwendung von neuronalen Netzen* (Michael Kohler)

Rothenbächer, Ann-Kathrin, *Verfahren der nichtparametrischen Regressionsschätzung und beispielhafte Anwendung zur Bewertung amerikanischer Optionen* (Michael Kohler)

Salupo, Giuseppe, *Robuste Portfolio-Optimierung mit Conditional Value-at-Risk als Risikomaß* (Stefan Ulbrich)

Schaffland, Tim Fabian, *Empirischer Vergleich von Verfahren der nichtparametrischen Regressionsschätzung* (Michael Kohler)

Schimmel, Janina, *Universal Consistency of the Kernel Density Estimate* (Michael Kohler)

Schmid, Christina, *Regression-based Monte Carlo Estimates for Pricing American Options using the Kernel Estimates* (Michael Kohler)

Schmidt, Robin, *Complex Interpolation, L^p-Spaces and the Fourier Transform* (Robert Haller-Dintelmann)

Schmidt, Roman, *Universelle Konsistenz des Kernschätzers* (Michael Kohler)

Schulz, Olga, *Dichteschätzung basierend auf realen und künstlich erzeugten Daten* (Michael Kohler)

Schwebel, Miriam, *Modellierung coexistierender Symbionten und Parasiten* (Biologie)

Starik, Sebastian, *Der empirische Vergleich des Tests von Kolmogoroff-Smirnow und des χ^2-Anpassungstests* (Michael Kohler)

Tilev, Ivelin Yanchev, *Pricing of American Options by Regression-based Monte Carlo Methods with multivariate smoothing splines* (Michael Kohler)

Tolksdorf, Patrick, *Riesz-Spectral Theory for the Flexible Beam Equation* (Robert Haller-Dintelmann)

Warta, Simon, *Deriving Signature Schemes from Public-Key Cryptosystems* (Johannes Buchmann)

Weber, Tobias, *On the Model Theory of the Unary Negation Fragment on Finite Graphs* (Martin Otto)

Wegmann, David, *L^p-Theorie starker Lösungen elliptischer partieller Differentialgleichungen zweiter Ordnung* (Reinhard Farwig)

Wenz, Sebastian Claus, *Theorem of Pollard* (Michael Kohler)

Weyer, Jonas Helmut, *Ein neues Relaxationsschema zur numerischen Lösung von MPECs* (Stefan Ulbrich)

Will, Karsten, *Implementierung und Test von Multirate-Rosenbrock-Verfahren* (Alf Gerisch / Jens Lang)

Wu, Jiqing, *The Existence of a Weak Solution for a Stationary Phase Field Problem* (Hans-Dieter Alber)

Zhou, Li, *Portfoliooptimierung im CRR-Modell* (Wilhelm Stannat)

Zhu, Liqun, *Bewertung amerikanischer Optionen mit der Finite-Elemente-Methode* (Wilhelm Stannat)

5 Presentations

5.1 Talks and Visits

5.1.1 Invited Talks and Addresses

Hans-Dieter Alber

04.05.11 *Der Grenzübergang vom Phasenfeldmodell zum Modell mit scharfer Phasengrenze - Wie kann man Phasenübergänge effektiv simulieren?*
Kolloquium, Universität Duisburg-Essen

09.07.12 *A phase field model with hyperbolic and parabolic properties - asymptotics and numerical efficiency*
Calculus of variations and partial differential equations, Szczawnica

21.08.12 *Basing the plasticity equations on dislocation dynamics - a mathematical theory*
Spectral theory and differential equations, V.N. Karazin Kharkiv National University

10.12.12 *Phase field models for three phase materials and propagation speed of interfaces*
Analysis and applications of pdes: an 80th birthday meeting for Robin Knops, International centre for Mathematical Sciences, Edinburgh

Tristan Alex

22.06.12 *Halbraumsätze im Heisenbergraum*
35. Süddeutsches Kolloquium über Differentialgeometrie 2012, Mainz

Claudia Alfes

09.01.12 *Towards an algebraic formula for the coefficients of half-integral weight harmonic Maass forms*
Number Theory Seminar, University College Dublin

31.01.12 *Appell-Lerch sums, the Mordell integral and W-superalgebras extending* gl(1|1)
Oberseminar Zahlentheorie, Universität Köln

Maksym Berezhnyi

23.08.12 *Asymmetric Hydrodynamics of Suspensions*
Marchenko Conference, V.N. Karazin Kharkiv National University

Volker Betz

03.02.11 *Effective density of states of a quantum oscillator coupled to a radiation field*
Workshop of the GDR Quantum Dynamics, Orleans

March 2011 *Minicourse: spatial random permutations*
On the invitation of Erwin Bolthausen, Universität Zürich

29.06.11 *Superadiabatic transitions in quantum molecular dynamics*
Workshop on Mathematical Challenges in Quantum Chemistry, Oberwolfach

03.11.11 *Spatial random permutations and Bose-Einstein condensation*
Workshop on Stochastic Dynamics in Mathematics, Physics and Engineering, Universität Bielefeld

23.07.12 *Effective density of states of a quantum oscillator coupled to a radiation field*
Seminar on mathematical physics, Universität Heidelberg

04.09.12 *Spatial random permutations and Bose-Einstein condensation*
Workshop on Stochastic and Analytic Methods in Mathematical Physics, Yerevan State University

03.10.12 *Effective density of states of a quantum oscillator coupled to a radiation field*
Workshop on Recent developments in the mathematical analysis of large systems, Universität Wien

Dieter Bothe

17.03.11 *Mathematical modeling of reactive multicomponent fluid systems*
Séminar d´Analyse Numerique, University of Rennes

18.07.11 *Transport Processes at Fluidic Interfaces: Sharp Interface Modeling and VOF-Simulation*
Heat Transfer Seminar, Université Libre Brussels

05.10.11 *Mathematical Modeling and Direct Numerical Simulation of Transport Processes at Fluidic Interfaces*
1st International Symposium on Multiscale Multiphase Process Engineerings, Kanazawa

22.11.11 *Continuum thermodynamics of chemically reacting fluid mixtures and the Maxwell-Stefan equations of multicomponent mass transport*
Universität Halle-Wittenberg

24.05.12 *Mathematical Modeling and Direct Numerical Simulation of Transport Processes at Fludic Interfaces*
5th International Workshop on Bubble and Droplet Interfaces, Krakow

13.06.12 *Continuum-thermodynamics of chemically reacting multicomponent fluid systems*
12th International Conference on Free Boundary Problems, Frauenchiemsee

15.06.12 *Modeling and Simulation of Thermocapillary Evaporative Flows*
12th International Conference on Free Boundary Problems, Frauenchiemsee

Regina Bruder

20.01.11 *Ein Unterrichtskonzept zu einem binnendifferenzierenden Mathematikunterricht mit ersten Erprobungsergebnissen aus dem Projekt MABIKOM*
Vortrag im Rahmen des Kolloquiums zur Mathematik und ihrer Didaktik, Koblenz

24.01.11 *Gestaltungselemente zur Binnendifferenzierung im Mathematikunterricht mit den Fachberatern Mathematik (H/R)*
Workshop, Frankfurt

25.01.11 *Risiken und Nebenwirkungen beim Technologieeinsatz im Mathematikunterricht – Konzept und Ergebnisse des CAS-Projektes CAliMERO in Niedersachsen*
Didaktisches Kolloquium der TU Braunschweig

05.02.11 *Förderung leistungsstarker Schüler/innen im Mathematikunterricht*
Workshop auf der Fachtagung "Potenziale erkennen – Persönlichkeiten stärken", Brühl

09.02.11 *Hausaufgaben*
Workshop, Saarbrücken-Dudweiler

11.02.11 *Wie kann man Mathematik nachhaltig lernen?*
70. Ernst-Schröder Kolloquium, Darmstadt

22.02.11 *Ein Unterrichtskonzept zur individuellen Förderung von Problemlösekompetenz*
Lehrertag der GDM-Jahrestagung, Freiburg

03.03.11 *Langfristig und nachhaltig Kompetenzen entwickeln in heterogenen Lerngruppen - aber wie?*
Hauptvortrag zu den 16. Tagen des mathematischen und naturwissenschaftlichen Unterrichts, Erfurt

26.03.11 *Problemlösen lernen - aber wie?*
Tag der Mathematik, Heilbronn

08.04.11 *Binnendifferenzierender Mathematikunterricht auch mit Technologieeinsatz – Erkenntnisse aus dem Niedersächsischen Modellversuch MABIKOM*
MNU-Tagung, Mainz

09.05.11 *Problemlösen kann man im Mathematikunterricht lernen - aber wie?*
Fachdidaktisches Kolloquium der Fakultät für Mathematik, Universität Wien

25.05.11 *Binnendifferenzierung im Mathematikunterricht*
Fortbildungsveranstaltung “Mathe anders machen”, Gütersloh

15.06011 *Gestaltungselemente zur Binnendifferenzierung im Mathematikunterricht*
Multiplikatorenfortbildung, Kiel

21.06.11 *Binnendifferenzierende Elemente in einem kompetenzorientierten Unterricht – Konzept und erste Ergebnisse aus dem Projekt MABIKOM*
Didaktisches Kolloquium, Universität Bremen

30.06.11 *Computeralgebrasystemen im Mathematikunterricht der gymnasialen Oberstufe*
Landesfortbildungstagung, Ludwigsfelde-Struveshof, LISUM

13.09.11 *Methodisch-Didaktische Aspekte für spielerisches Lernen*
Game Days, Darmstadt

14.09.11 *Langfristiger Kompetenzaufbau in heterogenen Lerngruppen*
Hauptvortrag auf der MNU-Tagung, Hannover

21.09.11 *Ein Unterrichtskonzept zur Binnendifferenzierung im Mathematikunterricht*
Lehrerfortbildungsveranstaltung im Rahmen von "“Mathematik anders machen"” der Deutsche Telekom Stiftung, Löhne

26.09.11 *Individueller Kompetenzaufbau in heterogenen Lerngruppen - ein Unterrichtskonzept*
Fachdidaktiktag, Graz

26.09.11 *Kompetenzentwicklungsmodelle - Wege zu einem langfristigen Kompetenzaufbau*
Fachdidaktiktag, Graz

27.09.11 *Kompetenzerwerb beim Problemlösen im Mathematikunterricht*
Vortrag auf der MNU-Tagung, Dortmund

28.10.11 *Konstruktiver Umgang mit Heterogenität: Aufgabenvielfalt für unterschiedliche Lernstile*
Kiel

14.11.11 *Langfristiger Kompetenzaufbau im mathematischen Argumentieren in den Sekundarstufen - ganz konkret*
4. Regionalkonferenz "Mathematik kann jeder", Fulda

09.01.12 *Modelle und Methoden für einen langfristigen und nachhaltigen Kompetenzaufbau im Mathematikunterricht*
Kolloquium am Fachbereich Mathematik, Universität Kassel

16.01.12 *Kompetenzmodellierung im Bereich Wechsel von Darstellungsformen funktionaler Zusammenhänge - Methoden und Ergebnisse des Projektes HEUREKO*
Didaktisches Kolloquium, Universität Landa

06.03.12 *Konsequenzen aus den Kompetenzen?*
Jahrestagung der GDM, Weingarten

07.05.12 *Vorstellung der AG Fachdidaktik*
Sitzung des Zentrums für Lehrerbildung, TU Darmstadt

14.05.12 *Mathematisches Problemlösen kann man lernen - Forschungsstationen auf dem Weg zu einem Unterrichtskonzept*
Didaktisches Kolloquium, Universität Paderborn

29.05.12 *Mathematische Kompetenzen entwickeln in heterogenen Lerngruppen*
Vorträge zur Lehrerfortbildung, Darmstadt

30.05.12 *Mathematische Kompetenzen entwickeln in heterogenen Lerngruppen*
Vorträge zur Lehrerfortbildung, Mathematikum, Giessen

31.05.12 *Stand und den Perspektiven der Fachdidaktik*
Workshop "Fachdidaktische Studien", Forschungs- und Studienzentrum für Pädagogik, Basel

01.06.12 *Den individuellen Lernmöglichkeiten und -bedürfnissen im Mathematikunterricht besser gerecht werden - mit CAS*
Regionaltagung t^3, Hamburg

21.06.12 *Was ist aus MABIKOM übertragbar? Elemente eines Unterrichtskonzeptes zur Binnendifferenzierung in der SII/FOS*
Informationsveranstaltung zum Transferprozess des Modellprojektes MABIKOM in die SII

11.07.12 *Eight target structure types of tasks as background for learning sourroundings*
ICME12, Seoul

20.09.12 *Serious games im Mathematikunterricht*
Game Days, Darmstadt

08.10.12 *Kompetenzentwicklungsmodelle - Wege zu einem langfristigen Kompetenzaufbau im Mathematikunterricht*
Vortrag zu den Wiener Bildungsgesprächen im Stadtschulamt, Wien

09.10.12 *Wege zu einem langfristigen Kompetenzaufbau im Mathematikunterricht*
Mathematiktag für Hauptschule, Wien

10.11.12 *Argumentieren lernen im Mathematikunterricht*
Hauptvortrag auf der 9. Niedersächsischen t^3-Regionaltagung,

Jan H. Bruinier

17.03.11 *Harmonic Maass forms and periods*
Conference *Modular Forms and Mock Modular Forms and their Applications in Arithmetic, Geometry and Physics*, ICTP Trieste, 14.3.11–18.03.11

26.04.11 *Harmonic Maass forms and periods*
Number Theory Seminar, Universität Köln

07.06.11 *Die Arithmetik von Partitionen*
Mathematisches Kolloquium, Universität Hamburg

21.06.11 *Harmonic Maass forms and periods*
Tagung *Algebraische Zahlentheorie*, Mathematisches Forschungsinstitut, Oberwolfach, 20.06.11–24.06.11

06.07.11 *Die Arithmetik von Partitionen*
Mathematisches Kolloquium, TU Darmstadt

05.09.11 *Harmonic Maass forms and periods*
Conference *Computations with Modular Forms*, Universität Heidelberg, 03.09.11–07.09.11

21.09.11 *On the converse theorem for Borcherds products*
Conference *Conformal Field Theory, Automorphic Forms and Related Topics*, Universität Heidelberg, 19.09.11–23.09.11

28.09.11 *On the converse theorem for Borcherds products*
Workshop *Lattices, codes and modular forms*, RWTH Aachen

02.11.11 *On the converse theorem for Borcherds products*
Workshop *Cycles on modular varieties*, Banff International Research Station, Canada

10.11.11 *Die Gross–Zagier-Formel und Borcherds-Produkte*
Mathematisches Kolloquium, Universität Göttingen

29.02.12 *Regularized theta lifts over totally real fields*
Symposium *Modular Forms, Mock Theta Functions, and Applications*, Universität Köln, 27.02.12–01.03.12

02.05.12 *On the converse theorem for Borcherds products*
Seminar on Number Theory and Physics, Max-Planck-Institute for Mathematics, Bonn

01.08.12 *Borcherds products and applications*
Summer school on *Automorphic Forms and related topics*, RWTH Aachen, 30.07.12–04.08.12

23.11.12 *Erzeugende Reihen und Schnittpaarungen von arithmetischen Divisoren*
Hauptseminar Algebra und Zahlentheorie, Universität Heidelberg

20.12.12 *Arithmetic theta lifts of harmonic Maass forms*
Conference *The Legacy of Srinivasa Ramanujan*, University of Delhi, 17.12.12–22.12.12

Sarah Drewes

07.04.11 *Exploiting structure in outer approximation based approaches for SOCP*
Algebra and Discrete Mathematics Seminar, University of California, Davis

14.04.11 *Methods to solve Mixed Integer Second Order Cone Programming Problems*
Industrial Engineering and Operations Research Seminar, University of California, Berkeley

17.05.11 *Maximizing expected utility in the presence of discrete decisions*
SIAM Conference on Optimization 2011, Darmstadt

20.06.11 *Cover Inequalities for Mixed-01 Nonlinear Programming*
Mixed Integer Programming Workshop 2011, Waterloo

Moritz Egert

03.10.12 *Square Roots of Elliptic Systems*
Louisiana State University

Herbert Egger

10.10.12 *Analysis and Numerical Methods for Fluorescence Diffuse Optical Tomography*
Oberseminar Angewandte Mathematik, Universität Münster

24.10.12 *Numerical Realization of Tikhonov Regularization*
Workshop on Computational Inverse Problems, Oberwolfach

Stephan Ehlen

25.03.11 *Twisted traces of CM values of modular functions*
25th Automorphic Forms Workshop, Oregon State University, Corvallis, 23.-26.03.2011

12.05.11 *Twisted traces of CM values of modular functions*
Explicit theory of automorphic forms, applications and computations, CIRM, Luminy, 09.-13.05.2013

25.05.11 *Twisted traces of CM values of modular functions*
Hauptseminar Modulformen, Universität Heidelberg

17.01.12 *Twisted theta liftings for orthogonal groups and applications*
Oberseminar Zahlentheorie, Universität Köln

27.04.12 *CM values of Borcherds products and harmonic weak Maass forms of weight one*
26th Automorphic Forms Workshop, Vancouver, 26.-29.04.2012

02.08.12 *Borcherds products and applications*
Summer school on Automorphic Forms and related topics, RWTH Aachen, 30.07.-04.08.2012

08.08.12 *CM values of Borcherds products and harmonic weak Maass forms of weight one*
Conference on Automorphic Forms and related topics, RWTH Aachen, 06.08.-10.08.2012

20.12.12 *Simple lattices of signature (2,n)*
Number Theory Afternoon, Universität Siegen

Reinhard Farwig

01.03.11 *Are Weak Solutions of the Navier-Stokes Equations Regular?*
German-Japanese International Workshop, TU Darmstadt

14.06.11 *On the Energy Equality of the Navier-Stokes Equations in Unbounded Domains*
Workshop on the Navier-Stokes Equations, RWTH Aachen

28.11.11 *Weak solutions of the nonstationary Navier-Stokes equations and their regularity*
4th Japanese-German International Workshop on Mathematical Fluid Dynamics, Waseda University Tokyo

02.07.12 *On the energy equality of the Navier-Stokes Equations*
6th European Congress of Mathematics, Krakow

02.09.12 *Concentration-Diffusion Phenomena for the Boussinesq System*
Parabolic and Navier-Stokes Equations Conference 2012, Banach Center Bedlewo

05.11.12 *Concentration-Diffusion Phenomena for the Boussinesq System*
7th Japanese-German International Workshop on Mathematical Fluid Dynamics, Waseda University Tokyo

05.11.12 *How Fast Do Solutions to the Boussinesq System in $\mathbb{R}^n$ Decay?*
Tokyo Institute of Technology

Walter Freyn

24.03.11 *Kac-Moody geometry*
New York Algebra Colloquium, New York

28.03.11 *Kac-Moody geometry*
Geometry-Topology seminar, University of Maryland, College Park

05.04.11 *From permutations to Kac-Moody geometry*
Colloquium of the department of mathematics, Oregon State University, Corvallis

16.05.11 *Kac-Moody geometry*
Annual meeting of the Israel mathematical Society, Bar Ilan

22.05.11 *Kac-Moody geometry: From symmetries to geometry*
Seminar of the Emmy Noether Institut, Bar Ilan

08.08.11 *Affine Kac-Moody symmetric spaces*
Encontro Paulista de Geometria, Sao Paulo

19.08.11 *Twin cities*
Seminario de Geometria, Sao Paulo

26.08.11 *Kac-Moody symmetric spaces*
Symposium on Symmetric Spaces, Augsburg

05.09.11 *Kac-Moody geometry*
DFG-JSPS Seminar "Lie Groups: Geometry and Analysis", Paderborn

27.09.11 *Twin cities*
Johns Hopkins University Baltimore

12.10.11 *Kac-Moody symmetric spaces*
Colloquium of the Hausdorff-Institut, Bonn

14.12.11 *From $SL(2)$ and hyperbolic space to hyperbolic Kac-Moody algebras and their buildings*
Seminar für Algebra, Universität Giessen

02.03.12 *Affine Kac-Moody symmetric spaces*
Max-Planck Institut for Gravitation, Potsdam

09.04.12 *Towards hyperbolic Kac-Moody geometry*
Oberwolfach Research Institut, Oberwolfach

13.04.12 *Affine Kac-Moody symmetric spaces*
Oberwolfach Research Institut, Oberwolfach

27.04.12 *Affine Kac-Moody symmetric spaces*
UCL Louvain

03.05.12 *From SL(2) and hyperbolic space to hyperbolic Kac-Moody algebras and their buildings*
University of Pittsburgh

18.09.12 *Combinatorial geometry of Chevalley groups*
Johns Hopkins University Baltimore

20.09.12 *Combinatorial geometry of Chevalley groups*
Rutgers University, New Brunswick

Andreas Gärtner

26.01.11 *Idempotent Markov operators*
WIMCS Stochastic Cluster Meeting: Trends in Quantum Probability and Stochastics, Aberystwyth (Wales)

06.09.12 *Recurrence, Transience and Noncommutative Poisson Integrals*
2012 LMS Midlands Regional Meeting & Workshop on Quantum Probabilistic Symmetries, Aberystwyth (Wales)

Matthias Geissert

11.06.12 *Analytical Aspects of Complex Fluids*
The 5th Japanese-German International Workshop on Fluid Dynamics, Tokyo

Alf Gerisch

05.04.11 *Fast evaluation of integral terms in a nonlocal PDE model of cellular adhesion*
Spring School on Evolution Equations, Universität Konstanz

13.11.12 *Mathematical modelling and numerical simulation of mechanical properties of muskuloskeletal mineralized tissues*
Conference and Workshop on Modelling and Computation in Musculoskeletal Engineering (MCME), Brisbane

Jane Ghiglieri

04.07.11 *Optimale Strömungskontrolle mit Plasmaaktuatoren*
Oberseminar Numerische Mathematik, Optimierung und Dynamische Systeme, Universität Bayreuth

13.04.12 *Optimale Strömungskontrolle basierend auf MPC und POD zur Auslöschung von Tollmien-Schlichting Wellen mit Plasma Aktuatoren*
Institut für Strömungsmechanik, TU Dresden

Vassilios Gregoriades

01.07.11 *Applications of Logic to Analysis*
Joint Mathematics Meetings, New Orleans

08.12.11 *The descriptive set theoretic complexity of the set of points of continuity of a multivalued function*
Oberseminar Fachbereich Mathematik und Informatik, Universität Münster

Roland Gunesch

17.06.11 *Binäre Teilungen und die Antwort auf alle Fragen*
PriMa-Projekt / Talentförderung Mathematik Hamburg, Universität Hamburg

26.10.11 *Chaos, Entropie und die Lösung aller Probleme*
Kolloquium Mathematik und ihre Didaktik, Universität Koblenz-Landau

10.03.12 *Chaos, Entropie und die Lösung aller Probleme*
Tag der Mathematik, Universität Koblenz-Landau

02.07.12 *Ergodic theory and topological intersections as a tool to solve geometrical problems (invited talk at special session on 'Topological and Combinatorial Dynamics')*
AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando

Karsten Grosse-Brauckmann

06.04.11 *Two Examples of Minimal Surfaces and their Relatives*
Surface Theory in 3-manifolds, Sevilla

04.10.11 *Mathematics of Minimal Surfaces*
Geometry of Interfaces, Primosten

12.03.12 *Dreifach periodische Minimalflächen*
AG-Workshop, Weinheim

Kai Habermehl

23.08.12 *Robust design of active trusses via mixed integer nonlinear semidefinite programming*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Robert Haller-Dintelmann

14.12.11 *Hardy's inequality for mixed boundary conditions*
Berliner Oberseminar "Nichtlineare partielle Differentialgleichungen" (Langenbach-Seminar), Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin

Katrin Herr

28.10.11 *Core sets and symmetric fibrations*
Workshop on Polyhedra, Symmetry, and Optimization, Universität Rostock

Matthias Hieber

17.02.11 *Viscoelastic flows past rotating bodies*
Fluidmechanic Seminar, University of Pittsburgh

14.04.11 *Presentation IRTG 1529*
DFG-JSPS Workshop, Waseda University, Tokyo

13.05.11 *Aspects of maximal regularity for evolution equations*
PDE Seminar, UC Santa Barbara

26.05.11 *Global existence for Oldroyd-B fluids in exterior domains*
International Conference Fluid Mechanics, Luminy, Marseille

30.08.11 *Stability of Ekman layers*
Special Program on Inverse Problems, Newton Institute Cambridge

25.09.11 *Two-phase free boundary value problems*
International Conference on Gas Dynamics, Jinhua

30.09.11 *Complex Fluids*
PDE Seminar, Zhejiang University, Hangzhou

12.10.11 *Deterministic and stochastic stability of Ekman layers*
International Conference on Evolution Equations, Bad Herrenalp

14.11.11 *Free boundary value problems for fluids*
SIAM Conference on PDE, San Diego

01.12.11 *Existence results for viscoelastic fluids*
IRTG-Workshop, Waseda University, Tokyo

15.12.11 *Funktionalkalküle und ihre Anwendungen*
Kolloquium, Universität Regensburg

19.03.12 *Analytical aspects of geophysical flows, part I-IV*
Springschool Evolution Equations, Universität Bielefeld

27.03.12 *Presentation IRTG 1529*
GAMM 2012, Darmstadt

03.07.12 *Navier-Stokes equations with linearly growing data*
PDE-Seminar, Lecce

07.08.12 *Hyperbolic-Parabolic systems in fluid dynamics*
International Conference on Fluids and Waves, Waseda University, Tokyo

15.08.12 *Weak Neumann implies Stokes*
Workshop Hydromechanics, Oberwolfach

26.10.12 *On Hyperbolic-Parabolic Systems*
Seminar, WIAS Berlin

09.11.12 *The equations of Navier-Stokes in the rotational framework*
IRTG-Workshop, Waseda University, Tokyo

20.11.12 *Quasilinear parabolic evolution equations, part I-IV*
Lecture Series, Polish Academy of Sciences, Warsaw

Karl Heinrich Hofmann

12.04.11 *On certain subgroups of compact groups*
Colloquium, Dalhousie University in Halifax

03.05.11 *The cardinality of closed subgroups of compact groups*
Colloquium, University of Palermo,

04.12.12 *Der Mathematiker W.A.F. Ruppert*
Festkolloquium, Universität für Bodenkultur, Wien

Silke Horn

16.05.12 *Topological Representations of Tropical Oriented Matroids*
Combinatorics Seminar, Aalto University, Finland

06.06.12 *A Topological Representation Theorem for Tropical Oriented Matroids*
Combinatorics Seminar, Universität Bremen

17.09.12 *Tropical Oriented Matroids*
Annual Meeting of the DMV, Universität des Saarlandes, Saarbrücken

Imke Joormann

05.03.12 *Analyzing conflicts in natural gas networks*
International Conference on High Performance Scientific Computing 2012, Hanoi, Vietnam

22.08.12 *Analyzing infeasibilities in natural gas networks*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Michael Joswig

08.02.11 *Computing bounded subcomplexes of unbounded polyhedra*
Workshop: Topological and Geometric Combinatorics, Oberwolfach

08.04.11 *Tropical hyperplane arrangements and associated monomial ideals*
Kolloquium, Universität Osnabrück

28.06.11 *Dressians and their rays*
Conference on "Tropical Geometry", University of Birmingham, England

02.09.11 *Highly symmetric integer linear programs*
University of California, Davis, USA

14.09.11 *Splitting polytopes*
San Francisco State University, USA

06.10.11 *Splitting polytopes*
University of California, Los Angeles, USA

24.10.11 *Totally splittable polytopes*
ERC Workshop, FU Berlin

14.12.11 *Dressians, tropical Grassmannians, and their rays*
CIEM, Castro Urdiales, Spain

02.04.12 *Tropical convexity and type ideals*
ICMS Edinburgh, Scotland

30.04.12 *Triangulations of products of simplices with a view towards tropical geometry*
Workshop: Triangulations, Oberwolfach

19.06.12 *An introduction to `polymake` 2.12*
Minisymposium on Publicly Available Geometric/Topological Software, University of North Carolina, Chapel Hill, USA

20.11.12 *Lattice polygons and real roots*
University of Queensland, Brisbane, Australia

30.11.12 *Tropical combinatorics*
University of Sydney, Australia

13.12.12 *`polymake` for high-dimensional computational geometry*
CGL Review Meeting, Berlin

Klaus Keimel

21.06.11 *Lokal konvexe Kegel und ein Satz von Schröder und Simpson*
Universität Siegen

11.10.11 *Betting, imprecise probabilities and Łukasiewicz logic*
Mal'tsev Meeting, Sobolev Institute, Novosibirsk, Russia

3.–14.12.11 *Domain theory and its applications in semantics*
Series of ten lectures, Al-Farabi Kazakh National University, Almaty, Kazakstan

05.10.12 *Begegnungen mit Karl Heinrich Hofmann und seiner Mathematik*
Festkolloqium anläßlich des 80. Geburtstages von Karl Heinrich Hofmann, TU Darmstadt

Martin Kiehl

26.02.2011 *Die Mathematik im Puzzlestein – Warum Mathematiker ein Leben lang spielen?*
Mathematikolympiade Hessen, Darmstadt

26.03.2011 *Die Mathematik im Puzzlestein – Warum Mathematiker ein Leben lang spielen?*
Tag der Mathematik, Reinheim

25.02.2012 *Gier – Manchmal ein Weg zum Erfolg*
Mathematikolympiade Hessen, Darmstadt

10.03.2012 *Gier – Manchmal ein Weg zum Erfolg*
Tag der Mathematik, Reinheim

Matthias Köhne

08.05.12 *On Incompressible Newtonian Flows – Artificial Boundary Conditions and Free Boundary Problems*
Seminar Thermodynamische Modellierung und Analyse von Phasenübergängen, WIAS Berlin

29.06.12 *On Incompressible Newtonian Flows – Artificial Boundary Conditions and Associated Semigroups, Free Boundaries and Qualitative Behaviour*
Oberseminar Analysis, Universität Regensburg

18.09.12 *On Incompressible Newtonian Flows in Domains with Artificial Boundaries*
Minisymposium Complex Fluids, DMV-Jahrestagung, Universität Saarbrücken

Ulrich Kohlenbach

07.01.11 *Uniform Bounds from Proofs in Nonlinear Ergodic and Fixed Point Theory (invited talk at special session on 'Logic and Analysis')*
Joint Mathematics Meeting, New Orleans

01.04.11 *Proof Interpretations and Their Use in Nonlinear Analysis*
Logic Seminar, Bucharest

06.04.11 *Applied Proof Theory*
Colloquium Lecture, Romanian Academy, Bucharest

28.04.11 *Proof Interpretations and Their Application to Current Mathematics*
Conference honoring the Winners of the Kurt Gödel Research Prize Fellowships 2008 and 2011, Wien

18.05.11 *Proof Interpretations and Their Use in Nonlinear Analysis and Ergodic Theory*
Logic Seminar Talk, Freiburg

25.05.11 *Functional Interpretation of Proofs in Ergodic Theory and Combinatorics*
Ramsey Theory in Logic, Combinatorics and Complexity 'RaTLoCC 2011', Bertinoro

23.06.11 *Logical Extraction of Effective Bounds from Proofs in Nonlinear Ergodic Theory*
Logic Seminar Talk, Carnegie Mellon University, Pittsburgh

29.06.11 *Logical Extraction of Effective Bounds from Proofs in Nonlinear Ergodic Theory*
Talk at Logic and Computation Seminar, University of Pennsylvania, Philadelphia

05.07.11 *Logical Extraction of Effective Bounds from Proofs in Nonlinear Ergodic Theory*
Talk at New York Logic Colloquium and Computational Logic Seminar, Graduate Center of CUNY, New York

21.02.12 *Logical Extraction of Effective Bounds from Proofs in Nonlinear Ergodic Theory*
Workshop on Proof Theory and Computability Theory 2012, Tokyo

08.06.12 *Recent Developments in Proof Mining: Bounds from Proofs in Nonlinear Ergodic Theory*
15th Latin American Symposium on Mathematical Logic, Bogota

11.07.12 *Logical Extraction of Effective Bounds from Proofs in Nonlinear Ergodic Theory*
10th International Conference of Fixed Point Theory and its Applications, Cluj-Napoca

26.08.12 *Proof Mining*
5 hours course at MALOA Training Workshop, Oxford

11.10.12 *A Logic-Based Approach to Fixed Point Theory: Effective Uniform Rates of Convergence in Fixed Point and Ergodic Theory*
International Workshop on Fixed Point Theory and Applications, Istanbul

Michael Kohler

16.09.11 *On nonparametric regression with random design*
Workshop on Probability Estimation in Prognostics, Zürich

16.01.12 *Nichtparametrische Regression und ihre Anwendungen*
Universität Ulm

17.01.12 *Nichtparametrische Regression und ihre Anwendungen*
Universität Stuttgart

20.11.12 *Statistische Methoden bei der Bewertung der Betriebsfestigkeit verzweigter Blechstrukturen*
TU Dortmund

Oliver Kolb

06.09.12 *Combination of Linear and Nonlinear Programming Techniques for the Solution of Mixed Integer Optimization Problems in Water Supply Networks*
Conference on Modelling, Simulation and Optimization in Applications, Darmstadt

Rolf Sören Kraußhar

08.04.11 *Hypercomplex-analytic automorphic forms and boundary value problems on some Riemannian manifolds*
Festkolloquium, TU Graz

06.07.11 *Hyperkomplex-analytische Spitzenformen*
Universität Heidelberg

20.07.11 *Several classes of hypercomplex-analytic automorphic forms*
ICCA 9 Weimar

25.11.11 *Explicit solutions for some boundary value problems on classes of conformally flat manifolds*
Universität Marburg

02.07.12 *Hyperkomplexe Modulformen*
Universität Würzburg

03.07.12 *Some harmonic analysis on the Möbius strip and the Klein bottle in R^n*
IKM 2012 Weimar

19.07.12 *Hyperkomplexe Modulformen*
Universität Erfurt

Burkhard Kümmerer

18.01.11 *Mathematik zwischen Anschauung und Sprache*
Seminar für Mathematik und ihre Didaktik, Universität Köln

28.06.11 *Mathematik zwischen Anschauung und Sprache*
Mathematisches Kolloquium (Didaktik), RWTH Aachen

11.07.11 *Exaktes "Sampling" ohne "Sample": Ein Propp-Wilson Algorithmus für quantenmechanische Gleichgewichtszustände*
Kolloquium Mathematische Physik, Bielefelder Graduiertenschule in den Theoretischen Wissenschaften, Universität Bielefeld

25.06.12 *Mathematik findet im Kopf statt*
Kolloquium Didaktik der Mathematik, Universität Duisburg-Essen

06.09.12 *A Propp-Wilson algorithm for quantum equilibrium states*
2012 LMS Midlands Regional Meeting & Workshop on Quantum Probabilistic Symmetries, Aberystwyth, Wales

Jens Lang

15.01.11 *W-Methods for Optimal Control*
Jan Verwer's 65th Birthday - Farewell Conference, CWI Amsterdam

28.01.11 *Model Reduction in Unsteady Transport Systems*
Workshop on Model Order Reduction, WIAS Berlin

08.11.11 *Linearly Implicit Methods for Optimal Control Problems*
Mathematical Seminar, Geneva

01.04.12 *Linearly Implicit Time Integrators for Optimal Control Problems*
AMS Meeting, Lawrence

26.04.12 *Adaptive Time Integrators in Computational Fluid Dynamics*
Workshop on Adaptive Methods with Applications in Fluid Dynamics, WIAS Berlin

07.05.12 *Model Reduction in Unsteady Transport Systems*
Mathematical Seminar, Geosciences Department, Frankfurt

21.05.12 *Adaptive Multilevel Methods for Large-Scale Optimal Control Problems*
Mathematical Seminar, Leuven

10.07.12 *Adaptive Moving Meshes in Large Eddy Simulation for Turbulent Flows*
World Congress of Computational Mechanics, Special Session in Honor of J. Tinsley Oden's 75th Birthday, Sao Paulo

10.08.12 *Surrogate Modelling in Unsteady Transport Systems*
Workshop on Surrogate Modelling and Space Mapping for Engineering Optimization, Reykjavik

Davorin Lešnik

17.06.12 *Topologies in functional analysis, synthetically*
Fourth Workshop on Formal Topology, Ljubljana

Andrew Linshaw

04.03.11 *Invariant subalgebras of vertex algebras*
Infinite-dimensional algebra seminar, MIT, Boston

11.03.11 *Introduction to vertex algebras and some connections with classical invariant theory*
Graduate Colloquium, University of Denver

01.06.11 *Introduction to $\mathcal{W}$-algebras*
Max Planck Institute for Gravitational Physics, Potsdam

24.06.11 *Invariant subalgebras of affine vertex algebras*
Lie Theory and its Applications in Physics, Bulgarian Academy of Sciences, INRNE, Varna

07.02.12 *Jet schemes and invariant theory*
Algebra Seminar, SUNY Binghamton

09.03.12 *Jet schemes and invariant theory*
Infinite-Dimensional Algebra Seminar, MIT, Boston

16.03.12 *Invariant subalgebras of affine vertex algebras*
Algebra and Combinatorics Seminar, North Carolina State University

22.08.12 *Invariant subalgebras of vertex algebras*
Infinite Dimensional Lie Theory: algebra, geometry, and combinatorics, CRM, Montreal

20.09.12 *Invariant subalgebras of vertex algebras*
Algebra and Topology Seminar, University of Albany

19.10.12 *Invariant subalgebras of vertex algebras*
Colloquium, College of Charleston

20.11.12 *Chiral equivariant cohomology*
Algebra Seminar, SUNY Binghamton

22.11.12 *Chiral equivariant cohomology*
Colloquium, Laval University

28.11.12 *Invariant subalgebras of vertex algebras*
Colloquium, SUNY Binghamton

Sonja Mars

23.08.12 *Approaches to solve mixed-integer semidefinite programmes*
International Symposion on Mathematical Programming (ISMP) 2012, Berlin

09.10.12 *Using SCIP to solve mixed-integer semidefinite programmes*
SCIP Workshop 2012, Darmstadt

Manuel Nesensohn

04.07.11 *L_p-theory for a generalized nonlinear viscoleastic fluid model of differential type*
IRTG 1529 Klausurtagung, Heppenheim

29.11.11 *L_p-theory for a generalized viscoelastic fluid model on a fix domain and with a free surface*
4th Japanese-German International Workshop on Mathematical Fluid Dynamics, Tokyo

12.07.12 *L_p-theory for a class of viscoelastic fluid models*
Workshop on Complex Fluids, Darmstadt

17.07.12 *L_p-theory for a viscoelastic fluid model of differential type*
Universität Hannover

17.09.12 *L_p-theory for a certain class of viscoelastic fluid models*
DMV-Jahrestagung, Saarbrücken

06.11.12 *On global L_p-solutions for some Oldroyd models on bounded domains*
7th Japanese-German International Workshop on Mathematical Fluid Dynamics, Tokyo

Martin Otto

15.07.11 *Tractable Finite Models*
Logic Colloquium, Barcelona

15.09.11 *The Freedoms of Guarded Bisimulation*
Computer Science Logic, Bergen

05.12.11 *Controlling Cycles in Finite Hypergraphs*
Methods for Discrete Structures, Graduiertenkolleg, Berlin

17.05.12 *Finite Model Constructions for Guarded Logics*
Summer School on Finite and Algorithmic Model Theory, Les Houches

23.10.12 *Pebble Games and Linear Equations*
Kolloquium Mathematische Informatik, Universität Frankfurt

Andreas Paffenholz

14.06.11 *Exploring Geometry with `polymake`*
San Francisco State University, USA

20.09.11 *Permutation Polytopes*
DMV-Tagung 2011, Köln

30.11.11 *Permutation Polytopes*
Oberseminar AG Diskrete Mathematik, Universität Frankfurt

05.12.11 *Permutation Polytopes*
Oberseminar AG Gruppen und Geometrie, Universität Bielefeld

24.08.12 *Permutation, Marginal, and Cut Polytopes*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

15.12.12 *Polyhedral Adjunction Theory*
Computational Geometry Seminar, University of Sydney, Australia

18.12.12 *Structure and Classifications of Fano Polytopes*
Oberseminar AG Algebra und Geometrie, Universität Magdeburg

Marc Pfetsch

16.05.12 *Compressed Sensing and Discrete Optimization*
Seminar Working Group Discrete Mathematics, Universität Frankfurt

11.07.12 *Compressed Sensing und Diskrete Optimierung*
Inaugural lecture, TU Darmstadt

24.08.12 *A computational comparison of symmetry handling methods in integer programming*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

30.11.12 *Compressed Sensing and Discrete Optimization*
Colloquium, Liège, Belgium

03.12.12 *Coloring and Symmetries*
Mathematical Colloquium, Universität Paderborn

11.12.12 *Computational Solver Comparison for Basis Pursuit*
Workshop "Sparse Representation of Functions: Analytic and Computational Aspects", Berlin

Ulrich Reif

25.05.11 *Ambient B-Splines*
Workshop Geometric Modeling, Dagstuhl

18.09.11 *Surface Representations – Retrospects and Prospects*
Workshop Subdivision and Refinability, Pontignano

27.09.11 *Surface Modeling beyond NURBS*
SAGA Fall School, Vilnius

07.12.11 *Surface Modeling beyond NURBS*
University of Lugano

20.02.12 *A Brief History of Subdivision*
BMS Days, FU Berlin

24.04.12 *Multivariate Interpolation and Approximation with Polynomials*
Universität Göttingen

12.06.12 *Approximation with Ambient B-Splines*
University of Cambridge

05.09.12 *Analysis of Geometric Subdivision Schemes*
Workshop on New Trends in Subdivision and Related Applications, Milan

27.11.12 *Analysis geometrischer Subdivisionsalgorithmen*
Universität Passau

Walter Reußwig

26.01.11 *A Class of Finitely Correlated States and Entanglement*
WIMCS Stochastic Cluster Meeting: Trends in Quantum Probability and Stochastics, Aberystwyth, Wales

06.09.12 *On entanglement of states on infinite tensor product algebras*
2012 LMS Midlands Regional Meeting & Workshop on Quantum Probabilistic Symmetries, Aberystwyth, Wales

Steffen Roch

26.–30.09.11 *Fractal Algebras of Approximation Sequences*
Summer School on "Applied Analysis" TU Chemnitz, 3 lectures

Jürgen Saal

13.04.11 *A vector measure approach to rotating boundary layers*
Vanderbilt University

18.05.11 *Analysis of a general model in elektrokinetics*
DMV-Tagung, Köln

18.05.11 *A vector measure approach to rotating boundary layers*
Universität Halle

23.05.11 *A vector measure approach to rotating boundary layers*
Conference on Vorticity, Rotation and Symmetry (II) - Regularity of Fluid Motion, Luminy

18.07.11 *Hyperbolic Navier-Stokes equations*
ICIAM 2011, Vancouver

10.10.11 *A vector measure approach to rotating boundary layers*
Conference on Evolution Equations: Randomness and Asymptotics, Bad Herrenalb

14.03.12 *Exponential convergence to equilibria for a general model in hydrodynamics*
University of Tokyo

24.03.12 *Global well-posedness and stability for a two-dimensional electrophoretic fluid model*
Workshop on Navier-Stokes equations, Calais

26.03.12 *Global well-posedness and stability for a two-dimensional electrophoretic fluid model*
GAMM 2012, Darmstadt

01.06.12 *Kontaktlinien, Elektrokinetic, etc.: Modellierung und Analysis komplexer Strömungsvorgänge*
Universität Düsseldorf

01.07.12 *Maximal regularity on cross-sections implies maximal regularity on a cylinder*
9th AIMS Conference, Orlando

13.07.12 *Kontaktlinien, Elektrokinetic, etc.: Modellierung und Analysis komplexer Strömungsvorgänge*
Universität Ulm

17.09.12 *Exponential stability in elektrokinetics*
DMV-Tagung, Saarbrücken

19.09.12 *Well-posedness of mixed order systems*
DMV-Tagung, Saarbrücken

26.11.12 *Kontaktlinien, Elektrokinetic, etc.: Modellierung und Analysis komplexer Strömungsvorgänge*
TU Dresden

Nils Scheithauer

11.05.11 *Some constructions of modular forms for the Weil representation*
Explicit theory of automorphic forms, applications and computations, CIRM Luminy

08.06.11 *Some constructions of modular forms for the Weil representation and applications*
Seminar Aachen-Bonn-Köln-Lille-Siegen on automorphic forms, MPI Bonn

22.09.11 *Modular forms for the Weil representation and Borcherds' conjecture*
Conformal field theory, automorphic forms and related topics, Heidelberg

16.04.12 *Modular forms for the Weil representation and Borcherds' conjecture*
Integrability in topological field theory, HIM Bonn

03.05.12 *Automorphe Formen auf orthogonalen Gruppen*
Kolloquium, Universität Freiburg

15.05.12 *Von Gruppen zu Algebren und automorphen Formen*
Kolloquium, FAU Erlangen-Nürnberg

11.09.12 *Discriminant forms and their automorphisms*
Conference on groups, vertex operator algebras and related structures in honor of Masahiko Miyamoto, Tsukuba

01.10.12 *Discriminant forms and their automorphisms*
Mathematical physics trimester seminar, HIM Bonn

23.11.12 *From groups to Lie algebras and automorphic forms*
Heilbronn day: Modular forms, geometry and physics, ICMS Edinburgh

26.11.12 *Discriminant forms and their automorphisms*
Algebraic geometry, modular forms and applications to physics, ICMS Edinburgh

Werner Schindler

24.05.11 *Wie sicher sind unsere Zahlungskarten?*
Deutsche Bank, Eschborn

13.09.12 *Understanding the Reasons for the Side-Channel Leakage is Indispensable for Secure Design*
PROOFS 2012, Leuven

21.11.12 *Der stochastische Ansatz in der Poweranalyse - ein effizientes Angriffsverfahren und ein designunterstützendes Werkzeug*
Oberseminar am Lehrstuhl Security in Telecommunications, TU Berlin

Kay Schwieger

06.09.12 *Asymptotics of diagonal quantum couplings*
2012 LMS Midlands Regional Meeting & Workshop on Quantum Probabilistic Symmetries, Aberystwyth, Wales

Adrian Sichau

14.11.11 *A Second Order Approximation Technique for Robust Shape Optimization*
1st International Conference on Uncertainty in Mechanical Engineering (ICUME), Darmstadt

Thomas Streicher

02.03.11 *Introduction to Type Theory and its Semantics*
Mini-Workshop Homotopy Type Theory, Oberwolfach

30.07.11 *A Categorical Account of Krivine's Classical Realizability*
TACL 2011, Marseille

06.09.11 *Quantum Theory in Topological Domain Theory*
Domains X, Swansea

30.11.11 *Isomorphic Types are Equal!*
MAP 11, Lorentz Center, Leiden

12.01.12 *A Categorical Approach to Krivine's Classical Realizability*
Inauguration Récré, ENS Lyon

14.02.12 *The Classical Realizability Tripos and Topos.*
Interaction Weeks, Luminy, Marseille

25.05.12 *On Univalent Foundations*
Sixth Scottish Category Theory Seminar, University of Glasgow

Andreas M. Tillmann

21.08.12 *Heuristic optimality check and computational solver comparison for basis pursuit*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

12.12.12 *Branch & Cut for ℓ_0-Minimization*
Workshop "Sparse Representation of Functions: Analytic and Computational Aspects", TU Berlin

Stefan Ulbrich

17.03.11 *Optimal Control of Discontinuous Solutions of Hyperbolic Conservation Laws*
Chemnitzer Seminar zur Optimalsteuerung, Haus im Ennstal, Austria

16.05.11 *Numerical Approximation of Optimal Control Problems for Discontinuous Solutions of Hyperbolic Conservation Laws*
SIAM Conference on Optimization 2011, Darmstadt

14.07.11 *Adaptive Multilevel Methods for PDE-Constrained Optimization Based on Adaptive Finite Element or Reduced Order Approximations*
AC.CES 2011, RWTH Aachen

20.07.11 *Optimal Control of Discontinuous Solutions of Hyperbolic Conservation Laws: Theory and Numerical Approximation*
9th Meeting on Hyperbolic Conservation Laws, Fluid Dynamics and Transport Equations, SISSA-ISAS, Trieste, Italy

15.09.11 *Numerical Approximation of Optimal Control Problems for Discontinuous Solutions of Hyperbolic Conservation Laws*
IFIP TC 7 Conference on System Modeling and Optimization 2011, Berlin

28.09.11 *Optimal Control of Discontinuous Solutions of Hyperbolic Conservation Laws: Theory and Numerical Approximation*
ESF Waves Workshop 2011, Würzburg

13.10.11 *Adaptive Multilevel Methods for PDE-Constrained Optimization Based on Adaptive Finite Element or Reduced Order Approximations*
International Workshop on Control and Optimization of PDEs, Graz, Austria

07.11.11 *Adaptive Multilevel Methods for PDE-Constrained Optimization Based on Adaptive Finite Element or Reduced Order Approximations*
Seminar of the IANS, Universität Stuttgart

02.12.11 *Numerical Approximation of Optimal Control Problems for Discontinuous Solutions of Hyperbolic Conservation Laws*
Workshop on Optimal Control of PDEs, Klaffenbach

03.02.12 *Adaptive Multilevel Methods for PDE-Constrained Optimization Based on Adaptive Finite Element or Reduced Order Approximations*
18. Treffen Rhein-Main-Arbeitskreis Mathematics of Computation, Darmstadt

12.02.12 *Multilevel Preconditioner for Contact Problems and Optimal Control*
Chemnitzer Seminar zur Optimalsteuerung, Haus im Ennstal, Austria

19.03.12 *Multilevel Methods for PDE-Constrained Optimization involving Adaptive Discretizations and Reduced Order Models*
Colloquium, CAAM Department, Rice University, Houston, USA

16.05.12 *Multilevel Methods for PDE-Constrained Optimization involving Adaptive Discretizations and Reduced Order Models*
Conference on Optimization Methods and Software 2012, Chania, Greece

21.08.12 *Multilevel Optimization based on Adaptive Discretizations and Reduced Order Models for Engineering Applications*
International Symposium on Mathematical Programming (ISMP 2012), Berlin

21.12.12 *Optimization of deep drawing processes*
Workshop on Complementarity and its Extensions, Institute for Mathematical Sciences, National University of Singapore

Christian H. Weiß

07.09.11 *Categorical Time Series: Analysis, Modelling, Monitoring?*
Eleventh Annual Conference of ENBIS (Young Statistician's Award), Coimbra

05.10.11 *Ein erweitertes Poisson INAR(1)-Modell*
Workshop des Zentrums für Statistik der TU Darmstadt, Grasellenbach

10.11.11 *Analyse und Modellierung von Zähldatenzeitreihen*
Forschungsseminar des Lehrstuhls für Statistik, Universität Augsburg

25.09.12 *Modeling and Analysis of Count Data Time Series: Recent Research Activities*
Mathematics Department, University of Aveiro

Jan Wolf

23.08.12 *Accelerating Nested Benders Decomposition with Game Tree Search Techniques to solve Quantified Linear Programs*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Irwin Yousept

11.05.11 *Optimal control of Maxwell's equations with H(div)-controls and state constraints*
Colloquium, HU Berlin

07.07.11 *Optimal control of Maxwell's equations and its applications*
Colloquium, RWTH Aachen

21.07.11 *Optimal control of 3D induction heating*
International Congress on Industrial and Applied Mathematics (ICIAM), Vancouver, Canada

16.09.11 *Control of Maxwell's equations*
IFIP TC 7 Conference on System Modeling and Optimization 2011, Berlin

26.10.11 *Optimal control of Maxwell's equations and its applications*
Colloquium, TU Darmstadt

31.10.11 *Optimal control in electromagnetic processes*
Colloquium, TU Berlin

29.11.11 *Optimal control of Maxwell's equations*
Workshop on Optimal Control of Partial Differential Equations, Klaffenbach

19.12.11 *Optimization of Maxwell's system*
MATHEON Workshop (application area C), TU Berlin

19.03.12 *PDE-constrained optimization in electromagnetic problems*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2012, Darmstadt

21.08.12 *PDE-constrained optimization involving eddy current equations*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

04.10.12 *Numerical aspects of optimal control problems of electromagnetic phenomena*
DK Seminar, Strobl, Austria

Martin Ziegler

06.07.11 *Computational Complexity of Quantum Satisfiability*
Real-number complexity at Foundations of Computational Mathematics (FoCM), Budapest

13.10.11 *Uniform Polytime Computable Operators on Univariate Real Analytic Functions*
Computing with Infinite Data: Topological and Logical Foundations, Dagstuhl

24.02.12 *Real Computation with Least Discrete Advice: A Complexity Theory of Nonuniform Computability*
Kyoto Symposium on Computable Analysis

30.08.12 *Computability and Complexity in Quantum Logic*
5th International Workshop on Physics and Computation, Swansea

Jan Carsten Ziems

19.05.11 *Adaptive multilevel optimization with reduced order models for PDE-constrained problems*
SIAM Conference on Optimization 2011, Darmstadt

27.07.11 *Adaptive multilevel optimization with reduced order models for PDE-constrained problems*
Oberseminar Numerik, Universität Konstanz

13.09.11 *Multilevel optimization with reduced order models for PDE-constrained problems*
IFIP TC07 Conference on System Modeling and Optimization 2011, Berlin

01.12.11 *Adaptive multilevel optimization with reduced order models for PDE-constrained problems*
Workshop on Optimal Control of Partial Differential Equations (in honor of Fredi Tröltzsch's 60th birthday), Chemnitz

05.03.12 *Adaptive multilevel optimization with reduced order models for PDE-constrained problems*
International Conference on High Performance Scientific Computing (HPSC) 2012, Hanoi, Vietnam

27.03.12 *Adaptive multilevel optimization with reduced order models for PDE-constrained problems*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2012, Darmstadt

10.05.12 *Adaptive multilevel SQP-Methods for Optimization with PDEs*
Collatz-Kolloquium für angewandte Mathematik der Universität Hamburg

5.1.2 Contributed Talks

Hans-Dieter Alber

20.04.11 *Precise asymptotic expansions for solutions of phase field models at the passage to the sharp interface limit*
GAMM 2011, TU Graz

22.09.11 *The hybrid model as a phase field model for crack propagation*
Workshop on Phase separation, damage and fracture, WIAS Berlin

06.10.11 *A rapidely converging phase field model for phase interfaces in solids*
Partial differential equations: theory, applications, simulations, Universität Stuttgart

20.01.12 *The phase field model for phase evolution in a material with three phase states*
11th GAMM Seminar on Microstructures, Universität Duisburg-Essen

04.09.12 *A hybrid phase field model for phase evolution in a material with three phase states*
STAMM XVIII: mechanics - new challenges, Technion, Israel

26.09.12 *A hybrid phase field model for phase evolution in a material with three phase states*
8th international workshop on direct and inverse problems in piezoelectricity, Graselllenbach

Benjamin Assarf

13.11.12 *On the classification of simplicial, terminal, and reflexive polytopes with many vertices*
Optimization Seminar, TU Darmstadt

Maksym Berezhnyi

21.01.11 *Discrete Model of the Nonsymmetric Elasticity Theory*
10th GAMM-Seminar on Microstructures, Darmstadt

28.03.12 *Asymmetric Hydrodynamics of Suspensions*
GAMM 83rd Annual Meeting, Darmstadt

Dieter Bothe

20.04.11 *A hybrid model for fully resolved numerical simulation of reactive mixing in a T-shaped micromixer*
GAMM 82nd Annual Meeting, TU Graz

21.06.11 *Modeling and 3D Simulation of Physical Mass Transfer at single rising gas bubbles for realistic Schmidt*
8th International Conference on Computational Fluid Dynamics in the Oil & Gas, Metallurgical and Process Industries, Trondheim

27.09.11 *Towards a computational analysis of binary collisions of shear-thinning droplets*
24th European Conference on Liquid Atomization and Spray systems (ILASS), Estoril

22.11.11 *DNS of thermocapillary flows based on two-scalar temperature representation*
64th annual meeting APS division Fluid Mechanics, Baltimore/MD

06.12.11 *Soluble surfactants at fluidic interfaces – experiments and simulation*
International Workshop: Transport Processes at Fluidic Interfaces - from Experimental to Mathematical Analysis, Aachen

04.09.12 *Experiments and Direct Numerical Simulations of binary collisions of miscible liquid droplets with different viscosities*
12th International Conference on Liquid Atomization and Spray Systems, Heidelberg

12.09.12 *A VOF-based method for the simulation of fluid particles influenced by surface active agents*
6th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS), Vienna

20.09.12 *Sharp-interface modeling and direct numerical simulation of mass transfer across fluidic interfaces*
7th International Symposium on Two-Phase Systems for Ground and Space Applications, Beijing

Stefanie Bott

29.09.12 *Multilevel Methods with POD for PDE-constrained Optimization with State Constraints*
GSC Retreat, Heppenheim

19.11.12 *Adaptive Multilevel SQP Method for State Constrained Optimization with PDEs*
Optimization Seminar, TU Darmstadt

13.12.12 *Adaptive Multilevel SQP Method for State Constrained Optimization with PDEs*
Veszprém Optimization Conference: Advanced Algorithms (VOCAL) 2012, Veszprém, Hungary

Christian Brandenburg

23.05.11 *Shape Optimization for the Navier-Stokes Equations*
International Conference on Finite Elements in Flow Problems (FEF) 2011, München

05.07.11 *Existence- and Differentiability Results for Shape Optimization Problems*
IRTG 1529 Klausurtagung, Heppenheim

Debora Clever

16.05.11 *Model Hierarchy Based Multilevel SQP-Methods for PDAE-Constrained Optimal Control Problems with Application to Radiative Heat Transfer*
SIAM Conference on Optimization, Darmstadt

26.09.11 *Adaptive Multilevel SQP-Methods for PDAE-constrained Optimization*
Joint talk with J.C. Ziems, Annual Meeting - SPP1253, Kloster Banz

04.10.11 *Model Hierarchy Based Multilevel SQP-Methods for PDAE-Constrained Optimal Control Problems - Application to Radiative Heat Transfer in 2d and 3d*
2nd International Conference on Computational Engineering, Darmstadt

26.03.12 *Multilevel Optimization for PDAE-Constrained Optimal Control Problems - Pointwise Constraints on Control and State*
83rd Annual Meeting of the International Association of Applied Mathematics and Mechanics, Darmstadt

23.07.12 *Towards a Fully Space-Time Adaptive Multilevel Optimization Environment*
Workshop on Adaptivity and Model Order Reduction in PDE Constrained Optimization, Hamburg

Pia Domschke

18.05.11 *Optimization of Gas and Water Supply Networks*
SIAM Conference on Optimization OP11, Darmstadt

07.06.11 *Adjoint-based error control for the simulation of gas and water supply networks*
International Conference on Adaptive Modeling and Simulation (ADMOS) 2011, Paris

Moritz Egert

10.06.11 *Feedback Stabilizability of Delay Systems in Banach Spaces*
Final workshop of the 14th Internet Seminar on Evolution Equations, Blaubeuren

08.06.12 *Rational Approximations of Semigroups without Scaling and Squaring*
Final workshop of the 15th Internet Seminar on Evolution Equations, Blaubeuren

Walter Freyn

06.10.11 *A lightcone construction for twin buildings of hyperbolic Kac-Moody algebras*
Conference: “Buildings 2011”, Münster

01.10.12 *Combinatorial geometry of Chevalley groups*
Conference: “Buildings 2012”, Münster

Dmytro Furer

07.03.12 *Fixed design regression estimation based on experimental and artificially generated data*
10th German Probability and Statistics Days 2012, Mainz

29.03.12 *Fixed design regression estimation based on experimental and artificially generated data*
GAMM 83rd Annual Meeting, Darmstadt

13.07.12 *Fixed design regression estimation based on experimental and artificially generated data*
8th World Congress in Probability and Statistics, Istanbul

Matthias Geissert

26.05.11 *A free boundary value problem related to the spin-coating process*
Vorticity, rotation and symmetry (II) - regularity of fluid motion, Luminy

11.10.11 *Rate of convergence of the finite element method for the stochastic heat equation with additive noise*
Evolution Equations: Randomness and Asymptotics, Bad Herrenalb

17.11.11 *Weak Neumann implies Stokes*
SIAM Conference on Analysis of Partial Differential Equations (PD11), San Diego

28.03.12 *A free boundary problem related to the spin-coating process*
GAMM Meeting, Darmstadt

03.09.12 *Weak Neumann implies H^∞ calculus for the Stokes operator*
Parabolic and Navier-Stokes Equations, Bedlewo

17.09.12 *On strong solutions for viscoelastic fluid models*
DMV Meeting, Saarbrücken

05.11.12 *Weak Neumann implies H^∞ calculus for the Stokes operator*
The 7th Japanese-German International Workshop on Mathematical Fluid Dynamics, Waseda

Alf Gerisch

18.01.11 *Fast evaluation of integral terms in a nonlocal PDE model of cellular adhesion*
Verwer65 Meeting, CWI, Amsterdam, The Netherlands

18.07.11 *A Micromechanical Model of the Mineralized Collagen Fibril Bundle with Application to Mineralized Turkey Leg Tendon Data (poster)*
ICIAM 2011, Vancouver, Canada

19.07.11 *Modelling and Simulation of Cellular Adhesion: the Impact on Spatio-temporal Patterns in Cancer Cell Invasion*
ICIAM 2011, Vancouver, Canada

27.10.11 *Numerical homogenization in multi-scale models of musculoskeletal mineralized tissues*
Comsol Conference, Stuttgart

16.11.11 *Numerical homogenization in multi-scale models of musculoskeletal mineralized tissues*
ACOMEM 2011, University of Liège, Belgium

02.05.12 *Tissue Scale Modelling and Simulation of Cell Adhesion*
SYNMIKRO Conference on Mathematical Modelling of Microbiological Systems, Universität Marburg

07.08.12 *Prediction of Effective Elastic Properties of Osteons by Means of Multiscale Models and Homogenization Methods (poster)*
SIAM Conference on the Life Sciences, San Diego, USA

11.09.12 *On the positivity in nonlocal PDE models of cell adhesion*
NUMDIFF-13, Universität Halle-Wittenberg

Jane Ghiglieri

20.04.11 *Optimal Flow Control Based on POD for the Cancellation of Tollmien-Schlichting Waves by Plasma Actuators*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2011, Graz, Austria

17.05.11 *Optimal Flow Control based on POD for the Cancellation of Tollmien-Schlichting Waves by Plasma Actuators*
SIAM Conference on Optimization 2011, Darmstadt

12.09.11 *Optimal Flow Control based on POD for the Cancellation of Tollmien-Schlichting Waves by Plasma Actuators*
IFIP TC 7 Conference on System Modeling and Optimization 2011, Berlin

06.10.11 *Optimal Flow Control Based on POD for the Cancellation of Tollmien-Schlichting Waves by Plasma Actuators*
International Conference on Computational Engineering, Darmstadt

12.02.12 *Optimale Strömungskontrolle mit POD und MPC zur Auslöschung von Tollmien-Schlichting Wellen mit Plasma-Aktuatoren*
Chemnitzer Seminar zur Optimalsteuerung 2012, Haus im Ennstal, Austria

16.05.12 *Optimal Flow Control Based on POD and MPC for the Cancellation of Tollmien-Schlichting Waves by Plasma Actuators*
Conference on Optimization Methods and Software 2012, Chania, Greece

24.08.12 *Optimal Flow Control Based on POD and MPC for the Cancellation of Tollmien-Schlichting Waves by Plasma Actuators*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Thea Göllner

16.05.11 *Geometry Optimization of Branched Sheet Metal Products*
Poster Session at SIAM Conference on Optimization 2011, Darmstadt

04.07.11 *Geometrieoptimierung flächiger und verzweigter Blechbauteile*
Optimization Seminar, TU Darmstadt

27.03.12 *Geometry Optimization of Branched Sheet Metal Products*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2012, Darmstadt

22.08.12 *Geometry Optimization of Branched Sheet Metal Products*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Vassilios Gregoriades

05.06.11 *Effective Theory on Arbitrary Polish Spaces*
8th Panhellenic Logic Symposium, Ioannina, Greece

13.10.11 *Effective Theory on Arbitrary Polish Spaces*
Dagstuhl seminar “Computing with Infinite Data", Dagstuhl, Germany

10.07.12 *Turning Borel sets into clopen effectively*
Workshop “Trends in set theory", Warsaw, Poland

Roland Gunesch

24.02.11 *Mathematisches Chaos begreifen - Eindrücke aus einem experimentellen Ästhetikwettbewerb*
Annual Conference of the Gesellschaft für Didaktik der Mathematik, Universität Freiburg

08.03.12 *Differentialgeometrie leichtverständlich erklärt - ein neues Vorlesungskonzept*
Annual Conference of the Gesellschaft für Didaktik der Mathematik, PH Weingarten

13.03.12 *Zählen von geschlossenen Geodätischen*
Arbeitsgruppentagung

Kai Habermehl

16.05.11 *Robust optimization of active trusses via Mixed Integer Semidefinite Programming*
SIAM Conference on Optimization 2011, Darmstadt

27.02.12 *Control of uncertainties within an interdisciplinary design approach of a robust high heel*
Uncertainties 2012, Maresias, Brazil

28.03.12 *Robust optimization of active trusses via Mixed Integer Semidefinite Programming*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2012, Darmstadt

Roberto Henschel

06.11.12 *Eine Verbindung des Chromatischen Polynoms zur Geometrie*
Optimization Seminar, TU Darmstadt

Katrin Herr

17.05.11 *Solving Highly Symmetric Integer Linear Programs*
SIAM Conference on Optimization 2011, Darmstadt

11.07.11 *Solving highly symmetric integer linear programs*
Optimization Seminar, TU Darmstadt

Ida Hertel

27.09.11 *Estimation of the optimal design of a nonlinear parametric regression problem via Monte Carlo experiments*
Conference on Optimal Design of Experiments-Theory and Application, Wien

29.03.12 *Estimation of the optimal design of a nonlinear parametric regression problem via Monte Carlo experiments*
GAMM 83rd Annual Meeting, Darmstadt

31.05.12 *Poster on: A Minimax design for a nonlinear and implicitly given parametric regression problem using Monte Carlo experiments*
Conference on Quantitative methods in statistics, biostatistics and actuarial sciences, Louvain-la-Neuve

15.06.12 *Estimation of fatigue behaviour based on a parametric model for the inverse relation*
First Conference of the International Society for Non Parametric Statistics (ISNPS), Chalkidiki

09.07.12 *Estimation of the optimal design of a nonlinear parametric regression problem via Monte Carlo experiments*
8th World Congress in Probability and Statistics, Istanbul

Karl Heinrich Hofmann

30.03.11 *On certain subgroups of compact groups*
Algebra Seminar, Tulane University in New Orleans, USA

26.09.12 *On near abelian pro-p-groups*
Algebra Seminar, Tulane University in New Orleans, USA

Silke Horn

11.11.11 *A Topological Representation Theorem for Tropical Oriented Matroids*
Kolloquium über Kombinatorik, Universität Magdeburg

13.11.11 *Two Topological Representation Theorems for Tropical Oriented Matroids*
Optimization Seminar, TU Darmstadt

13.12.11 *Tropical Oriented Matroids*
Research Seminar, TU Braunschweig

02.08.12 *A Topological Representation Theorem for Tropical Oriented Matroids*
The 24th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), Nagoya University, Japan

Priska Jahnke

13.05.11 *Semistability of restricted tangent bundles*
NoGaGs, HU Berlin

18.07.11 *Der Gaußsche Integralsatz*
Universität Regensburg

01.02.12 *Semistability of restricted tangent bundles*
Seminar Lie-Theorie and complex geometry, Universität Marburg

03.02.12 *Classification of algebraic varieties*
FU Berlin

07.02.12 *Der zentrale Grenzwertsatz*
Universität Augsburg

09.05.12 *Algebraische Kurven und deren Bedeutung in der Kryptographie*
TUDay, TU Darmstadt

20.06.12 *Algebraische Kurven und deren Bedeutung in der Kryptographie*
Schülerinnen-Schnuppertage, TU Darmstadt

17.10.12 *Klassifikation algebraischer Varietäten und ihre Bedeutung in der Kryptographie*
Kolloquium, TU Darmstadt

Daniel Jones

28.04.11 *Optimal exercising of American options in discrete time via forecasting of stationary and ergodic time series*
Workshop on Optimal Stopping, Sequential Methods and Related Topics, Freiburg

13.07.12 *Optimal exercising of American options via forecasting of stationary and ergodic time series*
8th World Congress in Probability and Statistics, Istanbul

Klaus Keimel

13.06.12 *The duality between direct and predicate transformer semantics*
Research Workshop on Duality Theory in Algebra, Logic and Computer Science, Oxford

Matthias Köhne

15.02.11 *L_p-Theory for Two-Phase Flows with Soluble Surfactant*
Workshop on Phase Field Models in Fluid Mechanics, Universität Regensburg

20.06.12 *On Asymptotic Boundary Conditions for Incompressible Newtonian Flows*
Workshop on Modeling, Optimization and Simulation of Complex Fluid Flow, TU Darmstadt

Daniel Körnlein

10.07.12 *Quantitative aspects of fixed point iterations for Lipschitz pseudocontractive maps*
The 10th International Conference on Fixed Point Theory and its Applications, Cluj-Napoca

Oliver Kolb

14.04.12 *Optimization of Gas and Water Supply Networks*
Workshop on Numerical Methods for Optimal Control and Inverse Problems (OCIP) 2012, München

Daniela Koller

17.03.11 *Optimale Steuerung wirkmedienbasierter Tiefziehprozesse*
Chemnitzer Seminar zur Optimalsteuerung, Haus im Ennstal

21.04.11 *Optimal control of hydroforming processes*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2011, Graz

02.05.11 *Optimale Steuerung wirkmedienbasierter Tiefziehprozesse*
Optimization Seminar, TU Darmstadt

18.05.11 *Optimal control of hydroforming processes*
SIAM Conference on Optimization 2011, Darmstadt

14.02.12 *Optimal Control of hydroforming processes*
Chemnitzer Seminar zur Optimalsteuerung, Haus im Ennstal

27.03.12 *Optimal control of hydroforming processes*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2012, Darmstadt

24.08.12 *Optimal control of hydroforming processes based on POD*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

14.11.12 *Flächige Bauteile mit verzweigtem Querschnitt durch integrierte Spaltbiegeprozesse, HSC-Fräsprozesse und Tiefziehprozesse*
8. Fachtagung Walzprofilieren und 4. Zwischenkolloquium SFB 666, Darmstadt

Christian Komo

09.02.11 *Existence and convergence properties of some special weak solutions of the Boussinesq-Oseen equations in domains with rough boundaries*
Winter School: Mathematical Analysis in Fluid Mechanics, Bialka Tatrzanska

22.09.11 *Optimal initial value conditions for local strong solutions of the Navier-Stokes equations in exterior domains*
8th International Conference FSDONA, Tabarz

28.03.12 *Convergence properties of weak solutions of the Boussinesq equations in domains with rough boundaries*
GAMM 2012, Darmstadt

17.12.12 *Optimal initial value conditions for local strong solutions of the Navier-Stokes equations in exterior domains*
International Winter School on Mathematical Fluid Dynamics, Levico Terme

Karen Kuhn

24.07.12 *Stability analysis for multirate Rosenbrock- and Peer-methods*
ECMI, Lund

13.09.12 *Stability analysis for multirate Rosenbrock- and Peer-methods*
NUMDIFF-13, Halle

Jens Lang

13.07.11 *Linearly Implicit Methods for Optimal Control Problems*
SCiCADE 2011, Jan Verwer Memorial, Toronto

20.07.11 *Large Eddy Simulation with Adaptive Moving Meshes*
ICIAM 2011, Vancouver

06.09.11 *Adaptive Finite Elements with Anisotropic Mesh Refinement*
ENUMATH 2011, Leicester

26.06.12 *Adaptive Moving Meshes in Large Eddy Simulation for Turbulent Flows*
3rd European Seminar on Computing, Pilsen

10.09.12 *Adaptive Two-Step Peer Methods in Computational Fluid Dynamics*
NUMDIFF13, Halle

24.09.12 *Adaptive and Higher Order Methods in Computational Fluid Dynamics*
25th Chemnitz FEM Symposium 2012

Nicole Lehmann

13.02.12 *Modeling with ambient B-splines*
New Trends in Applied Geometry, Gazzada

Stéphane Le Roux

10.10.11 *Infinite Nash Equilibrium*
Computing with Infinite Data: Topological and Logical Foundations, Schloss Dagstuhl

30.05.12 *From determinacy to Nash equilibrium*
2nd Workshop on Continuity, Computability, Constructivity: from Logic to Algorithms; Universität Trier

19.06.12 *From determinacy to Nash equilibrium*
10th Conference on Logic and the Foundations of Game and Decision Theory, University of Sevilla

08.09.12 *From determinacy to Nash equilibrium*
Annual Workshop of the ESF Networking Programme on Games for Design and Verification, University of Naples

08.11.12 *From winning strategy to Nash equilibrium*
AlgoSyn, RWTH Aachen

Sonja Mars

18.05.11 *Actuator positioning in Truss Topology Design*
SIAM Conference on Optimization 2011, Darmstadt

31.08.11 *Optimal positioning of active components in trusses under multiple loads*
International Conference on Operations Research (OR) 2011, Zürich

David Meffert

03.06.12 *Inhomogeneous and semilinear evolution equations*
Operator Semigroups for Numerical Analysis, Blaubeuren

Hannes Meinlschmidt

05.06.12 *Geometric Theory of Semilinear Problems*
Final workshop on the 15th Internet Seminar on Evolution Equations, Blaubeuren

Claudia Möller

04.02.12 *Exact calculation of the JSR by depth first search on set-valued trees*
22. Rhein-Ruhr-Workshop, Bestwig

05.09.12 *Connecting the JSR to set-valued trees*
Workshop: New trends in subdivision and related applications, Milano

Martin Otto

16.02.12 *Tree Unfoldings and Their Finite Counterparts*
Algorithmic and Finite Model Theory, Ilmenau

06.09.12 *Pebble Games and Linear equations*
Computer Science Logic, Fontainebleau

Andreas Paffenholz

09.06.11 *Defect Polytopes and Counter-Examples with* `polymake`
ISSAC 2011, San José

28.11.11 *Permutation Polytopes*
Workshop "Polyhedra, Symmetry and Optimization", Rostock

21.02.12 *Defect Polytopes and Dual Defective Toric Varieties*
Workshop "Emerging Developments in Real Algebraic Geometry", Magdeburg

28.02.12 *Polyhedral Adjunction Theory*
Annual Meeting of SPP 1489, Hannover

11.05.12 *Construction of examples for Kähler-Einstein toric Fano manifolds with* `polymake`
Symposium der Fachgruppe Computeralgebra, Kassel

Sebastian Pfaff

26.09.11 *Optimal control of switched networks for nonlinear hyperbolic conservation laws*
Annual Meeting of DFG-SPP 1253, Kloster Banz

30.01.12 *Initial-Boundary-Value-Problems for Hyperbolic Conservation Laws*
Optimization Seminar, Darmstadt

14.05.12 *Optimal Boundary Control for Nonlinear Hyperbolic Conservation Laws with Source Terms*
Conference on Optimization Methods and Software 2012, Chania

25.06.12 *Optimal Boundary Control for Nonlinear Hyperbolic Balance Laws*
International Conference on Hyperbolic Problems 2012, Padua

24.08.12 *Optimal Boundary Control for Nonlinear Hyperbolic Conservation Laws with Source Terms*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Marc Pfetsch

05.03.12 *The Maximum k-Colorable Subgraph Problem and Symmetry*
International Conference on High Performance Scientific Computing (HPSC) 2012, Hanoi

Ulrich Reif

19.05.11 *Evaluation of the Joint Spectral Radius*
International Symposium in Approximation Theory, Nashville

Steffen Roch

12.09.12 *Essential spectral approximation, Arveson dichotomy and fractality*
Workshop on Operator Theory and Operator Algebras (WOAT), Lisbon

Rolf Roth

17.03.11 *Multilevel optimization applied in flow control*
Chemnitzer Seminar zur Optimalsteuerung, Haus im Ennstal

17.05.11 *Multilevel optimization for flow control with discrete adjoints*
SIAM Conference on Optimization 2011, Darmstadt

12.09.11 *Multilevel optimization for flow control with discrete adjoints*
IFIP TC07 Conference on System Modeling and Optimization 2011, Berlin

03.11.11 *Multilevel optimization for flow control with discrete adjoints*
Final Colloquium of the Collaborative Research Center (SFB) 568, Seeheim-Jugenheim

Carsten Schäfer

26.11.12 *Optimization of Adaptronic Systems*
Optimization Seminar, TU Darmstadt

13.12.12 *Optimization of Adaptronic Systems*
Veszprém Optimization Conference: Advanced Algorithms (VOCAL) 2012, Veszprém

Bettina Schieche

04.10.11 *Adjoint Error Estimation for Stochastic Collocation Methods*
2nd International Conference on Computational Engineering, Darmstadt

29.03.12 *Adaptive Stochastic Collocation on Sparse Grids*
GAMM, Darmstadt

02.04.12 *Adjoint Error Estimation for Stochastic Collocation Methods*
SIAM Conference on Uncertainty Quantification, Raleigh, North Carolina

26.06.12 *Analysis and Application of PDEs with Random Parameters*
European Seminar on Computing, Pilsen

05.07.12 *Analysis and Application of PDEs with Random Parameters*
2nd Workshop on Sparse Grids and Applications, Garching

Werner Schindler

17.06.11 *Security Research Between Attack and Design*
Cryptarchi 2011, Bochum

21.06.12 *Security Evaluation of RNGs - The Updated Evaluation Guidelines AIS 20 and AIS 31*
CryptArchi 2012, Marcoux

Dirk Schröder

10.09.12 *Adjoint Consistent Implicit Peer Methods*
Numerical Solution of Differential and Differential-Algebraic Equations (NUMDIFF-13), 10-14 September 2012, Universität Halle-Wittenberg

Adrian Sichau

18.05.11 *A Second Order Approximation Technique for Robust Shape Optimization*
SIAM Conference on Optimization, Darmstadt

27.03.12 *A Second Order Approximation Technique for Robust Shape Optimization*
Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM) 2012, Darmstadt

22.08.12 *Shape optimization under uncertainty employing a second order approximation for the robust counterpart*
International Symposium on Mathematical Programming (ISMP) 2012, Berlin

Nada Sissouno

21.02.11 *Spline spaces on planar domains*
New trends in applied geometry, Hurdal, Norway

10.06.11 *Approximation with tensor product splines on domains*
Geometry Seminar, Oslo, Norway

04.02.12 *Kondensierte B-Splines*
Rhein-Ruhr-Workshop, Bestwig

28.06.12 *Aspects of multivariate spline approximation on domains*
Eighth International Conference on Mathematical Methods for Curves and Surfaces, Oslo, Norway

Sara Tiburtius

30.06.11 *A multiscale model of mineralized fibril bundles - a homogenization approach*
ECMTB, Krakow

26.08.11 *A multiscale model of mineralized turkey leg tendon - a homogenization approach*
SimOrtho, Rostock

24.03.12 *SPP 1420 Project VI: Multiscale structure functional modeling of musculoskeletal tissues*
SPP 1420 Winter School, Golm

10.08.12 *Prediction of effective elastic properties of osteons by means of multiscale models and homogenization methods*
SIAM Conference on the Life Sciences (poster), San Diego

06.12.12 *Project VI: Multiscale structure-functional modeling of musculoskeletal mineralized tissues*
SPP 1420 project meeting, Düsseldorf

Sebastian Ullmann

27.03.12 *POD and CVT Galerkin reduced modeling of the flow around a cylinder*
GAMM 2012, Darmstadt

21.11.12 *POD-Galerkin-Modellierung thermo-konvektiver Strömungen*
Metström Bündeltreffen Adaptivität, Darmstadt

Christian H. Weiß

02.03.11 *Continuously Monitoring Categorical Processes*
Tenth Workshop on Stochastic Models and Their Applications, Wismar

21.09.11 *Empirical Measures of Signed Serial Dependence in Categorical Time Series*
Statistische Woche, Jahrestagung 2011, Leipzig

11.09.12 *Detection of Abrupt Changes in Count Data Time Series: Cumulative Sum Derivations for INARCH(1) Models*
Twelvth Annual Conference of ENBIS, Ljubljana

19.09.12 *Chain Binomial Models and Binomial Autoregressive Processes*
Statistische Woche, Jahrestagung 2012, Wien

Jan Wolf

06.09.11 *Quantified Linear Programs: A Computational Study*
European Symposium on Algorithms 2011, Saarbrücken

Martin Ziegler

01.02.11 *Relative Computability and Uniform Continuity of Relations*
Eighth International Conference on Computability and Complexity in Analysis (CCA), Cape Town

22.06.11 *Computational Complexity of Quantum Satisfiability*
26th Annual IEEE Symposium on Logic In Computer Science (LiCS), Toronto

25.06.12 *Uniform Polytime Computable Operators on Univariate Real Analytic Functions*
Ninth International Conference on Computability and Complexity in Analysis (CCA), Cambridge

20.07.12 *Einführung in die reelle Komplexitätstheorie*
Gemeinsamer Sondertheorietag für "Algorithmen und Komplexität" und "Automaten und Formale Sprachen", Tübingen

14.09.12 *Relative Computability and Uniform Continuity of Relations*
Colloquium Logicum 2012, Paderborn

28.09.12 *Uniform second-order polynomial-time computable operators and data structures for real analytic functions*
15th GAMM-IMACS International Symposium on Scientific Computing, Computer Arithmetic and Verified Numerical Computations (SCAN), Novosibirsk

Jan Carsten Ziems

26.09.11 *Adaptive multilevel optimization with reduced order models for PDE-constrained problems*
Annual Meeting of DFG-SPP 1253, Kloster Banz

5.1.3 Visits

Claudia Alfes, Emory University, June 2011

Maksym Berezhnyi, ILTPE of NASU, August 2012

Dieter Bothe, ENS Cachan, Antenne de Bretagne, March 2011

Dieter Bothe, University of Pittsburgh, August 2011

Dieter Bothe, WIAS Berlin, several visits during 2011 and 2012

Regina Bruder, University of Technology Sydney, Australia, March 2012

Regina Bruder, University of Melbourne, Australia, April 2012

Regina Bruder, Monash University of Melbourne, Australia, April 2012

Regina Bruder, Hobart-University, Tasmania, April 2012

Jan Bruinier, Max-Planck Institute for Mathematics, Bonn, April – June 2011

Moritz Egert, Louisiana State University, 19.09.12 - 05.10.12

Herbert Egger, ETH Zürich, 11.-14.09.2012

Herbert Egger, TU München, 27.-28.09.2012

Herbert Egger, Universität Münster, 10.-11.10.2012

Herbert Egger, Oberwolfach, 21.-27.10.2012

Herbert Egger, Universität Linz, 9.-10.11.2012

Herbert Egger, TU München, 11.-12.11.2012

Reinhard Farwig, CIRM Luminy, May 2011

Reinhard Farwig, RWTH Aachen, June 2011

Reinhard Farwig, Academy of Sciences, Prague, July 2011

Reinhard Farwig, Oberwolfach (RIP), August-September 2011

Reinhard Farwig, Waseda University Tokyo, November-December 2011

Reinhard Farwig, Krakow, July 2012

Reinhard Farwig, Oberwolfach, August 2012

Reinhard Farwig, Banach Center Bedlewo, September 2012

Reinhard Farwig, Waseda University Tokyo, Tokyo Institute of Technology, November 2012

Reinhard Farwig, RWTH Aachen, June 2011

Walter Freyn, Oregon State University, Corvallis, March 2011

Walter Freyn, Rutgers University, New Bunswick, March and April 2011

Walter Freyn, Emmy Noether Institut, Bar Ilan university, Tel Aviv, May 2011

Walter Freyn, IHÉS (Institut des Hautes Études Scientifiques), May 2011

Walter Freyn, Hausdorff Institut, Bonn, September – December 2011

Walter Freyn, Rutgers University, New Bunswick, October 2011

Walter Freyn, Max-Planck Institut für Gravitation, Potsdam, March 2012

Walter Freyn, Rutgers University, New Bunswick, May 2012

Walter Freyn, IHÉS (Institut des Hautes Études Scientifiques), June 2012

Walter Freyn, Rutgers University, New Bunswick, September 2012

Walter Freyn, IHÉS (Institut des Hautes Études Scientifiques), December 2012

Andreas Gärtner, Aberystwyth University, Aberystwyth, Jan. 19 – Jan. 27., 2011

Andreas Gärtner, Universität Saarbrücken, July 25, 2011

Matthias Geissert, MPI, Leipzig, Feb 2012

Vassilios Gregoriades, Universität Münster, December 2011

Roland Gunesch, Universität Hamburg, July–August 2012

Roland Gunesch, Mathematisches Forschungsinstitut Oberwolfach, September 2012

Karsten Grosse-Brauckmann, Newton Institute, Cambridge, October 2012

Robert Haller-Dintelmann, University of Valenciennes and Hainaut-Cambrésis, April 2011

Robert Haller-Dintelmann, Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin, December 2011

Robert Haller-Dintelmann, Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin, February 2012

Matthias Hieber, Universität Heidelberg, January 2011

Matthias Hieber, Universität Regensburg, January 2011

Matthias Hieber, University of Pittsburgh, February 2011

Matthias Hieber, UC Santa Barbara, April to June 2011

Matthias Hieber, Luminy, Marseille, June 2011

Matthias Hieber, Newton Institute, Cambridge, August to September 2011

Matthias Hieber, Zhejiang University, Hangzhou, September 2011

Matthias Hieber, Waseda University, Tokyo, December 2011

Matthias Hieber, Universität Bielefeld, March 2012

Matthias Hieber, DFG Office Japan, Tokyo, April 2012

Matthias Hieber, Lecce University, July 2012

Matthias Hieber, Waseda University, Tokyo, August 2012

Matthias Hieber, MFO Oberwolfach, August 2012

Matthias Hieber, WIAS Berlin, October 2012

Matthias Hieber, Waseda University, Tokyo, November 2012

Matthias Hieber, Academy of Sciences, Warsaw, December 2012

Silke Horn, Aalto University, Finland, May 15–17, 2012

Priska Jahnke, Universität Marburg, February 2012

Priska Jahnke, FU Berlin, December 2011

Klaus Keimel, Swansea University, 6.–10.09.2011

Klaus Keimel, Sobolev Institute, Novosibirsk, 8.–15.10.2011

Klaus Keimel, Laboratoire Preuves, Programmes et Systèmes, University of Paris Diderot (Paris VII), November 2011

Klaus Keimel, Almaty, Al-Farabi Kazakh National University, Kazakstan, 3.–14.12.2011

Klaus Keimel, East China Normal University, Shanghai, China, 13.–16.03.2012

Klaus Keimel, University of Birmingham, 29.05.–05.06.2012

Klaus Keimel, University of Bath, 05.–09.06.2012

Klaus Keimel, University of Oxford, 12.–15.06.012

Klaus Keimel, University of Birmingham, 20.11.–04.12.2012

Ulrich Kohlenbach, Romanian Academy, Bucharest, March-April 2011

Ulrich Kohlenbach, Carnegie Mellon University, Pittsburgh, June-July 2011

Burkhard Kümmerer, Aberystwyth University, Aberystwyth, 19.–27.01.2011

Burkhard Kümmerer, RWTH Aachen, 6.–8.10.2011

Burkhard Kümmerer, TU Dortmund, 28.–29.10.2011

Jens Lang, University of Kansas, March-April 2012

Stéphane Le Roux, University of Cape Town, Feb. 2011

Stéphane Le Roux, University of Cambridge, March 2012

Hannes Meinlschmidt, Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin, December 5–7, 2012

Martin Otto, University of California Santa Cruz, 09.10.11–08.11.11

Martin Otto, HU Berlin, 19.11.11–29.02.12

Andreas Paffenholz, Universität Bielefeld, December 5–6, 2011

Andreas Paffenholz, University of Sydney, Australia, November 9–18, 2012

Andreas Paffenholz, University of Queensland, Australia, November 18–25, 2012

Andreas Paffenholz, San Francisco State University, USA, June 13–16, 2011

Jan-Frederik Pietschmann, KTH Royal Institute of Technology, 19.-24. November 2012

Ulrich Reif, University of Cambridge, June 2012

Walter Reußwig, Aberystwyth University, Aberystwyth, 19.–27.01.2011

Walter Reußwig, Universität Saarbrücken, July 25, 2011

Steffen Roch, IST Lisbon, September 2012

Jürgen Saal, Vanderbilt University, April 2011

Jürgen Saal, The University of Tokyo, March 2012

Nils Scheithauer, CIRM, Luminy, May 2011

Nils Scheithauer, MPI, Bonn, June 2011

Nils Scheithauer, Universtät Heidelberg, September 2011

Nils Scheithauer, HIM, Bonn, April 2012

Nils Scheithauer, Universtät Freiburg, May 2012

Nils Scheithauer, Universität Erlangen-Nürnberg, May 2012

Nils Scheithauer, TU Dortmund, June 2012

Nils Scheithauer, Tsukuba, September 2012

Nils Scheithauer, HIM, Bonn, October 2012

Nils Scheithauer, ICMS, Edinburgh, November 2012

Bettina Schieche, Universität Linz, December 2011

Kay Schwieger, Universität Saarbrücken, July 25, 2011

Nada Sissouno, University of Oslo, September 2011

Nada Sissouno, University of Oslo, March 2012

Thomas Streicher, University of Sussex, January – February 2011

Thomas Streicher, University of Paris Diderot (Paris VII), March 2012

Sara Tiburtius, Pierre-and-Marie-Curie University (Paris VI), Laboratoire d'Imagerie Paramétrique, February - March 2011

Sara Tiburtius, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, 06.12.2012

Stefan Ulbrich, Rice University, Houston, USA, March 2011

Stefan Ulbrich, Rice University, Houston, USA, March 2012

Martin Ziegler, KTH Royal Institute of Technology, Stockholm, Aug 2012

Martin Ziegler, Universität Greifswald, Jul 2011

Martin Ziegler, Schloss Dagstuhl, Oct 2011

Martin Ziegler, Ecole Polytechnique, Palaiseau, Jun 2012

Martin Ziegler, University of Cambridge, Jun 2012

Martin Ziegler, Waseda University, Jun 2012

5.2 Organization of Conferences and Workshops

Hans-Dieter Alber

- 10th GAMM-Seminar on Microstructures 21-22 January, 2011 (jointly with S. Nesenenko)
- 83rd Annual Meeting of the International Association of Applied Mathematics and Mechanics GAMM, March 26-30, 2012 (jointly with C. Tropea, D. Bothe, P. Hagedorn, R. Markert, M. Oberlack and S. Ulbrich)
- Sektion "Partielle Differentialgleichungen" auf der DMV-Jahrestagung 2012, Universität Saarbrücken, 17.-20.9.2012 (jointly with D. Apushkinskaya, M. Fuchs and N. Kraltseva)

Benjamin Assarf

– 3rd `polymake` Workshop, TU Darmstadt, March 22 and 23, 2012 (with Katrin Herr, Michael Joswig, Benjamin Lorenz and Andreas Paffenholz)

Maksym Berezhnyi

– 83rd Annual Meeting of the International Association of Applied Mathematics and Mechanics, Co-Chairman of the subsection "Generalized continua" (jointly with Sergiy Nesenenko)

Volker Betz

– Workshop on many-body quantum systems in Venice (jointly with Daniel Ueltschi)

Dieter Bothe

– Seminar Series "Contact Line Dynamics - Theory", February 2011, Darmstadt

– Section "Interfacial Flows" at the GAMM Annual Meeting, 20.04.2011, Graz

– Summerschool "Partial Differential Equations",12.-16.09.11, Caputh

– 1st International Symposium on Multiscale Multiphase Process Engineering (MMPE), 04.-07.10.11, Kanazawa, Japan

– International Workshop "Transport Processes at Fluidic Interfaces - from Experimental to Mathematical Analysis", 05.-07.12.11, Aachen

– GAMM Annual Meeting (LOC) und Sektion "Interfacial Flows", March 2012, Darmstadt

– International Workshop "Modeling, Simulation and Optimization of Complex Fluid Flows", 20.-22.06.12, Darmstadt

– 7th International OpenFOAM Workshop, 25.-28.06.12, Darmstadt

– Numerical Methods for Two-phase Flow, 28.-30.11.12, Stuttgart

Regina Bruder

– Meeting and Inservice-teachertraining for teacher-students from TU Darmstadt (last 10 years), 07.10.2011

– Mentoring in the seminar of the GDM for doctoral candidates, 26–28.09.2012, Bad Wildbad

Jan H. Bruinier

– AKLS-Seminar on *Automorphic Forms* (jointly with K. Bringmann, V. Gritsenko, A. Krieg, G. Nebe, N.-P. Skoruppa, D. Zagier), 28.03.11 Köln, 08.06.11 MPI Bonn, 28.09.11 Aachen, 30.11.11 Lille, 14.03.12 Köln, 20.06.12 Bonn, 01.10.12 Lille

– Workshop *Arithmetic geometry of orthogonal and unitary Shimura varieties* (jointly with E. Goren and F. Andreatta), Banff International Research Station, 03.06.12–08.06.12

– Winter School on “The Birch and Swinnerton–Dyer Conjecture” (jointly with Y. Choie, H. Darmon, W. Kohnen, J. Park), Postech, Pohang, Korea, 2012

– Winter School on “Serre’s Modularity Conjecture” (jointly with Y. Choie, H. Darmon, W. Kohnen, J. Park), Postech, Pohang, Korea, 2011

Reinhard Farwig

– International Conference: Vorticity, Rotation and Symmetry (II) - Regularity of Fluid Motion (CIRM, Luminy 2011) (jointly with Jiri Neustupa and Patrick Penel)

– GAMM 2012, Section on Turbulence and Reactive Flows (jointly with Stefan Braun, Vienna)

– International Conference: Parabolic and Navier-Stokes Equations, Banach Center Bedlewo 2012 (jointly with Wojciech Zajaczkowski, Jiri Neustupa, Yoshihiro Shibata, Joanna Renclawowicz, Piotr Mucha)

– 7th Japanese-German International Workshop on Mathematical Fluid Dynamics, Tokyo 2012 (jointly with Matthias Hieber, Hideo Kozono, Yoshihiro Shibata)

Matthias Geissert

– Workshop on Complex Fluids (jointly with Matthias Hieber and Edris S. Titi)

– Minisymposium on “Complex Fluids” at the DMV Meeting (jointly with Horst Heck)

Matthias Hieber

– Spring School IRTG 1529

– Special Lectures by Giovanni P. Galdi

– Klausurtagung 2011 IRTG 1529

– Summer Courses on Mathematical Fluid Dynamics

– Summer School IRTG 1529 (jointly with Universität Hannover)

– Mini-Symposium, SIAM, San Diego

– 4th Japanese-German International Workshop on Mathematical Fluid Dynamics (jointly with Waseda University, Tokyo)

– German-Japanese Mini-Workshop on Fluid Dynamics

– The 5th Japanese-German International Workshop on Mathematical Fluid Dynamics (jointly with Waseda University, Tokyo)

– Conference on Complex Fluids (jointly with M. Geissert, E. Titi)

– The 7th Japanese-German International Workshop on Mathematical Fluid Dynamics (jointly with Waseda University, Tokyo)

– Klausurtagung 2012 IRTG 1529

Silke Horn

- 1st `polymake` Workshop, TU Darmstadt, March 31 and April 1, 2011 (with Katrin Herr, Sven Herrmann, Michael Joswig, Katja Kulas and Benjamin Lorenz, and Andreas Paffenholz)

Michael Joswig

- 1st `polymake` Workshop, TU Darmstadt, March 31 and April 1, 2011 (with Katrin Herr, Sven Herrmann, Silke Horn, Katja Kulas and Benjamin Lorenz, and Andreas Paffenholz)
- 2nd `polymake` Workshop, University of California, Berkeley, USA, September 13, 2011
- 3rd `polymake` Workshop, TU Darmstadt, March 22 and 23, 2012 (with Benjamin Assarf, Katrin Herr, Benjamin Lorenz, and Andreas Paffenholz)

Klaus Keimel

- Workshop Domains X, University of Swansea, GB, 7.–9. September 2011, Co-chair Programme Committee

Martin Kiehl

- Mathematikolympiade Hessen (Landesentscheid), 25.-26.02.2011, Darmstadt (jointly with Zentrum für Mathematik, Bensheim)
- Autumn School for Pupils; Mathematische Modellierungswoche, 9.-14.10.2011, Weilburg (jointly with Zentrum für Mathematik, Bensheim)
- Mathematikolympiade Hessen (Landesentscheid), 24.-25.02.2012, Darmstadt (jointly with Zentrum für Mathematik, Bensheim)
- Autumn School for Pupils; Mathematische Modellierungswoche, 14.-19.10.2012, Fuldatal (jointly with Zentrum für Mathematik, Bensheim)

Ulrich Kohlenbach

- 2011 Joint Mathematics Meeting, New Orleans, Jan. 6-9, 2011, AMS-ASL Special Session on Logic and Analysis (jointly with Jemery Avigad and Henry Towsner)
- Oberwolfach Workshop on Mathematical Logic: Proof Theory, Constructive Mathematics, Nov. 6-12, 2011 (jointly with Sam Buss, Michael Rathjen)

Jens Lang

- Invited Minisymposium on Adaptivity in Space and Time at NUMDIFF2009, 14-18 September 2009, Halle
- International Workshop on Multi-Scale Methods in Computational Engineering, 9-10 December 2010, Darmstadt

Ulf Lorenz

– Minisymposium: Multistage Robustness at the 21st International Symposium on Mathematical Programming (ISMP), Berlin 19.08.12 - 24.08.12

Sonja Mars

– SCIP Workshop, October 2012, Darmstadt (with Marc Pfetsch)

Andreas Paffenholz

– 1st `polymake` Workshop, TU Darmstadt, March 31 and April 1, 2011 (with Katrin Herr, Sven Herrmann, Silke Horn, Michael Joswig, Katja Kulas and Benjamin Lorenz)

– 3rd `polymake` Workshop, TU Darmstadt, March 22 and 23, 2012 (with Benjamin Assarf, Katrin Herr, Michael Joswig, and Benjamin Lorenz)

Marc Pfetsch

– SCIP Workshop, October 2012, Darmstadt (with Sonja Mars)

– Workshop "Sparse Representation of Functions: Analytic and Computational Aspects", December 10–14, 2012, TU Berlin (with Gitta Kutyniok and Volker Mehrmann)

Ulrich Reif

– Industry Challenges in Geometric Modeling, CAD and Simulation - 2011 (jointly with Ewald Quak)

– Industry Challenges in Geometric Modeling, CAD and Simulation - 2012 (jointly with Ewald Quak)

Steffen Roch

– Section 23 on "Applied operator theory", GAMM Annual Meeting 2011, Graz (jointly with Marko Lindner)

Werner Schindler

– Second International Workshop on Constructive Side-Channel Analysis and Secure Design - COSADE 2011 in Darmstadt (jointly with Sorin Huss)

– Third International Workshop on Constructive Side-Channel Analysis and Secure Design - COSADE 2012 in Darmstadt (jointly with Sorin Huss)

Stefan Ulbrich

– Local Organizer (Chair) and member of Organizing Committee SIAM Conference on Optimization 2011, May 16–19, 2011, Darmstadt

– Local Organizing Committee 83rd GAMM Annual Meeting, March 26–30, 2012, Darmstadt

– Local Organizing Committee Workshop on Modeling, optimization and simulation of complex fluid flow, June 20–22, 2012, Darmstadt

– Invited Minisymposium *Optimal Control of Hyperbolic Conservation Laws*, 25th IFIP TC 7 Conference, CSMO 2011, Berlin, September 12–16, 2011

Irwin Yousept

– Minisymposium: MS 358 Numerical PDE-constrained optimization (jointly with J.C. de los Reyes) at the 7th International Congress on Industrial and Applied Mathematics (ICIAM), Vancouver, Canada, July 18–22, 2011

– Matheon Workshop: Optimization with PDE constraints (application area C), Berlin, December 19, 2011

6 Workshops and Visitors at the Department

6.1 The Colloquium

Winter term 2010/2011

20.10.10. Prof. Dr. Jürgen Saal (Center of Smart Interfaces, TU Darmstadt), *Waschmaschinen, Wirbelstürme und mehr: Modellierung und Analysis von rotierenden Flüssigkeiten*

27.10.10. Prof. Dr. Michael Barot (National University of Mexico), *Rundgang durch Hyperbolien. Schwierigkeiten und Erstaunliches aus der hyperbolischen Geometrie*

03.11.10. Prof. Dr. Alain Damlamian (University of Paris-Est), *The periodic unfolding method: an approach to homogenization and singular differential equations*

10.11.10. Prof. Dr. Ulrich Stadtmüller (Universität Ulm), *Über einige Entfaltungsprobleme in der Statistik*

17.11.10. Prof. Dr. Tadahisa Funaki (University of Tokyo), *Scaling limits for the interface models and derivation of nonlinear PDEs*

24.11.10. Prof. Dr. Peter Bürgisser (Universität Paderborn), *Über die Wahrscheinlichkeit, dass ein leicht perturbiertes numerisches Problem schwierig ist*

01.12.10. Prof. Dr. Michael Griebel (Universität Bonn), *Ein paralleler Level–Set–Löser für Zweiphasenströmungen mit Oberflächenspannung*

08.12.10. Prof. Dr. Edriss Titi (University of California, Irvine, and Weizmann Institute of Science, Rehovot (Israel)), *Is Dispersion a Stabilizing or Destabilizing Mechanism?*

15.12.10. Prof. Dr. Angelika Bikner-Ahsbahs (Universität Bremen), *Mathematikinteresse fördern – geht das? Einblicke in die Theorie interessendichter Situationen*

12.01.11. Prof. Dr. Friedrich Eisenbrand (Federal Polytechnic School of Lausanne), *Ganzzahlige Optimierung und Geometrie der Zahlen*

19.01.11. Prof. Dr. Otmar Venjakob (Universität Heidelberg), *Können ζ–Funktionen Diophantische Gleichungen lösen?*

26.01.11. Prof. Dr. Kunibert Siebert (Universität Duisburg-Essen, Duisburg), *Konvergenz und Optimalität adaptiver Finite Elemente Verfahren*

02.02.11. Prof. Dr. Arnd Rösch (Universität Duisburg-Essen, Duisburg), *Parameteridentifikation und optimale Steuerung bei partiellen Differentialgleichungen*

09.02.11. Prof. Dr. Roland Speicher (Universität Saarbrücken), *Was sind und was sollen Quantenpermutationen?*

16.02.11. Prof. Dr. Annette Werner (Universität Frankfurt), *Gruppen, Gebäude und analytische Räume*

Summer term 2011

13.04.11. Priv.-Doz. Dr. Sören Kraußhar (TU Darmstadt), *Hyperkomplexe automorphe Formen in Analysis, Geometrie und Zahlentheorie*

20.04.11. Prof. Dr. Gabriele Nebe (RWTH Aachen), *Extremale Gitter*

27.04.11. Prof. Dr. Robert Schaback (Universität Göttingen), *Kernbasierte gitterfreie numerische Methoden*

04.05.11. Prof. Dr. Helmut Linneweber-Lammerskitten (Fachhochschule Nordwestschweiz, Aarau), *Mathematische Kurzfilme und autonomes Lernen*

11.05.11. Prof. Dr. Jaap van Oosten (University of Utrecht), *Synthetic Nonstandard Arithmetic*

18.05.11. Prof. Dr. Reinhold Schneider (TU Berlin), *Coupled Cluster-Methoden zur Berechnung der elektronischen Struktur*

25.05.11. Graduation Ceremony for winter term 2010/2011 and summer term 2011: Prof. Dr. William A. Casselman (University of British Columbia, Vancouver), *Kunst in der Mathematik, Mathematik in der Kunst*

01.06.11. Prof. Dr. Hansjörg Geiges (Universität Köln), *Wie zeichnet man bis zu 5-dimensionale Mannigfaltigkeiten?*

08.06.11. Prof. em. Dr. Dr. h.c. Erich Wittmann (TU Dortmund), *Mathematik vom Kindergarten bis zum Abitur aus einem Guss*

15.06.11. Prof. Dr. Gabriel Wittum (Universität Frankfurt), *Modellierung und Simulation komplexer Systeme: Zellen, Stofftransport, Strömungen und mehr*

22.06.11. Prof. Dr. Ingo Steinwart (Universität Stuttgart), *Statistische Analyse von Support Vector Machines*

29.06.11. Prof. Dr. Hannah Markwig (Universität Saarbrücken), *Überlagerungen algebraischer Kurven und tropische Hurwitzzahlen*

06.07.11. Prof. Dr. Jan Hendrik Bruinier (TU Darmstadt), *Die Arithmetik von Partitionen*

13.07.11. Prof. Dr. Jan Prüß (Universität Halle), *Evolutionsgleichungen, maximale Regularität und freie Randwertprobleme*

Winter term 2011/2012

19.10.11. Prof. Dr. Dorin Bucur (University of Savoie, Chambéry), *Could rough boundaries be more slippery?*

26.10.11. Memorial Colloquium in Honour of Prof. Dr. Benno Artmann (TU Darmstadt),

- Prof. Dr. Günter Törner (Universität Duisburg-Essen), *Mathematische Wissenschaften im Wandel der Zeit? Eine Hommage an Benno Artmann*
- Prof. Dr. Dietmar Guderian (Pädagogische Hochschule Freiburg), *Zufall – Zahlen – Wegenetze: Berührungen zwischen Mathematik und der Kunst der Gegenwart*

02.11.11. Prof. Dr. Robert Weismantel (ETH Zürich), *Black-Box-Algorithmen zur Minimierung konvexer Funktionen über ganzzahligen Punkten in Polyedern*

09.11.11. Prof. Dr. Roland Pulch (Bergische Universität Wuppertal), *Stochastische Galerkin-Ansätze für Differentialgleichungssysteme mit zufallsabhängigen Parametern*

16.11.11. Prof. Dr. Alfio Borzi (Universität Würzburg), *PDE Optimierung unter Unsicherheiten und die Suche nach einer Robusten Steuerung*

23.11.11. Prof. em. Dr. Dr. h.c. Erich Wittmann (TU Dortmund), *Mathematik vom Kindergarten bis zum Abitur aus einem Guss*

30.11.11. Prof. Dr. Dr. h.c. Hans-Dieter Alber (TU Darmstadt), *Der Grenzübergang vom Phasenfeldmodell zum Modell mit scharfer Grenzfläche – effektive Simulation von Phasenübergängen*

07.12.11. Prof. Dr. Özlem Imamoglu (ETH Zürich), *Some old and new results on Klein's j-invariant*

14.12.11. Prof. Dr. Alex Simpson (University of Edinburgh), *The Topology of Randomness*

21.12.11. Dr. Cornelia Wichelhaus (Universität Heidelberg), *Nichtparametrische Analyse für Netzwerke von Warteschlangen*

11.01.12. Prof. Dr. Markus Bläser (Universität Saarbrücken), *Untere Schranken für die Komplexität der Matrixmultiplikation und das Tensorrang-Problem*

18.01.12. Prof. Dr. Reinhard Racke (Universität Konstanz), *Stabilität in thermoelastischen Systemen: Fourier versus Cattaneo*

25.01.12. Prof. Dr. Werner Blum (Universität Kassel), *Verlässliche Individualdiagnosen mit 0/1-Kodierungen? Chancen und Grenzen von "Vergleichsarbeiten" im Fach Mathematik*

01.02.12. Prof. Dr. Wolfgang Rueß (Universität Duisburg-Essen), *Flussinvarianz bei nichtlinearen Evolutionsgleichungen mit Gedächtnis*

08.02.12. Prof. Dr. Iain Gordon (University of Edinburgh), *Quantization of symplectic varieties and representation theory*

Summer term 2012

11.04.12. Prof. Dr. Volker Betz (TU Darmstadt), *Brown'sche Bewegung, Feynman-Kac-Pfadintegrale und Bose-Einstein-Kondensation: Methoden der Wahrscheinlichkeitstheorie in der mathematischen Quantenphysik*

18.04.12. Prof. Dr. Benoît Daniel (University of Lorraine, Nancy), *Constant mean curvature surfaces in homogeneous manifolds*

25.04.12. Prof. em. Dr. Günter Harder (Max-Planck-Institut für Mathematik, Bonn), *Kohomologie arithmetischer Gruppen und zahlentheoretische Anwendungen*

02.05.12. Prof. Dr. Joachim von zur Gathen (Bonn-Aachen International Center for Information Technology (b-it) Bonn), *Census of polynomials*

09.05.12. Prof. Dr. Werner Schindler (Bundesamt für Sicherheit in der Informationstechnik (BSI), Bonn, and Center for Advanced Security Research Darmstadt (CASED)), *Stochastik und mathematische Statistik in der Kryptographie und IT-Sicherheit*

16.05.12. Prof. Dr. Lisa Hefendehl-Hebeker (Universität Duisburg-Essen), *Zur Entwicklung algebraischen Denkens – von präalgebraischen Kontexten zum "Structure Sense"*

23.05.12. Prof. Dr. Ivan Izmestiev (TU Darmstadt), *Infinitesimale Starrheit konvexer Flächen und Variationen des Hilbert-Einstein-Funktionals*

30.05.12. Graduation Ceremony for winter term 2011/2012 and summer term 2012: Prof. Dr. Günter M. Ziegler (FU Berlin), *"Das ist doch keine Kunst?" Sieben Bilder aus der Mathematik*

06.06.12. Prof. Dr. Joachim Escher (Universität Hannover), *Zur Regularitätstheorie von Lösungen des klassischen Wasserwellenproblems*

13.06.12. Prof. Dr. Stefan Müller-Stach (Universität Mainz), *Perioden und Motive: eine Einführung*

20.06.12. Prof. Dr. Willem Hundsdorfer (Centrum Wiskunde & Informatica, Amsterdam), *IMEX Methods: Attempts to get the best from Implicit and Explicit Methods*

27.06.12. Prof. Dr. Ysette Weiss-Pidstrygach (Universität Mainz), *Geschichte der Mathematik als Quelle der Inspiration zur Unterrichtsgestaltung*

04.07.12. Prof. Dr. Benjamin Miller (Universität Münster), *Borel equivalence relations, classification problems, and definable cardinality*

11.07.12. Prof. Dr. Marc Pfetsch (TU Darmstadt), *Compressed Sensing und Diskrete Optimierung*

Winter term 2012/2013

17.10.12. Prof. Dr. Priska Jahnke (TU Darmstadt), *Klassifikation algebraischer Varietäten und ihre Bedeutung in der Kryptographie*

24.10.12. Prof. Dr. Vasco Brattka (Universität der Bundeswehr München), *Wie kann man mathematische Sätze sortieren?*

31.10.12. Prof. Dr. Martin Gander (University of Geneva), *Euler, Ritz, Galerkin, Courant: On the road to the finite element method*

07.11.12. Prof. Dr. Patrizio Neff (Universität Duisburg-Essen), *Neues zur Kornschen Ungleichung in der linearen Elastizitätstheorie*

14.11.12. Prof. Dr. Christian Haase (Universität Frankfurt), *Diskrete Methoden in Algebra und algebraischer Geometrie*

21.11.12. Prof. Dr. Isabelle Gallagher (University of Paris Diderot (Paris VII)), *On the geometry of the set of global solutions to the Navier-Stokes equations*

28.11.12. Prof. Dr. Anton Wakolbinger (Universität Frankfurt), *Zufällige Genealogien*

05.12.12. Prof. Dr. Robert Denk (Universität Konstanz), *Pseudodifferentialoperatoren und maximale L^p-Regularität*

12.12.12. Prof. Dr. Manfred Lehn (Universität Mainz), *Der Satz von Grothendieck-Brieskorn-Slodowy und symplektische Hyperflächensingularitäten*

19.12.12. Prof. Dr. Gerhard Huisken (Max-Planck-Institut für Gravitationsphysik, Potsdam-Golm), *Der Fluss von Flächen entlang der inversen mittleren Krümmung und seine Anwendungen*

16.01.13. Prof. Dr. Stefan Ufer (LMU München), *Lernen aus Fehlern im Mathematikunterricht*

23.01.13. Prof. Dr. Martin Möller (Universität Frankfurt), *Kenngrößen für die Dynamik von Billardtischen*

30.01.13. Prof. Dr. Volker Kaibel (Universität Magdeburg), *Erweiterte Formulierungen ganzzahliger Optimierungsprobleme*

06.02.13. Prof. Dr. Stefan Volkwein (Universität Konstanz), *A-Posteriori-Fehleranalyse für die Optimalsteuerung von partiellen Differentialgleichungen: Analysis und Numerik*

13.02.13. Prof. Dr. Irwin Yousept (TU Darmstadt), *Optimal control of electromagnetic processes and its modern applications*

6.2 Seminar Talks

06.06.12. Prof. Dr. Joachim Escher (Universität Hannover), *Zur Regularitätstheorie von Lösungen des klassischen Wasserwellenproblems*

17.02.12. Prof. Corneliu Balan (Polytechnical University of Bukarest), *Rheology and thermodynamics of viscoelastic materials*

09.02.12. Prof. Henri Gouin (University of Aix-Marseille and C.N.R.S. UMR 6181), *Interactions between liquids and solids. Fluid motions at nanoscales*

08.08.11. Prof. Azei Tezuka (WASEDA University), *Global stability of flow around various shaped objects*

11.07.11. Dr. Viactehslav Bykov (Karlsruhe Institute of Technology (KIT)), *Model reduction for chemically reacting flows*

25.09.11. Prof. Dr. Anne Prescott (University of Technology Sydney, Australia), *Teacher professionell Development-research questions and answers*

29.03.11. Dr. Shaul Zemel (Hebrew University, Israel), *Relations between Heegner cycles over modular and Shimura curves*

15.05.12. Dr. Martin Raum (MPIM, Bonn), *Why does the two-variable μ-function split*

26.06.12. Prof. Stephen Kudla (University of Toronto, Canada), *Modular generating series for arithmetic special cycles*

10.07.12. Prof. Dr. Jens Funke (University of Durham, UK), *The Kudla-Millson theta lift for SO(2,2)*

24.07.12. Dr. Larry Rolen (University of Atlanta, USA), *Integrality of Hilbert class polynomials for non-holomorphic modular functions*

20.11.12. Dr. Hatice Bolyan (Universiät Siegen), *Linear characters of Hilbert modular groups and associated automorphic forms*

11.05.11. Dipl.-Math. Giulia Giantesio (Università di Ferrara, Italien), *MHD oblique stagnation-point flow*

13.07.11. Prof. Dr. Alexander Ramm (Kansas State University, Manhattan, USA), *Stability of solutions to some evolution problems*

23.03.12. Costas Poulios (University of Athens), *The fixed point property on tree-like Banach spaces*

11.01.11. Prof. Dr. Dirk Blömker (Universität Augsburg), *On a PDE from surface growth - Problems with existence and uniqueness*

18.01.11. Thorsten Riedl (Universität Bayreuth), *Existence, Uniqueness Questions and Regularity of Solutions to div* $v = p$, $v \in H_0^{m,q}(G)$

25.01.11. PD Dr. Peer Kunstmann (Karlsruhe Institute of Technology (KIT)), *On optimal* L^p *-* L^q *estimates for parabolic boundary value problems*

01.02.11. Dr. Mats Ehrnström (Universität Hannover), *Existence of steady water waves with multiple critical layers*

01.02.11. Andreas Schulz (RWTH Aachen), *Über die optimale Rohrform beim Flüssigkeitstransport*

08.02.11. Dr. Kohei Soga (Waseda University, Tokyo, Japan), *Continous limit of random walks and its application to approximation of nonlinear PDEs*

28.02.11. Prof. Dr. Josef Malek (Charles University, Prague), *Non-Newtonian fluid mechanics and analysis of relevant boundary-value problems*

28.02.11. Prof. Dr. Takaaki Nishida (Waseda University), *Pattern formation of heat convection problems*

28.02.11. Prof. Dr. Boris Vexler (TU München), *Space-time finite element methods for optimal control problems*

28.02.11. Thorsten Riedl (Universität Bayreuth), *Existence, Uniqueness Questions and Regularity of Solutions to div* $v=p$

28.02.11. Piotr Minakowski (University of Warsaw), *On the constitutive relations for electrorheological fluids*

01.03.11. Hani Ali (University of Rennes), *On a critical Leray alpha model of turbulence: Regularity and Singularity issues*

01.03.11. Jan Burczak (University of Warsaw), *On the blowup of parabolic-parabolic Keller-Segel system*

01.03.11. Giulia Giantesio (University of Ferrara), *MHD oblique stagnation-point flow of a Newtonian fluid*

01.03.11. Tomasz Piasecki (University of Warsaw), *Compressible perturbation of a Poiseuille-type flow with slip boundary conditions*

01.03.11. Joanna Renclawowicz (University of Warsaw), *On global nonstationary flow for the Navier-Stokes equations*

01.03.11. Masahiro Suzuki (Waseda University, Tokyo), *Stationary solutions to the Euler-Poisson equations arising in plasma physics*

02.03.11. Jan Brezina (Kyushu University), *On the linearized stability of time-periodic parallel flows to the compressible Navier-Stokes equations*

02.03.11. Dr. Elfriede Friedmann (Universität Heidelberg), *Efforts in drag calculation of rough surfaces in turbulent flow: Modeling and asymptotic analysis*

02.03.11. Matthias Maier (Universität Heidelberg), *Efforts in drag calculation of rough surfaces in turbulent flow: Numerical simulation and validation*

02.03.11. Prof. Dr. Sarka Nečasová (Academy of Sciences of the Czech Republic, Prague), *On a model in radiation hydrodynamics*

02.03.11. Takahiro Okabe (Tohoku University, Sendai), *L^2 decay of the Navier-Stokes flow in the half-space*

02.03.11. Gabriela Rusnakova (Universität Mainz), *Modeling of Blood Flow in Compliant Vessels: Numerical Results & Stability Analysis*

19.04.11. Prof. Dr. Lorenzo Brandolese (University of Lyon, France), *Large time behavior for a viscous Boussinesq system*

26.04.11. Dr. Philipp Reiter (Universität Freiburg), *Approximation nicht-konvexer anisotroper Energien*

10.05.11. Daniel Lengeler (Universität Freiburg), *Global existence for a fluid-shell interaction problem*

17.05.11. Prof. Dr. Muriel Boulakia (Pierre-and-Marie-Curie University (Paris VI)), *Controllability of a fluid-structure interaction problem*

24.05.11. Prof. Dr. Juan Carlos de los Reyes (National Technical University, Quito), *PDE-constrained optimization techniques for nonsmooth problems arising in fluid mechanics*

30.05.11. Prof. Dr. Yoshikazu Giga (University of Tokyo), *Analyticity of the Stokes semigroup in Spaces of Bounded Functions*

14.06.11. Prof. Dr. Pierre-Etienne Druet (WIAS Berlin), *On existence and regularity results for the equations of magnetohydrodynamics in complex geometries*

29.06.11. Prof. Dr. Michael Renardy (Virginia Tech, U.S.A), *Zur Stabilität viskoelastischer Strömungen*

12.07.11. Prof. Dr. Antonio Russo (Second University of Naples), *Existence theorem for the steady-state two-dimensional exterior Navier-Stokes equations*

15.09.11. Dr. Satoshi Yokoyama (Waseda University), *Construction of weak solutions of a certain stochastic Navier-Stokes equation*

18.10.11. Prof. Dr. Dorin Bucur (University of Savoy), *A Gamma convergence approach to the rugosity effect*

18.10.11. Prof. Dr. Edriss Titi (University of California, Irvine & Weizmann Institute), *A Numerical Algorithm for Advancing Slow Features in Fast-Slow Systems without Scale Separation - A Young Measure Approach*

25.10.11. Konrad Böttcher (TU Dortmund), *Radial spreading and stability of thin rotating drops*

01.11.11. Erika Ushikoshi (Tohoku University), *Hadamard variational formula for the Green Matrix of the Stokes equations*

08.11.11. Prof. Dr. Hans Knüpfer (Universität Bonn), *Moving contact line and lubrication approximation*

08.11.11. Prof. Dr. Daoyuan Fang (Zhejiang University, China), *Global solution for the idea incompressible viscoelastic fluids in the critical L^p framework*

15.11.11. Kendy Diogo Matsumoto (Waseda University), *Dynamical braces and dynamical Yang-Baxter maps*

15.11.11. Yoichi Enatsu (Waseda University), *Stability analysis of a positive equilibrium for delayed epidemic models*

22.11.11. Hajime Koba (Waseda University), *Weak solutions of an Ekman perturbed system, the uniqueness, and the smoothness*

22.11.11. Ken Abe (Waseda University), *Generation of analytic semigroups by the Stokes operator in spaces of bounded functions*

06.12.11. Prof. Dr. Yutaka Terasawa (University of Tokyo), *On Hausdorff dimension of Blow-Up times relavant to weak solutions of generalized Navier-Stokes fluids*

13.12.11. Dr. Sven Groß (RWTH Aachen), *XFEM for 3D incompressible two-phase flow problems*

20.12.11. Bin Han (Zhejiang University, China), *Global existence for the two dimensional incompressible viscous fluid with linearly growing initial velocity*

20.12.11. Ruizhao Zi (Zhejiang University, China), *Decay Estimates for Isentropic Compressible Navier-Stokes Equations in Bounded Domain*

10.01.12. Prof. Dr. Wolf-Patrick Düll (Universität Stuttgart), *Approximation theorems for the water wave problem in the arc length formulation*

17.01.12. Prof. Dr. Wolfgang Dreyer (WIAS Berlin), *The incompressible two-phase flow in the diffuse interface setting*

24.04.12. Dr. Elfriede Friedmann (Universität Heidelberg), *In search of an optimal surface: drag predictions of rough surfaces from boundary layer models*

08.05.12. Mathias Wilke (Universität Halle-Wittenberg), *On the Rayleigh-Taylor instability for the two-phase Navier-Stokes equations with surface tension in a capillary*

15.05.12. Prof. Dr. Jörg Wolf (Universität Magdeburg), *Generalization of the Caffarelli-Kohn-Nirenberg theorem with applications in the theory of Newtonian and non-Newtonian incompressible fluids*

29.05.12. Prof. Dr. Gudrun Thäter (Karlsruhe Institute of Technology (KIT)), *Rayleigh-Bénard-Convection: Boussinesq approximation and generalizations*

19.06.12. Prof. Dr. Simon Blatt (University of Warwick), *Analysis of O'Hara's knot energies*

26.06.12. Hirokazu Saito (Waseda University), *On the $L_p - L_q$ maximal regularity of the Neumann-Dirichlet problem for the Stokes equations in an infinite layer*

03.07.12. Miho Murata (Waseda University), *On the sectorial $\mathscr{R}$-boundedness of the Stokes operator for the compressible viscous fluid flow with slip boundary condition*

03.07.12. Ruizhao Zi (Zhejiang University), *Global classical large solutions to a 1D fluid-particle interaction model: The bubbling regime*

03.07.12. Hui Chen (Zhejiang University), *Remark on multiscale asymptotic behavior of the Schrodinger equation*

10.07.12. Prof. Dr. Nader Masmoudi (Courant Institute, New York), *Existence Results for some Micro-Macro Models*

10.07.12. Prof. Dr. Chun Liu (Penn State, State College), *Energetic Variational Approaches for Ionic Fluids and Ion Channels*

10.07.12. Prof. Dr. Yasunori Maekawa (Kobe University), *On zero viscosity limit of viscous incompressible flows in the half plane*

10.07.12. Prof. Dr. László Szekélyidi (Universität Leipzig), *Dissipative Euler flows and Onsager's conjecture*

10.07.12. Prof. Dr. Uwe Thiele (Loughborough University), *The rugged beauty of deposition patterns at receding contact lines*

10.07.12. Dr. Elfriede Friedmann (Universität Heidelberg), *Analytical and numerical issues about Drag Predictions from boundary layer models of turbulent flow over rough surfaces*

10.07.12. Thomas Wick (Universität Heidelberg), *Adaptive Finite Elements for PDE-Constrained Optimization with Fluid-Structure Interaction*

10.07.12. Tristan Buckmaster (Universität Leipzig), *The Korteweg-de Vries Equation at H^{-1} regularity*

11.07.12. Dr. Franck Sueur (Pierre-and-Marie-Curie University (Paris VI)), *Uniqueness results for weak solutions of two-dimensional fluid-solid systems*

11.07.12. Prof. Dr. Michael Růžička (Universität Freiburg), *Numerical analysis of problems with p-structure*

11.07.12. Prof. Dr. Joachim Naumann (HU Berlin), *Remarks on Kolmogorov's and Prandtl's model of turbulence*

11.07.12. Prof. Dr. Slim Ibrahim (University of Victoria), *On the wellposedness of the Navier-Stokes Maxwell equations*

11.07.12. Prof. Dr. Werner Varnhorn (Universität Kassel), *On extensions of Serrin's condition for the Navier-Stokes equations*

11.07.12. Dr. Thomas Richter (Universität Heidelberg), *Fluid-Structure Interactions in Eulerian Coordinates*

11.07.12. Mathias Wilke (Universität Halle-Wittenberg), *On the Rayleigh-Taylor instability for the two-phase Navier-Stokes equations with surface tension in a capillary*

12.07.12. Prof. Dr. Raphael Danchin (University of Paris XII), *A Lagrangian approach for inhomogeneous incompressible fluids*

12.07.12. Prof. Dr. Daoyuan Fang (Zhejiang University, Hangzhou), *Strong Solutions of 3D Compressible Oldroyd-B Fluids*

12.07.12. Prof. Dr. Luc Molinet (University of Tours), *Newtonian limit for some viscoelastic models*

12.07.12. Prof. Dr. Hideo Kozono (Waseda University), *Uniqueness of weak solutions of the Navier-Stokes equations in general unbounded domains*

12.07.12. Prof. Dr. Hans Knüpfer (Universität Bonn), *Well-posedness & Lubrication approximation of the Darcy flow in the presence of a moving contact line*

12.07.12. Prof. Dr. Okihiro Sawada (Gifu University), *Ill-posedness and norm-inflation arguments of the 3-D Navier-Stokes*

12.07.12. Prof. Dr. Sarka Nečasová (Academy of Sciences of the Czech Republic, Prague), *Weak solutions for the motion of a self-propelled deformable structure in a viscous incompressible fluid*

12.07.12. PD Dr. Peer Kunstmann (Karlsruhe Institute of Technology (KIT)), *Functional calculi for some operators in fluid dynamics*

13.07.12. Prof. Dr. Eduard Feireisl (Academy of Sciences of the Czech Republic, Prague), *A new approach to thermodynamics of liquid crystals*

13.07.12. Prof. Dr. Helmut Abels (Universität Regensburg), *On a Diffuse Interface Model for Two-Phase Flows with Different Densities and Degenerate Mobility*

13.07.12. Prof. Dr. Sylvie Monniaux (Paul Cézanne University Aix-Marseille III), *Navier-Stokes-Coriolis equations in unbounded domains*

13.07.12. Prof. Dr. Yoshihiro Shibata (Waseda University), *On some unique existence theorem of strong solutions in the mathematical theory of viscous compressible fluid flow*

13.07.12. Prof. Dr. Andreas Prohl (Universität Tübingen), *Space-time discretization of the stochastic incompressible Navier-Stokes equation*

13.07.12. Prof. Dr. Jan Prüss (Universität Halle-Wittenberg), *Modeling and Analysis of Incompressible Two-Phase Flows with Phase Transitions and Variable Surface Tension*

16.10.12. Ken Abe (Waseda University), *Stokes resolvent estimates in spaces of bounded functions*

23.10.12. Tomoyuki Nakatsuka (Waseda University), *Uniqueness of steady Navier-Stokes flows in exterior domains*

30.10.12. Dr. Martin Meyries (Universität Halle-Wittenberg), *Traces and embeddings of anisotropic function spaces*

20.11.12. Prof. Dr. Isabelle Gallagher (University of Paris Diderot (Paris VII)), *Remarks on global solutions to the incompressible Navier-Stokes equations*

27.11.12. Pen-Yuan Hsu (Waseda University), *On nonexistence for stationary solutions to the Navier-Stokes equations with a linear strain*

27.11.12. Yuto Imai (Waseda University), *The quarternification of the Lie algebra $Map(S^3, g)$ and its central extension*

11.12.12. Dr. Bogdan-Vasile Matioc (Universität Wien), *Two-phase flows in porous media*

10.05.11. Prof. Dr. Jaap van Oosten (University of Utrecht), *Another Heyting Algebra for embedding the Turing degrees*

13.05.11. Christian Ikenmeyer (Universität Paderborn), *Introduction to Geometric Complexity Theory and Tensor Rank*

20.05.11. Dr. Martin Lotz (University of Edinburgh), *Geometry and Complexity in Optimization*

07.07.11. Victor Poupet (Aix-Marseille University), *Elementary construction of an aperiodic tile set*

08.07.11. Prof. Dr. Vasco Brattka (University of Cape Town), *Computable Analysis in the Weihrauch Lattice*

05.08.11. Dr. Akitoshi Kawamura (University of Tokyo), *Why Lipschitz Continuous Ordinary Differential Equations are Polynomial-Space Complete*

16.09.11. Dr. Akitoshi Kawamura (University of Tokyo), *Distance k-Sectors and zone diagrams*

07.10.11. Takayuki Kihara (Tohoku University), *Non-computability of planar continua*

07.10.11. Hideki Tsuiki (University of Kyoto), *Unimodal Maps as Boundary-Restrictions of Two-Dimensional Full-Folding Maps*

11.11.11. Shiguang Feng (Sun Yat-sen University Guangzhou), *The expressive Power and Complexity of second-ordered extended Horn Logic and Krom Logic*

06.12.11. Dr. Paulo Oliva (Queen Mary University of London), *On the restricted form of Spector's bar recursion*

12.01.12. Yoshihiro Maruyama (Oxford University), *Chu duality, Born coalgebras, and quantum symmetries*

13.01.12. Prof. Dr. Sam Sanders (Ghent University), *Reuniting the antipodes: Bringing together Nonstandard Analysis and Constructive Analysis*

18.01.12. Prof. Dr. Jean-Yves Beziau (Federal University of Rio de Janeiro), *Universal Logic: A general completeness theorem*

20.04.12. Samuele Maschio (University of Pavia), *Initial algebras and internal syntax*

02.05.12. Prof. Dr. Joachim von zur Gathen (Bonn-Aachen International Center for Information Technology), *Census of polynomials*

18.05.12. Dr. Andrey Morozov (Sobolev Institute of Mathematics), *On Sigma-definability of structures over the reals*

01.06.12. Prof. Dr. André Nies (University of Auckland), *Algorithmic randomness and differentiability*

22.06.12. Atefeh Keshavarzi Zafarghandi (Amirkabir University of Technology), *Dynamical System via Domain Theory*

04.07.12. Prof. Dr. Benjamin Miller (Universität Münster), *Borel equivalence relations, classification problems, and definable cardinality*

06.07.12. Prof. Dr. Benjamin Miller (Universität Münster), *An anti-basis theorem for definable cardinals*

17.07.12. Prof. Dr. Hans-Peter Künzi (University of Cape Town), *The Katetov construction revisited*

24.08.12. Tahereh Jafarikhah (University of Tehran), *Computable Riesz representation on the dual of C[0;1]*

24.08.12. Hiroyuki Ota (University of Tokyo), *Computational complexity of smooth differential equations*

21.09.12. Arno Pauly (University of Cambridge), *Synthetic Descriptive Set Theory*

19.10.12. Viktor Winschel (Universität Mannheim), *Coalgebraic Analysis of Subgame-perfect Equilibria in Infinite Games without Discounting - Towards Reflexive Economics*

24.10.12. Prof. Dr. Vasco Brattka (Universität der Bundeswehr München), *Wie kann man mathematische Sätze sortieren?*

26.10.12. Prof. Dr. Reiner Hähnle (TU Darmstadt, Fachbereich Informatik), *Abstract Symbolic Execution*

09.11.12. PD Dr. Laurentiu Leustean (Simion Stoilow Institute of Mathematics of the Romanian Academy), *Proof mining in nonlinear analysis*

14.11.12. Prof. Christian Haase (Universität Frankfurt), *Linearsysteme auf tropischen Kurven*

16.11.12. PD Dr. Olaf Beyersdorff (Universität Hannover), *How difficult is it to verify proofs?*

23.11.12. Makoto Fujiwara (Tohoku University), *Marriage Theorem for Countable Graphs and Computability*

29.11.12. Dr. Rasmus Møgelberg (ITU Copenhagen), *Presheaf models for guarded recursion*

04.12.12. Dr. Tomer Kotek (University of Haifa), *Applications of logic in graph theory: definability of graph invariants*

14.12.12. Dr. Kord Eickmeyer (National Institute of Informatics, Tokyo), *Order-invariant logics on restricted classes of structures*

07.02.11. Dr. Hassan Farshbaf-Shaker (Universität Regensburg), *A Relaxation approach to Allen-Cahn MPEC problems*

29.03.11. Thomas Rehn (Universität Rostock), *Computational Tools for Exploiting Symmetries*

29.03.11. Brandon Dutra (University of California at Davis), *Software for Exact Integration of Polynomials Over Polyhedra*

11.04.11. Prof. Dr. Martin Rumpf (Universität Bonn), *Multi-Scale Linear and Nonlinear Elastic Shape Optimization under Uncertainty*

24.05.11. Prof. Dr. Juan Carlos De Los Reyes (National Technical University Quito), *PDE-constrained optimization techniques for nonsmooth problems arising in fluid mechanics*

30.05.11. Dr. Carsten Lange (FU Berlin), *Minkowski decompositions of associahedra*

06.06.11. Dr. Xavier Allamigeon (École Polytechnique), *Algorithmics of tropical polyhedra, and application to software verification*

10.11.11. Dr. Alexander Rahm (Weizmann Institute of Science), *Polyhedral models for arithmetic groups*

14.11.11. Dr. Priska Jahnke (TU Darmstadt), *Fano-Varietäten*

07.12.11. Pascal Benchimol (École Polytechnique), *Tropicalization of interior point methods in linear programming*

23.01.12. Dr. Nicole Megow (TU Darmstadt/MPI Saarbrücken), *Scheduling unter Unsicherheit: Modelle, Algorithmen und Praxisanwendungen*

14.03.12. Madhusudan Manjunath (MPI Saarbrücken), *Riemann-Roch theorems in discrete mathematics: an overview*

23.03.12. Dr. Mathieu Dutour Sikirić (Ruđer Bošković Institute, Zagreb), *Polyhedral: A GAP package for dual description and homology computations*

18.04.12. Arnaud Padrol (Polytechnic University of Catalonia), *Many neighborly polytopes*

27.04.12. Dr. Julian Pfeifle (Polytechnic University of Catalonia), *Removing symmetry from the Universal Polytope*

03.05.12. Dr. Thomas Albrecht (Forschungszentrum Dresden Rossendorf), *Control of fluid flow using electromagnetic body forces*

07.05.12. Dr. Benjamin Burton (University of Queensland, Brisbane), *Normal surface theory: Using the big machine*

07.05.12. Prof. Stephan Tillmann (University of Sydney), *Cross ratios, representations and valuations*

13.06.12. Dr. Nitin Ahuja (PTV AG), *Some Problems From The World Of Transport Logistics*

15.08.12. Prof. Dr. Benjamin Nill (Case Western Reserve University, Cleveland), *Von Ehrhart-Theorie zu fast-nachbarschaftlichen Polytopen*

06.09.12. Dr. Domenico Salvagnin (University of Padova), *Randomness and Tree Search / Approximating the first split closure*

10.09.12. Prof. Dr. Sebastian Pokutta (Georgia Tech), *Linear Programming Formulierungen für das TSP Polytop*

06.12.12. Prof. Dr. Dirk Pauly (Universität Duisburg-Essen), *Functional A Posteriori Error Estimates for Static Maxwell Type Problems*

10.12.12. Prof. Francsico Santos (University of Santander), *Diameter of simplicial complexes and their combinatorial abstractions*

13.04.11. Prof. Dr. Vladimir S. Rabinovich (IPN Mexico City), *The essential spectrum of pseudodifferential operators with operator-valued symbols*

07.06.11. Prof. Dr. Gerald Höhn (Kansas State University, USA), *Extremale Vertexoperator-Algebren*

21.06.11. Prof. Dr. Rudolf Scharlau (TU Dortmund), *Existenz und Nicht-Existenz extremaler Gitter*

05.07.11. Prof. Dr. Thorsten Wedhorn (Universität Paderborn), *The fundamental lemma (after Ngo)*

19.07.11. Dr. Nora Ganter (University of Melbourne, Australia), *Elliptic Schubert calcalus*

14.10.11. Prof. Dr. Martin Ziegler (TU Darmstadt), *An invitation to algebraic complexity theory*

25.10.11. Dr. Kappagantula Gopala Krishna (MPI Bonn), *Counting dyonic states in string theory using modular forms*

22.11.11. Prof. Dr. Winfried Kohnen (Universität Heidelberg), *Verallgemeinerte Modulformen*

29.11.11. Prof. Dr. Eberhard Freitag (Universität Heidelberg), *Einige neue Calabi-Yau Mannigfaltigkeiten*

07.08.12. Dr. Nora Ganter (University of Melbourne, Australia), *Representation and character theory in 2-categories*

18.12.12. Prof. Dr. Gerald Höhn (HIM Bonn), *Mathieu moonshine*

18.12.12. Prof. Dr. Tomoyuki Arakawa (RIMS Kyoto, Japan), *Affine W-algebras*

14.03.12. Dr. Stefan Görtz (Deutsches Zentrum für Luft- und Raumfahrt, Braunschweig), *Reduzierte Modelle für aerodynamische Berechnungen*

6.3 Visitors

Guillaume Rolland (ENS Cachan, Antenne de Bretagne), June 2011, December 2011.

Yangkyun Kim (Hokkaido University), January to February 2012.

Kohei Soga (Waseda University), January to February 2012.

Prof. Dr. Anne Prescott (University of Technology Sydney, Australia), September 2011.

Prof. Dr. Jens Funke (University of Durham, UK), July 2011.

Prof. Dr. Jens Funke (University of Durham, UK), December 2011.

Prof. Stephen Kudla (University of Toronto, Canada), December 2011.

Prof. Tonghai Yang (University of Wisconsin, USA), January 2012.

Prof. Tonghai Yang (University of Wisconsin, USA), May 2012.

Prof. Stephen Kudla (University of Toronto, Canada), June to July 2012.

Prof. Dr. Jens Funke (University of Durham, UK), July 2012.

Prof. Stephen Kudla (University of Toronto, Canada), October 2012.

Dipl.-Math. Giulia Giantesio (Università di Ferrara, Italien), April to July 2011.

Prof. Dr. Alexander Ramm (Kansas State University, Manhattan, USA), July 2011.

Prof. Dr. Josef Bemelmans (RWTH Aachen), May 2012.

Prof. Dr. Josef Malek (Mathematical Institute Charles University, Prague), February - March 2011.

Prof. Dr. Yoshikazu Giga (University of Tokyo), May - June 2011.

Prof. Dr. Robert Denk (Universität Konstanz), July 2011.

Prof. Dr. Edriss Titi (University of California, Irvine & Weizmann Institute), October 2011.

Prof. Dr. Yoshihiro Shibata (Waseda University, Tokyo), March 2012.

Prof. Dr. Chun Liu (Penn State, State College), July 2012.

Prof. Dr. Helmut Abels (Universität Regensburg), July 2012.

Prof. em. Sidney A. Morris (University of Ballarat), April 2012.

Prof. Dr. Dirk Blömker (Universität Augsburg), January 2011.

Thorsten Riedl (Universität Bayreuth), January 2011.

PD Dr. Peer Kunstmann (Karlsruhe Institute of Technology (KIT)), January 2011.

Dr. Mats Ehrnström (Universität Hannover), January - February 2011.

Andreas Schulz (RWTH Aachen), February 2011.

Dr. Kohei Soga (Waseda University), February 2011.

Prof. Dr. Takaaki Nishida (Waseda University), February - March 2011.

Prof. Dr. Boris Vexler (TU München), February - March 2011.

Prof. Dr. Yoshiaki Teramoto (Osaka University), February - March 2011.

Prof. Dr. Wojciech Zajaczkowski (Polish Academy of Sciences, Warsaw), February - March 2011.

Prof. Dr. Sarka Necasova (Czech Academy of Sciences, Prague), February - March 2011.

Prof. Dr. Asei Tezuka (Waseda University, Tokyo), March 2011.

Giacomo Albi (University of Ferrara), March 2011.

Hani Ali (University of Rennes), March 2011.

Robin Beier (Universität Bielefeld), March 2011.

Georgij Bispen (Universität Mainz), March 2011.

Johannes Brand (RWTH Aachen), March 2011.

Jan Brezina (Kyushu University), March 2011.

Jan Burczak (University of Warsaw), March 2011.

Matteo Cerminara (University of Pisa), March 2011.

Matthias Deipenbrock (RWTH Aachen), March 2011.

Paul Deuring (University of the Littoral Opal Coast, Calais), March 2011.

Elfriede Friedmann (Universität Heidelberg), March 2011.

Giulia Giantesio (University of Ferrara), March 2011.

Leonie Herden (RWTH Aachen), March 2011.

Norihiso Ikoma (Waseda University, Tokyo), March 2011.

Noboru Ito (Waseda University, Tokyo), March 2011.

Hajime Koba (Waseda University, Tokyo), March 2011.

Masahiro Kunimoto (Waseda University, Tokyo), March 2011.

Omar Lazar (University Paris-Est Marne-la-Vallée), March 2011.

Matthias Maier (Universität Heidelberg), March 2011.

Ute May (RWTH Aachen), March 2011.

Stefan Meyer (Universität Halle-Wittenberg), March 2011.

Piotr Minakowski (University of Warsaw), March 2011.

Atsuhiko Mizusawa (Waseda University, Tokyo), March 2011.

Dr. Yuka Naito (Waseda University, Tokyo), March 2011.

Takahiro Okabe (Tohoku University, Sendai), March 2011.

Tomasz Piasecki (University of Warsaw), March 2011.

Joanna Renclawowicz (University of Warsaw), March 2011.

Thorsten Riedl (Universität Bayreuth), March 2011.

Gabriela Rusnakova (Universität Mainz), March 2011.

Konrad Simon (Weizmann Institute, Rehovot), March 2011.

Mindaugas Skujus (Vilnius University), March 2011.

Masahiro Suzuki (Waseda University, Tokyo), March 2011.

Kamila Szumzilak (University of Warsaw), March 2011.

Erika Ushikoshi (Tohoku University, Sendai), March 2011.

Prof. Dr. Masao Yamazaki (Waseda University, Tokyo), March 2011.

Florian Zander (Universität Kassel), March 2011.

Prof. Dr. Asei Tezuka (Waseda University, Tokyo), March 2011.

Prof. Dr. Lorenzo Brandolese (University of Lyon, France), April 2011.

Dr. Philipp Reiter (Universität Freiburg), April 2011.

Prof. Dr. Daniel Lengeler (Universität Freiburg), May 2011.

Dr. Muriel Boulakia (Pierre-and-Marie-Curie University (Paris VI)), May 2011.

Prof. Dr. Juan Carlos de los Reyes (National Technical University, Quito), May 2011.

Norihisa Ikoma (Waseda University), May 2011.

Prof. Dr. Mi-Ho Giga (University of Tokyo), May - June 2011.

Prof. Dr. Yutaka Terasawa (University of Tokyo), May - June 2011.

Prof. Dr. Anne Robertson (University of Pittsburgh), June 2011.

Prof. Dr. Paolo Galdi (University of Pittsburgh), June - July 2011.

Prof. Dr. Pierre-Etienne Druet (WIAS Berlin), June 2011.

Prof. Dr. Michael Renardy (Virginia Tech), June - July 2011.

Prof. Dr. Yutaka Terasawa (University of Tokyo), July 2011.

Prof. Dr. Dirk Blömker (Universität Augsburg), July 2011.

Antonio Russo (Second University of Naples), July 2011.

Prof. Dr. Asei Tezuka (Waseda University, Tokyo), September 2011.

Prof. Dr. Gerhard Huisken (MPI Golm), September 2011.

Prof. Dr. Felix Otto (Universität Bonn), September 2011.

Dr. Satoshi Yokoyama (Waseda University), September 2011.

Prof. Dr. Dorin Bucur (University of Savoy), October 2011.

Prof. Dr. Daoyuan Fang (Zhejiang University, Hangzhou), October - November 2011.

Bin Han (Zhejiang University, Hangzhou), October 2011 - January 2012.

Ruizhao Zi (Zhejiang University, Hangzhou), October 2011 - January 2012.

Konrad Böttcher (TU Dortmund), October 2011.

Prof. Dr. Hans Knüpfer (Universität Bonn), November 2011.

Prof. Dr. Yutaka Terasawa (University of Tokyo), December 2011.

Dr. Sven Groß (RWTH Aachen), December 2011.

Prof. Dr. Wolf-Patrick Düll (Universität Stuttgart), January 2012.

Prof. Dr. Wolfgang Dreyer (WIAS Berlin), January 2012.

Dr. Hirofumi Notsu (Waseda University), January - February 2012.

Mario Kaip (Universität Konstanz), January 2012.

Tobias Nau (Universität Konstanz), January 2012.

Masashi Ohnawa (Waseda University), February 2012.

Dr. Elfriede Friedmann (Universität Heidelberg), April 2012.

Mathias Wilke (Universität Halle-Wittenberg), May 2012.

Prof. Dr. Jörg Wolf (Universität Magdeburg), May 2012.

Prof. Dr. Gudrun Thäter (Karlsruhe Institute of Technology (KIT)), May 2012.

Prof. Dr. Yoshiaki Teramoto (Osaka University), June 2012, August 2012.

Dr. Kohei Soga (Waseda University), June 2012.

Prof. Dr. Simon Blatt (University of Warwick), June 2012.

Hui Chen (Zhejiang University, Hangzhou), June - July 2012.

Ruizhao Zi (Zhejiang University, Hangzhou), June - July 2012.

Prof. Dr. Daoyuan Fang (Zhejiang University, Hangzhou), June - July 2012.

Dr. Issei Oikawa (University of Tokyo), June 2012.

Prof. Dr. Yukihito Suzuki (Waseda University), June 2012.

Prof. Dr. Masahisa Tabata (Waseda University), June 2012.

Dr. Hirofumi Notsu (Waseda University), June 2012.

Prof. Dr. Rainald Löhner (George Mason University, Fairfax), June 2012.

Prof. Dr. Yuri Bazilevs (University of California, San Diego), June 2012.

Prof. Dr. Raz Kupferman (The Hebrew University, Jerusalem), June 2012.

Prof. Dr. Arnold Reusken (RWTH Aachen), June 2012.

Prof. Dr. Volker John (WIAS Berlin), June 2012.

Prof. Dr. Karl Kunisch (Universität Graz, Austria), June 2012.

Prof. Dr. Stefan Turek (TU Dortmund), June 2012.

Prof. Dr. Michael Hinze (Universität Hamburg), June 2012.

Prof. Dr. Hideo Kozono (Tohoku University, Sendai), July 2012.

Prof. Dr. Okihiro Sawada (Gifu University), July 2012.

Prof. Dr. Yoshihiro Shibata (Waseda University, Tokyo), July 2012.

Prof. Dr. Yasunori Maekawa (Kobe University), July 2012.

Prof. Dr. Reza Aftabizadeh (Ohio University), July 2012.

Prof. Dr. Michael Růžička (Universität Freiburg), July 2012.

Prof. Dr. Joachim Naumann (HU Berlin), July 2012.

Prof. Dr. Uwe Thiele (Loughborough University), July 2012.

Tristan Buckmaster (Universität Leipzig), July 2012.

Prof. Dr. Raphael Danchin (University of Paris XII), July 2012.

Prof. Dr. Lars Diening (LMU München), July 2012.

Markus Klein (Universität Tübingen), July 2012.

Prof. Dr. Luc Molinet (University of Tours), July 2012.

Dr. Franck Sueur (Pierre-and-Marie-Curie University (Paris VI)), July 2012.

Dr. Thomas Richter (Universität Heidelberg), July 2012.

Prof. Dr. Edriss Titi (University of California, Irvine & Weizmann Institute), July 2012.

Alexander Schöwe (Universität Konstanz), July 2012.

Prof. Dr. Andreas Prohl (Universität Tübingen), July 2012.

Dr. Elfriede Friedmann (Universität Heidelberg), July 2012.

Prof. Dr. Sylvie Monniaux (Paul Cézanne University Aix-Marseille III), July 2012.

Prof. Dr. Slim Ibrahim (University of Victoria), July, 2012.

Prof. Dr. Nader Masmoudi (Courant Institute), July, 2012.

Prof. Dr. Thomas Wick (Universität Heidelberg), July 2012.

Florian Zanger (Universität Kassel), July, 2012.

Prof. Dr. László Szekélyidi (Universität Leipzig), July 2012.

PD Dr. Peer Kunstmann (Karlsruhe Institute of Technology (KIT)), July 2012.

Stefan Meyer (Universität Halle-Wittenberg), July 2012.

Prof. Dr. Werner Varnhorn (Universität Kassel), July 2012.

Prof. Dr. Jan Prüss (Universität Halle-Wittenberg), July 2012.

Matthias Eisenmann (TU Berlin), July 2012.

Mathias Wilke (Universität Halle-Wittenberg), July 2012.

Prof. Dr. Anna Mazzucato (Penn State University), July 2012.

Prof. Dr. Sarka Nečasová (Czech Academy of Sciences, Prague), July 2012.

Prof. Dr. Eduard Feireisl (Czech Academy of Sciences, Prague), July 2012.

Prof. Dr. Hans Knüpfer (Universität Bonn), July 2012.

Prof. Dr. Masahiro Kunimoto (Waseda University), August 2012.

Prof. Dr. Yoshiaki Teramoto (Osaka University), August – September 2012.

Dr. Martin Meyries (Universität Halle-Wittenberg), October 2012.

Prof. Dr. Isabelle Gallagher (University of Paris Diderot (Paris VII)), November 2012.

Dr. Bogdan-Vasile Matioc (Universität Wien), December 2012.

Prof. Dr. Rolf Gohm (Aberystwyth University), August/September 2011.

Prof. Dr. Gabriel Wittum (Universität Frankfurt), June 2011.

Jun.-Prof. Dr. Roland Pulch (Universität Wuppertal), April-October 2011.

Dr. Nilles (BASF Ludwigshafen), October 2011.

Prof. Dr. Rüdiger Weiner (Universität Halle-Wittenberg), February 2012.

Dr. Oswald Knoth (Leibnitz Institute for Tropospheric Research Leipzig), February 2012.

Prof. Dr. Willem Hundsdorfer (CWI Amsterdam), June 2012.

Prof. Dr. Martin Gander (University of Geneva), October 2012.

Hadrien Batmalle (ENS Cachan), May to August 2012.

Prof. Dr. Jean-Yves Beziau (Federal University of Rio de Janeiro), January 2012.

Prof. Dr. Vasco Brattka (University of Cape Town), July 2011.

Prof. Dr. Vasco Brattka (Universität der Bundeswehr München), October 2012.

Shiguang Feng (Sun Yat-sen University Guangzhou), November 2011.

Makoto Fujiwara (Tohoku University), September 2012 to March 2013.

Dr. David Janin (University Bordeaux I), October 2012.

Dr. Akitoshi Kawamura (University of Tokyo), July to September 2011.

Atefeh Keshavarzi Zafarghandi (Amirkabir University of Technology), June to August 2012.

Muhammad Aqeel Ahmad Khan (University of Bahawalpur), April to September 2012.

Takayuki Kihara (Tohoku University), October 2011.

Dr. Takayuki Kihara (Japan Advanced Institute of Sciences and Technology), June 2012.

Dr. Tomer Kotek (University of Haifa), December 2012.

Prof. Dr. Stephan Kreutzer (HU Berlin), May 2011.

Prof. Dr. Hans-Peter Künzi (University of Cape Town), July 2012.

Prof. Dr. Jimmie Lawson (Louisiana State University), November 2011 and October 2012.

PD Dr. Laurentiu Leustean (Simion Stoilow Institute of Mathematics of the Romanian Academy), November 2012.

Dr. Martin Lotz (University of Edinburgh), May 2011.

Yoshihiro Maruyama (Oxford University), January 2012.

Samuele Maschio (University of Pavia), February to July 2012.

Prof. Dr. Benjamin Miller (Universität Münster), July 2012.

Dr. Rasmus Møgelberg (ITU Copenhagen), November 2012.

Prof. Dr. Takakazu Mori (University of Kyoto), April to September 2012.

Dr. Andrey Morozov (Sobolev Institute of Mathematics), May 2012.

Prof. Dr. André Nies (University of Auckland), June 2012.

Prof. Dr. Damian Niwinski (University of Warsaw), May 2011.

Dr. Anvar Nurakunov (Kyrgyz Academy of Sciences), June 2012.

Dr. Paulo Oliva (Queen Mary University of London), December 2011.

Hiroyuki Ota (University of Tokyo), August 2012.

Arno Pauly (University of Cambridge), September 2012.

Kostas Poulios (University of Athens), March 2012.

Victor Poupet (Aix-Marseille University), July 2011.

Colin Riba (ENS Lyon), June 2012.

Prof. Dr. Sam Sanders (Ghent University), January 2012.

Prof. Dr. Marina Semenova (Sobolev Institute of Mathematics), March and April 2011.

Hideki Tsuiki (University of Kyoto), October 2011.

Brandon Dutra (University of California, Davis), March 27–April 1, 2011.

Pascal Benchimol (École Polytechnique), November 2011.

Dr. Benjamin Burton (University of Queensland, Brisbane), May 7–11, 2012.

Dr. Jonathan Spreer (University of Queensland, Brisbane), May 7–11, 2012.

William Patterson (University of Queensland, Brisbane), May 7–11, 2012.

Prof. Dr. Stephan Tillmann (University of Sydney), May 7–11, 2012.

Prof. Dr. Benjamin Nill (Case Western Reserve University, Cleveland), August 13–16, 2012.

Prof. Dr. Christian Haase (Universität Frankfurt), December 10–14, 2012.

Prof. Francisco Santos (University of Santander), December 10–14, 2012.

Dr. Domenico Salvagnin (University of Padova), June 5–6, 2012.

Prof. Dr. Vladimir S. Rabinovich (IPN Mexico City), March to April 2011.

Prof. Dr. Robert Denk (Universität Konstanz), May 2011.

Dr. Tobias Nau (Universität Konstanz), May 2011.

Prof. Dr. Yoshikazu Giga (University of Tokyo), June 2011.

Prof. Dr. Robert Denk (Universität Konstanz), December 2012.

Dr. Nora Ganter (University of Melbourne), July 2011 and August 2012.

Prof. Dr. Gerald Höhn (HIM Bonn), December 2012.

Prof. Dr. Tomoyuki Arakawa (RIMS Kyoto), December 2012.

Prof. Dr. Matthias Heinkenschloss (Rice University of Houston), June 2011, July 2012.

Prof. Dr. Bülent Karasözen (METU Ankara), July 2011, July 2012.

Prof. Dr. Dirk Pauly (Universität Duisburg-Essen), December 3–9, 2012.

6.4 Workshops and Conferences

- Workshop on modeling, optimization and simulation of complex fluid flow, 20.-22.06.12 (organized by Graduate School of Computational Engineering TU Darmstadt)
- Workshop about initial differentiation in math lessons (inservice-teacher-education for teacher-educators, Frankfurt), 24.01.2011 (organized by Regina Bruder)
- Workshops about initial differentiation in math lessons (inservice-teacher-education), for teacher-educators, Soest, founded by the Deutsche Telekom-Stiftung (project: teaching mathematics in a different way), 15.-16.02.2011 (organized by Regina Bruder)
- Workshops about initial differentiation in math lessons (inservice-teacher-education), for teacher-educators, Bünden (Herford), founded by the Deutsche Telekom-Stiftung (project: teaching mathematics in a different way), 16.03.2011 (organized by Regina Bruder)
- Workshops about initial differentiation in math lessons (inservice-teacher-education), for teacher-educators, Münster, founded by the Deutsche Telekom-Stiftung (project: teaching mathematics in a different way), 23.03.2011 (organized by Regina Bruder)
- Startup-workshop for our 5-half-year online-teacher-training courses at Darmstadt, March 2011 (organized by Regina Bruder and Axel Böhnke)
- Workshops about initial differentiation in math lessons (inservice-teacher-education), for teacher-educators, Gütersloh, founded by the Deutsche Telekom-Stiftung (project: teaching mathematics in a different way), 25.05.2011 (organized by Regina Bruder)

- Workshop in Graz, Austria about the development of math competencies (inservice-teacher-education for teacher-educators), 26.09.2011 (organized by Regina Bruder)
- Startup-workshop for our 5-half-year online-teacher-training courses at Darmstadt, September 2011 (organized by Regina Bruder and Axel Böhnke)
- Workshop in Eisenstadt, Austria (inservice-teacher-education), 27.02.2012 (organized by Regina Bruder)
- Startup-workshop for our 5-half-year online-teacher-training courses at Darmstadt, March 2012 (organized by Regina Bruder and Axel Böhnke)
- Startup-workshop for our 5-half-year online-teacher-training courses at Darmstadt, September 2012 (organized by Regina Bruder and Axel Böhnke)
- Workshop in Linz, Austria (inservice-teacher-education), 26.-27.11.2012 (organized by Regina Bruder)
- Student Conference on Automorphic Forms, October 13-14, 2011 (organized by Claudia Alfes, Jan Hendrik Bruinier and Stephan Ehlen)
- International Conference: Vorticity, Rotation and Symmetry (II) - Regularity of Fluid Motion, May 23 to 27, 2011 (organized by Reinhard Farwig, Jiri Neustupa and Patrick Penel)
- Turbulence and Reactive Flows, GAMM Annual Meeting 2012, March 26 to 30, 2012 (organized by Reinhard Farwig, Stefan Braun)
- International Conference: Parabolic and Navier-Stokes Equations, September 02 to 08, 2012 (organized by Reinhard Farwig, Wojciech Zajaczkowski, Jiri Neustupa, Yoshihiro Shibata, Joanna Renclawowicz, Piotr Mucha)
- 7th Japanese-German International Workshop on Mathematical Fluid Dynamics, November 05 to 08, 2012 (organized by Reinhard Farwig, Matthias Hieber, Hideo Kozono, Yoshihiro Shibata)
- International Project Meeting *Multiscale structure-functional modeling of musculoskeletal mineralized tissues*, TU Darmstadt, 10.-12.01.11 (organized by Alf Gerisch)
- *Gruppen*-Seminar, 18.03.11 (organized by Ralf Gramlich)
- Young Set Theory Workshop, March 21st to 25th, 2011 (organized by Andrew Brooke-Taylor, Benjamin Seyfferth, Ioanna Dimitriou, Miguel Angel Mota, Philipp Schlicht and Thilo Weinert)
- Young Set Theory Workshop, April 30th to May 4th, 2012 (organized by Julien Melleray, Lionel Nguyen Van Thé, Todor Tsankov and Matteo Viale)
- Workshop Trends in Set Theory, July 8th to 11th, 2012 (organized by Piotr Koszmider, Janusz Pawlikowski, Grzegorz Plebanek, Marcin Sabok and Slawek Solecki)
- 6th European Congress of Mathematics, July 2nd to 7th, 2012 (organized by the Polish Mathematical Society and the Jagiellonian University in Krakow, chaired by Prof. Stefan Jackowski.)

– Spring School IRTG 1529, February 28 to March 3, 2011 (organized by International Research Training Group 1529)

– Special Lectures by Giovanni P. Galdi University of Pittsburgh, June 7 to July 4, 2011 (organized by International Research Training Group 1529)

– Klausurtagung IRTG 1529, July 4 to 5, 2011 (organized by International Research Training Group 1529)

– Summer Courses on Mathematical Fluid Dynamics, July 6 - 8, 2011 (organized by International Research Training Group 1529)

– Summer School IRTG 1529, September 12 - 16, 2011 (organized by International Research Training Group 1529, jointly with Universität Hannover)

– 4th Japanese-German International Workshop on Mathematical Fluid Dynamics, November 28 - December 2, 2011 (organized by International Research Training Group 1529, jointly with Waseda University, Tokyo)

– German-Japanese Mini-Workshop on Fluid Dynamics, January 31, 2012 (organized by International Research Training Group 1529)

– The 5th Japanese-German International Workshop on Mathematical Fluid Dynamics, June 11 - 15, 2012 (organized by International Research Training Group 1529, jointly with Waseda University, Tokyo)

– Conference on Complex Fluids, July 10 - 13, 2012 (organized by International Research Training Group 1529, jointly with M. Geissert, E. Titi)

– The 7th Japanese-German International Workshop on Mathematical Fluid Dynamics, November 5 - 8, 2012 (organized by International Research Training Group 1529, Waseda University, Tokyo)

– Klausurtagung IRTG 1529, November 29 - 30, 2012 (organized by International Research Training Group 1529)

– Third Summer Workshop on Algebraic Geometry, Universität Tübingen, July 21 to 22, 2011 (organized by Jürgen Hausen)

– Workshop Extremal Laurant Polynomials and Fano Varieties, FU Berlin, December 14 to 16, 2011 (organized by Klaus Altmann and Elena Martinengo)

– Ergodische Eigenschaften von Quanten-Geburts-und-Todes-Prozessen, February 22 to 25, 2011 (organized by Burkhard Kümmerer)

– Endlich-korrelierte Zustände und deren Verschränkung, March 05 to 07, 2012 (organized by Burkhard Kümmerer)

– Workshop on Mathematics of Computation, Feb 3, 2012 (organized by Jens Lang and Stefan Ulbrich)

– 2nd International Conference on Computational Engineering, Oct 4-6, 2011 (organized by Marek Behr, Jens Lang, Ernst Rank, Michael Schäfer)

– SCIP Workshop 2012, October 8 to 10, 2012 (organized by Sonja Mars and Marc Pfetsch)

– 1st `polymake` Workshop, March 31 and April 1, 2011 (organized by Katrin Herr, Sven Herrmann, Silke Horn, Michael Joswig, Katja Kulas, Benjamin Lorenz, and Andreas Paffenholz)

– 3rd `polymake` Workshop, March 22 and 23, 2012 (organized by Benjamin Assarf, Katrin Herr, Michael Joswig, Benjamin Lorenz, and Andreas Paffenholz)

– Zsigmondy Colloquium, March 5 to 7, 2012 (organized by Elmar Bonnacurso, Valentina Marcon, Jürgen Saal)

– SIAM Conference on Optimization 2011, May 16–19, 2011 (organized by Conference Co-Chairs: Michael Ferris, University of Wisconsin, USA, Stephen Vavasis, University of Waterloo, Canada; Local Chair: Stefan Ulbrich, TU Darmstadt)

– Workshop on modeling, optimization and simulation of complex fluid flow, June 20–22, 2012 (organized by Dieter Bothe, Michael Schäfer, Stefan Ulbrich, TU Darmstadt and by Mária Lukáčová, Universität Mainz)

– 64. Workshop über Algorithmen und Komplexität, Oct 4 to 5, 2012 (organized by Ulrike Brandt and Martin Ziegler)

6.5 Scientific and Industrial Cooperations

Hans-Dieter Alber

– B. Markert (Universität Stuttgart), R. Müller (TU Kaiserslautern): Analytical and numerical comparison of a hybrid phase field model for phase transitions and damage with the Allen-Cahn model.

– A. Böttcher (TU Darmstadt): Solution of the hybrid phase field model with finite elements.

– Peicheng Zhu (Basque center of applied mathematics, Bilbao): Existence theory for phase field models.

Maksym Berezhnyi

– Prof. Dr. E. Khruslov (ILTPE of NASU): Project PICS of CNRS, Mathematical Physics-methods and applications (France-Ukraine, 2009-2011).

Volker Betz

– Dr. Daniel Ueltschi (University of Warwick): Spatial random permutations and Bose-Einstein condensation.

– Prof. Dr. George Hagedorn (Virginia Tech): Nonadiabatic Transition through Born-Oppenheimer surfaces.

– Prof. Dr. Tadahisa Funaki (University of Tokyo): Interacting Brownian motions and motion by mean curvature.

– Prof. Dr. Erwin Bolthausen (Universität Zürich): Enhanced binding via path integrals.

Dieter Bothe

– Prof. Dr. Wolfgang Dreyer (Weierstrass-Institut für Angewandte Analysis und Stochastik, Leibniz-Institut im Forschungsverbund Berlin e. V.): Continuum thermodynamics of chemical reacting fluid mixtures.

– Prof. Dr. Reinhard Miller (Max-Planck-Institut für Kolloid- und Grenzflächenforschung): Experimental and computational Analysis of fluidic interfaces influenced by soluble surfactant.

– Prof. Dr. Michel Pierre (ENS Cachan, Antenne de Bretagne): Analysis of reaction-diffusion systems.

– Prof. Dr. Jan Prüss (Universität Halle-Wittenberg): Analysis of Navier-Stokes equations for non-standard boundary conditions.

– Prof. Dr. Anne-Marie Robertson (University of Pittsburgh): Dynamics of buoyant oil droplets.

– Prof. Dr. Michael Schlüter (Institut für Mehrphasenströmung TU Hamburg-Harburg): Increasing the energy efficiency and reduction of greenhouse emissions via multiscale modeling of multiphase reactors – "Multi-Phase".

– Prof. Dr. Martin Sommerfeld (Universität Halle-Wittenberg): Direct Numerical Simulations and Computational analysis of binary droplet collisions for complex fluids.

– Prof. Dr. H.-J. Warnecke (Universität Paderborn): Mass transfer from rising gas bubbles.

– Prof. Dr. Bernhard Weigand (Universität Stuttgart): Theoretical and numerical investigation of reactive mass transfer at rising gas bubbles.

Stefanie Bott

– Graduate School GSC 233: “Computational Engineering”. German Excellence Initiative. Speaker Prof. Dr. Michael Schäfer (Department of Mechanical Engineering, TU Darmstadt).

Christian Brandenburg

– International Research Training Group (IGK 1529): “Mathematical Fluid Dynamics”. Speaker Prof. Dr. Matthias Hieber (TU Darmstadt).

Regina Bruder

– Texas Instruments, Mr. Stephan Griebel: Evaluation of model-projects in Hessen, Niedersachsen, Rheinland-Pfalz and scientific coaching in Hamburg and Schleswig-Holstein (issue: computerbased learning Mathematics)..

– Ministry of Education Hessen, Rheinland-Pfalz, Niedersachsen and Hamburg: Development of concepts for further teacher training.

– IGD Darmstadt, Dr. Göbel: Quality of game-based learning.

– PH Freiburg, Prof. Dr. Timo Leuders, Prof. Dr. Markus Wirtz: Research project for diagnostic of competencies (modeling, problem solving).

– ion2s, Agency for Interaction Darmstadt, Mr. Sauer: Third party certification of quality of E-Learning- Environments.

– Universität Kassel, Prof. Dr. Rolf Biehler: (Department of Mathematics) Development of bridge courses in Mathematics.

– University of Melbourn, Prof. Dr. Kaye Stacey: Development of instruments for evaluation of learning-results in math-lessons.

– Universität Graz, Dr. Alexandra Sindler: Development of quality of E-Learning on both universities (book-project).

– Institut für Qualitätsentwicklung im Bildungswesen, Berlin, Dr. Claudia Pöhlmann: Begleitforschung zur Implementation der Bildungsstandards.

– Department of Teacher Education (Amt für Lehrerbildung) Hessen, Frankfurt, Mr. Maitzen: Steuerungsgruppe zur Implementation der Bildungsstandards in Mathematik für das Land Hessen.

– University of Technology, Sydney, Prof. Dr. Anne Prescott: Development of competencies in the inservice training of Math-teachers and measurement of competencies.

– Prof. Dr. Gilbert Greefrath (Universität Münster) and Prof. Dr. Guido Pinkernell (Pädagogische Hochschule Heidelberg): Definition of basic knowledge on secondary level.

Jan H. Bruinier

– Prof. Dr. K. Ono (Emory University): Harmonic weak Maass forms.

– Prof. Dr. B. Howard (Boston College) and Prof. Dr. T. Yang (University of Wisconsin at Madison): Arithmetic intersection theory on Shimura varieties.

– Prof. Dr. J. Funke (University of Durham) and Prof. Dr. O. Imamoglu (ETH Zürich): Regularized theta liftings and periods of modular functions.

– Prof. Dr. E. Freitag (Universität Heidelberg): Automorphic products.

– Prof. Dr. S. Kudla (University of Toronto): Regularized theta liftings for symplectic groups.

Debora Clever

– Stefanie Bott, Prof. Dr. Stefan Ulbrich, Dr. Carsten Ziems (TU Darmstadt): Adaptive multilevel SQP-methods for PDAE-constrained optimization with restrictions on control and state. Supported by DFG, SPP 1253.

Moritz Egert

– Prof. Dr. F. Neubrander (Louisiana State University), J. Rozendaal (Delft University of Technology): Semigroup approximation without scaling and squaring.

Herbert Egger

– Prof. S. Arridge, PhD (University College London): Numerical Methods for Optical Tomography.

– Prof. Dr. A. Chernov (Universität Bonn): Stability estimates for the Raviart-Thomas projector.

– Prof. Dr. A. Düster (TU Hamburg-Harburg): Domain-decomposition preconditioners for the Finite-Cell Method.

– Prof. Dr. P. Egger (ETH Zürich): Unique Solutions for Prices in Dixit-Stiglitz and Eaton-Kortum Models of Trade.

– Dr. C. Waluga (TU München): Hybrid DG Methods for Incompressible Flow.

– Prof. Dr. B. Wohlmuth (TU München), Prof. Dr. U. Rüde (Universität Erlangen-Nürnberg): Finite Element Methods for Corner Singularities.

Sarah Essert

– Graduate School GSC 233: “Computational Engineering”. German Excellence Initiative. Speaker Prof. Dr. Michael Schäfer (Department of Mechanical Engineering, TU Darmstadt).

Reinhard Farwig

– Prof. Dr. Y. Taniuchi (Shinshu University Matsumoto): Problems on Uniqueness and Energy for Navier-Stokes Solutions.

– Prof. Dr. T. Hishida (Nagoya Univeristy): Asymptotic Theory for Navier-Stokes Equations.

– Prof. Dr. M. Yamazaki (Waseda University, Tokyo): Concentration-Diffusion Phenomena for Equations of Fluid Dynamics.

– Prof. Dr. H. Kozono (Waseda University, Tokyo): Theory of Weak, Very Weak and Strong Solutions to the Navier-Stokes System.

– Prof. Dr. S. Necasova (Academy of Sciences, Prague): Fluid Flow past Rotating Obstacles.

– Prof. Dr. J. Neustupa (Academy of Sciences, Prague): Regularity and Spectral Theory for Solutions to the Navier-Stokes System.

– Prof. Dr. W. Varnhorn (Universität Kassel): Regularity Theory for Weak Solutions to the Navier-Stokes System.

– Prof. Dr. H. Sohr (Universität Paderborn): Regularity Theory for Weak and Very Weak Solutions to the Navier-Stokes System.

Tobias Fischer

– Graduate School GSC 233: "Computational Engineering". German Excellence Initiative. Speaker Prof. Dr. Michael Schäfer (Department of Mechanical Engineering, TU Darmstadt).

Walter Freyn

– Prof. Dr. L. Carbone (Rutgers, the State University of New Jersey): Geometry of hyperbolic Kac-Moody algebras.

– Prof. Dr. H. Sati (University of Pittsburgh): Hyperbolic Kac-Moody algebras in M-theory.

– Prof. Dr. A. Feingold (Binghamton University): Geometry of Hyperbolic Kac-Moody algebras.

– Prof. Dr. C. Consani (Johns Hopkins University, Baltimore): Absolute algebraic geometry, Geometry over $\mathbb{F}_1$.

– Prof. Dr. E. Heintze (Universität Augsburg): Affine Kac-Moody geometry.

– Prof. Dr. P.-E. Caprace (UCL, Louvain-la-Neuve): Structure theory of hyperbolic Kac-Moody algebras.

– Prof. Dr. R. Köhl (Universität Gießen): Towards an algebraic theory of Kac-Moody symmetric spaces.

Matthias Geissert

– Prof. Dr. Y. Shibata (Waseda University, Tokyo): Global L^p solutions for Oldroyd-B models.

– PD Dr. P. Kunstmann (Karlsruhe Institute of Technology (KIT)): On H^∞ calculus of the Stokes operator.

Alf Gerisch

– Prof. Dr. K. Raum (Charité Universitätsmedizin Berlin) and Prof. Dr. Q. Grimal (Pierre-and-Marie-Curie University (Paris VI), France): Multiscale structure-functional modeling of musculoskeletal mineralized tissues.

– Prof. Dr. M. Chaplain (University of Dundee, Scotland): Mathematical modeling and simulation of cancer invasion.

– Prof. Dr. J. Lang (TU Darmstadt), Prof. Dr. R. Weiner, and Dr. H. Podhaisky (Universität Halle-Wittenberg): PEER methods and their application in the Finite Element system KARDOS.

– Prof. Dr. L. Geris (University of Liége, Belgium): Modeling and simulation of fracture healing and angiogenesis and in tissue engineering.

Jane Ghiglieri

– Graduate School GSC 233: “Computational Engineering”. German Excellence Initiative. Speaker Prof. Dr. Michael Schäfer (Department of Mechanical Engineering, TU Darmstadt).

Thea Göllner

– Collaborative Research Centre (SFB) 666: “Integral sheet metal design with higher order bifurcations – development, production, evaluation”. Speaker Prof. Dr.-Ing. Peter Groche (Department of Mechanical Engineering, TU Darmstadt).

Roland Gunesch

– Prof. Dr. Reiner Lauterbach (Universität Hamburg): Working group Dynamical Systems.

Karsten Grosse-Brauckmann

– Prof. Dr. John Sullivan (TU Berlin): Constant mean curvature surfaces.

– Dr. Gerd Schröder-Turk (Universität Erlangen-Nürnberg): Interfaces.

– Prof. Dr. Robert Kusner (University of Massachusetts in Amherst): Constant mean curvature surfaces.

– Prof. Dr. Valerio Batista (UFedABC Sao Paulo): Isoperimetric problems.

Kai Habermehl

– Collaborative Research Center (SFB) 805: “Control of Uncertainty of load carrying structures in mechanical engineering”. Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering).

Robert Haller-Dintelmann

– Joachim Rehberg (Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin): Elliptic and parabolic regularity for divergence operators in non-smooth situations.

– Pascal Auscher (University of Paris-Sud (Paris XI)), Nadine Badr (University Lyon I), Joachim Rehberg (Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin): The square root problem for second order, divergence form operators with mixed boundary conditions on L^p.

– Joachim Rehberg and Hans-Christoph Kaiser (Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin), Günter M. Ziegler (FU Berlin): Optimal elliptic Sobolev regularity near three-dimensional multi-material Neumann vertices.

– Alf Jonsson (Umeå University), Dorothee Knees and Joachim Rehberg (Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin): Elliptic and parabolic regularity for mixed boundary value problems.

– Felix Ali Mehmeti and Virginie Régnier (University of Valenciennes and Hainaut-Cambresis): Dispersive waves with multiple tunnel effect on a star-shaped network.

Matthias Hieber

– Prof. Dr. G. P. Galdi (University of Pittsburgh): Analysis of Fluid-Solid-Interactions.

– Prof. Dr. D. Fang (Zhejiang University Hangzhou): Analysis of Partial Differential Equations and Applications.

– Prof. Dr. C. Tropea (TU Darmstadt): Center of Smart Interfaces.

– Prof. Dr. Y. Shibata (Waseda University): Complex Fluids.

– Prof. Dr. Y. Giga (University of Tokyo): The Stokes and Navier-Stokes Equation in Spaces of Bounded Functions.

– Prof. Dr. J. Prüss (Universität Halle-Wittenberg): Dynamics of Liquid Crystal Flows.

– Prof. Dr. R. Denk und Prof. Dr. R. Racke (Universität Konstanz): Spin Coating.

– Prof. Dr. S. Monniaux (Paul Cézanne University Aix-Marseille III): Stokes equations on Lipschitz domains.

Karl Heinrich Hofmann

– Tulane University New Orleans, LA, USA: Graduate Student Exchange Treaty between Tulane and TU Darmstadt.

Priska Jahnke

– PD Dr. Ivo Radloff (Universität Tübingen): Semistability of restricted tangent bundles and a question of I. Biswas.

– Prof. Dr. Thomas Peternell (Universität Bayreuth): Threefolds with big and nef anticanonical bundles II.

Imke Joormann

– Group of Dr. René Henrion, Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin: Gas Transport Optimization.

– Group of Dr. Thorsten Koch (Zuse-Institut Berlin): Gas Transport Optimization.

– Group of Prof. Dr. Alexander Martin (Universität Erlangen-Nürnberg): Gas Transport Optimization.

– Group of Prof. Dr. Werner Römisch (HU Berlin): Gas Transport Optimization.

– Group of Prof. Dr. Rüdiger Schultz (Universität Duisburg-Essen): Gas Transport Optimization.

– Group of Prof. Dr. Marc Steinbach (Universität Hannover): Gas Transport Optimization.

– German Federal Network Agency (Bundesnetzagentur): Project "Technical Capacities of Gas Networks".

– Open Grid Europe GmbH, formerly E.ON Gastransport GmbH: Project FORNE.

Michael Joswig

– Dr. Richard Bödi (ZHAW): Symmetric integer linear programs.

– Dr. Benjamin Burton (University of Queensland, Brisbane): "Algorithmic Methods in Combinatorial Topology", Go8 Australia-Germany Joint Research Co-operation Scheme 2012/13 (German Academic Exchange Service).

– Prof. Dr. Wolfram Decker (TU Kaiserslautern): Mathematical software.

– Dr. Anton Dochtermann (Stanford University): Tropical convexity.

– Ewgenij Gawrilow (TomTom N.V.): Mathematical software.

– Prof. Dr. Stéphane Gaubert (École Polytechnique): Tropical convexity.

– Dr. Thilo Rörig (TU Berlin): Mathematical visualization.

– Prof. Dr. Raman Sanyal (FU Berlin): Tropical convexity.

– Prof. Dr. Bernd Sturmfels (University of California, Berkeley): Tropical geometry.

– Prof. Dr. Thorsten Theobald (Universität Frankfurt): Algorithmic geometry.

– Dr. Stephan Tillmann (University of Sydney): "Algorithmic Methods in Combinatorial Topology", Go8 Australia-Germany Joint Research Co-operation Scheme 2012/13 (German Academic Exchange Service).

– Prof. Dr. Günter M. Ziegler (FU Berlin): Polytope theory.

– Priority Program 1489 (German Research Foundation): "Algorithmic and Experimental Methods in Geometry, Algebra, and Number Theory", Speaker Prof. Dr. Wolfram Decker (TU Kaiserslautern).

Ulrich Kohlenbach

– Dr. Laurentiu Leustean (Romanian Academy): Proof Mining in Nonlinear Analysis.

– Prof. Dr. Jeremy Avigad (CMU): Metastability and fluctuation bounds in ergodic theory.

Michael Kohler

– Prof. Dr. Luc Devroye (McGill University Montreal): Estimation of a density using real and artificial data.

– Prof. Dr. Augustin Kelava (TU Darmstadt, Institut für Psychologie): Nonparametric estimation of a latent variable model.

– Prof. Dr. Adam Krzyżak (Concordia University Montreal): Adaptive density estimation based on real and artificial data.

– Prof. Dr. Harro Walk (Universität Stuttgart): Weakly universally consistent static forecasting of stationary and ergodic time series via local averaging and least squares estimates.

– SFB 666 (TU Darmstadt): Efficient estimation of fatigue parameters.

– SFB 805 (TU Darmstadt): Estimation of a density in a simulation model.

Oliver Kolb

– Prof. Dr. Kathrin Klamroth (Universität Wuppertal), Prof. Dr. Jens Lang (TU Darmstadt), Prof. Dr. Günter Leugering (Universität Erlangen-Nürnberg), Prof. Dr. Alexander Martin (Universität Erlangen-Nürnberg), Prof. Dr. Martin Oberlack (TU Darmstadt), Prof. Dr. Manfred Ostrowski (TU Darmstadt), Hessenwasser GmbH & Co. KG, Siemens AG: Diskret-kontinuierliche Optimierung komplexer dynamischer Wasserver- und -entsorgungssysteme. Supported by BMBF, 2007-2010.

Daniela Koller

– Collaborative Research Centre (SFB) 666: “Integral sheet metal design with higher order bifurcations - development, production, evaluation”. Speaker Prof. Dr.-Ing. Peter Groche (Department of Mechanical Engineering, TU Darmstadt).

Jens Lang

– Prof. Dr. Jan Verwer (University of Amsterdam and CWI): W-Methods for optimal control.

– Prof. Dr. Weizhang Huang (University of Kansas): Anisotropic mesh methods.

– Jun.-Prof. Dr. Oliver Kolb (Universität Mannheim): Simulation and optimization of gas and water networks.

– Prof. Dr. Malte Braack (Universität Kiel): Stabilized finite elements for transient flow problems.

– Prof. Dr. Rüdiger Weiner (Universität Halle-Wittenberg): Linearly implicit time integrators.

– Bodo Erdmann (ZIB): Kardos programming.

– Prof. Dr. Günter Leugering, Prof. Dr. A. Martin (Universität Erlangen-Nürnberg): Modelling, Analysis, Simulation and Optimal Control of Gas Transport in Networked Pipelines. Supported by DFG, 2007-2011.

– SFB 568: “Flow and Combustion in Future Gas Turbines”. Speaker Prof. Dr.-Ing. Johannes Janicka (Department of Mechanical Engineering, TU Darmstadt). Supported by DFG, 2007-2011.

– GK 1344: “Instationary System Modelling of Aircraft Turbines”, Speaker Prof. Dr.-Ing. Johannes Janicka (Department of Mechanical Engineering, TU Darmstadt). Supported by DFG, 2006-2014.

– SPP 1253: Optimization with PDEs. Supported by DFG, 2009-2012, jointly with Prof. Dr. Stefan Ulbrich (TU Darmstadt).

– Prof. Dr. Jochen Fröhlich (TU Dresden): Large Eddy Simulation with Adaptive Moving Meshes, Supported by DFG, Metstroem, 2007-2013.

– Dr. Nilles, BASF: Numerical Simulation, Modelling and Optimization of Multi-Phase and Multi-Scale Combustion Processes.

Andrew Linshaw

– Dr. Thomas Creutzig (TU Darmstadt): Vertex algebras.

– Prof. Dr. Bailin Song (University of Science and Technology of China): Invariant theory, geometry of jet schemes and arc spaces.

– Prof. Dr. Gerald Schwarz (Brandeis University): Invariant theory, geometry of jet schemes and arc spaces.

Ulf Lorenz

– Prof. Dr.-Ing. Peter Pelz (TU Darmstadt): System optimization of the heating plant in the Darmstadtium.

– VDMA, KSB: System optimization of the heating plant in the Darmstadtium.

– Prof. Dr. Marco Platzner (Universität Paderborn): Computer Go.

– Prof. Dr. Alexander Martin (Universität Erlangen-Nürnberg): Quantified Linear Programs.

– Collaborative Research Center (SFB) 805: “Control of Uncertainty of load carrying structures in mechanical engineering”. Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt).

– German Research Foundation (DFG): Erweiterung mathematischer Optimierungsmethoden zur Lösung PSPACE-vollständiger Probleme mit Hilfe quantifizierter linearer Programme.

– Microsoft: PhD Sponsorship within the Microsoft Research PhD Scholarship program.

Hendrik Lüthen

– Collaborative Research Centre (SFB) 666: “Integral sheet metal design with higher order bifurcations - development, production, evaluation”. Speaker Prof. Dr.-Ing. Peter Groche (Department of Mechanical Engineering, TU Darmstadt).

Sonja Mars

- Prof. Dr. Alexander Martin (Universität Erlangen-Nürnberg): Solving mixed-integer semidefinite programs.
- Dr. Lars Schewe (Universität Erlangen-Nürnberg): Truss Topology Design and MIS-DPs.
- Collaborative Research Center (SFB) 805: "Control of Uncertainty of load carrying structures in mechanical engineering". Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt).

Hannes Meinlschmidt

- Prof. Dr. Christian Meyer (TU Dortmund): Optimal control of the thermistor problem.
- Dr. Joachim Rehberg (WIAS Berlin): Optimal control of the thermistor problem.

Martin Otto

- Prof. Dr. Georg Gottlob (University of Oxford) and Dr. Vince Barany: Finite controllability and finite model properties of guarded logics.
- Dr. Balder ten Cate (UC Santa Cruz) and Dr. Vince Barany: Finite and algorithmic model theory of guarded logics.
- Dr. Mark Weyer and Achim Blumensath: Boundedness problems.
- Prof. Dr. Anuj Dawar (Cambridge University): Finite and algorithmic model theory.
- Prof. Dr. Martin Grohe (HU Berlin, now RWTH Aachen): Linear programming, Ehrenfeucht–Fraïssé games and graph isomorphism.

Andreas Paffenholz

- PD Dr. Barbara Baumeister (Universität Bielefeld): Permutation Polytopes of Abelian Groups.
- Dr. Benjamin Burton (University of Queensland, Brisbane): "Algorithmic Methods in Combinatorial Topology", Go8 Australia-Germany Joint Research Co-operation Scheme 2012/13 (German Academic Exchange Service).
- Sandra Di Rocco (KTH Stockholm): Polyhedral Adjunction Theory.
- Prof. Dr. Christian Haase (Universität Frankfurt): Permutation, Cut, and Marginal Polytopes; Polyhedral Adjunction Theory; Unimodular Triangulations.
- PD Dr. Carsten Lange (Pierre-and-Marie-Curie University (Paris VI)): Minkowski Decompositions of Generalized Permutahedra.
- Prof. Dr. Benjamin Nill (Case Western Reserve University, Cleveland): Permutation, Cut, and Marginal Polytopes; Polyhedral Adjunction Theory.

– Prof. Lindsay Piechnik (Duke University): Unimodular Triangulations.

– Prof. Francisco Santos (University of Santander): Unimodular Triangulations.

– Prof. Dr. Stephan Tillmann (University of Sydney): "Algorithmic Methods in Combinatorial Topology", Go8 Australia-Germany Joint Research Co-operation Scheme 2012/13 (German Academic Exchange Service).

– Priority Program 1489 (German Research Foundation): "Algorithmic and Experimental Methods in Geometry, Algebra, and Number Theory", Speaker: Wolfram Decker.

Sebastian Pfaff

– Priority Program (SPP) 1253: "Optimization with Partial Differential Equations". Speaker Prof. Dr. Günter Leugering (Universität Erlangen-Nürnberg).

Marc Pfetsch

– Dr. Ralf Borndörfer (Zuse-Institut Berlin): Steiner Connectivity Problems.

– Group of Dr. René Henrion, Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin: Gas Transport Optimization.

– Prof. Dr. Volker Kaibel (Universität Magdeburg): Symmetries in Integer Programming.

– Group of Dr. Thorsten Koch (Zuse-Institut Berlin): Gas Transport Optimization.

– Prof. Dr. Dirk Lorenz (TU Braunschweig): Compressed Sensing.

– Group of Prof. Dr. Alexander Martin (Universität Erlangen-Nürnberg): Gas Transport Optimization.

– Group of Prof. Dr. Werner Römisch (HU Berlin): Gas Transport Optimization.

– Group of Prof. Dr. Rüdiger Schultz (Universität Duisburg-Essen): Gas Transport Optimization.

– Group of Prof. Dr. Marc Steinbach (Universität Hannover): Gas Transport Optimization.

– Collaborative Research Center (SFB) 805: "Control of Uncertainty of load carrying structures in mechanical engineering". Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt).

– Collaborative Research Centre (SFB) 666: "Integral sheet metal design with higher order bifurcations – development, production, evaluation". Speaker Prof. Dr.-Ing. Peter Groche (Department of Mechanical Engineering, TU Darmstadt).

– Graduate School GSC 233: "Computational Engineering". German Excellence Initiative. Speaker: Prof. Dr. Michael Schäfer (Department of Mechanical Engineering, TU Darmstadt).

– German Federal Network Agency (Bundesnetzagentur): Project “Technical Capacities of Gas Networks”.

– Open Grid Europe (OGE): Project FORNE.

Anne Philipp

– LOEWE - Research Priority Program: “Cooperative Sensor Communication - Cocoon”. Excellence Initiative of Hesse. Speaker Prof. Dr.-Ing. Abdelhak Zoubir (Department of Electrical Engineering, TU Darmstadt).

Jan-Frederik Pietschmann

– Prof. Dr. Martin Burger (Universität Münster): Flow Characteristics in a Crowded Transport Model.

– Dr. Marie-Therese Wolfram (Universität Wien): Numerical simulation and inverse problems related to ion channels.

– Prof. Dr. Zuzanna Siwy (University of California, Irvine): Modeling and simulation of nanopores.

– Prof. Dr. Henrik Shahgholian (KTH Royal Institute of Technology Stockholm): Numerical discretization of Hele-Shaw flow problems.

Ulrich Reif

– Fraunhofer IGD, Darmstadt: Ambient B-Splines.

– Prof. Dr. Kai Hormann (University of Lugano): Generalized Lane-Riesenfeld Algorithms.

– Dr. Malcolm Sabin (University of Cambridge): Geometric Subdivision Algorithms.

– Dr. Oleg Davydov (Strathclyde University): Two-Stage Approximation on Domains.

Steffen Roch

– Prof. Dr. Bernd Silbermann (TU Chemnitz): Operator theory and numerical analysis.

– Dr. Marko Lindner (TU Hamburg-Harburg): Spectral theory of band operators.

– Prof. Dr. Vladimir S. Rabinovich (IPN Mexico/City): Limit operators and their applications to the spectral theory of PDE.

– Prof. Dr. Pedro A. dos Santos (IST Lisbon): Numerical analysis for convolution-type operators.

– Prof. Dr. Torsten Ehrhardt (UC Santa Cruz): Szegö limit theorems.

Rolf Roth

- Collaborative Research Centre (SFB) 568: “Flow and Combustion in Future Gas Turbine Combustion Chambers”. Speaker Prof. Dr.-Ing. Johannes Janicka (Department of Mechanical Engineering, TU Darmstadt).
- Dr. Sven Grundmann (TU Darmstadt): “Kernspintomographie zur Optimierung von Transportprozessen in technischen Apparaten”.
- Prof. Dr.-Ing. Cameron Tropea (TU Darmstadt): “Kernspintomographie zur Optimierung von Transportprozessen in technischen Apparaten”.

Jürgen Saal

- Prof. Dr. Robert Denk (Universität Konstanz), Prof. Dr. Jörg Seiler: Mixed order systems.
- Prof. Dr. Yoshikazu Giga (University of Tokyo), Prof. Dr. Alex Mahalov (Arizona State Universtity): Geophysical flows.
- Prof. Dr. Jan Prüß (Universität Halle), Prof. Dr. Gieri Simonett (Vanderbilt University): Free boundary problems.
- Prof. Dr. Dieter Bothe (TU Darmstadt): Elektrokinetic fluids.
- Prof. Dr. Reinhard Racke (Universität Konstanz): Hyperbolic fluid models.
- Prof. Dr. Bettina Frohnapfel (Karlsruhe Institute of Technology (KIT)), Dr. Tobias Baier (TU Darmstadt): Drag control and form optimization.

Carsten Schäfer

- LOEWE-Center AdRIA: Technological sector simulation tools.

Nils Scheithauer

- Prof. Dr. R. E. Borcherds (UC Berkeley): Automorphic forms and vertex algebras.
- Prof. Dr. E. Freitag (Universität Heidelberg): Automorphic forms.
- Prof. Dr. G. Höhn (Kansas State University): Vertex algebras and infinite-dimensional Lie algebras.

Adrian Sichau

- Collaborative Research Centre (SFB) 805: “Control of uncertainty of load carrying systems in mechanical engineering”. Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt).

Sara Tiburtius

– SPP 1420: “Biomimetic Materials Research: Functionality by Hierarchical Structuring of Materials”. Supported by the German Research Foundation (DFG), 2012-2013, joint project of Dr. Alf Gerisch (Department of Mathematics, TU Darmstadt) and Prof. Dr. Kay Raum (Julius Wolff Institute and Berlin-Brandenburg School for Regenerative Therapies, Charité-Universitätsmedizin Berlin).

Andreas M. Tillmann

– Marco Ament (Universität Stuttgart): Visualization of Astronomical Nebulae.

– Prof. Dr. Rémi Gribonval (INRIA Rennes - Bretagne Atlantique): Complexity of Cosparse Projection.

– Dr. Stefan Guthe (TU Braunschweig): Visualization of Astronomical Nebulae.

– Christian Kruschel (TU Braunschweig): SPEAR project.

– Prof. Dr. Dirk A. Lorenz (TU Braunschweig): SPEAR project, Visualization of Astronomical Nebulae, Compressed Sensing.

– Prof. Dr.-Ing. Marcus Magnor (TU Braunschweig): Visualization of Astronomical Nebulae.

– Prof. Dr. Marc E. Pfetsch (TU Darmstadt): SPEAR project, Compressed Sensing, Computational Complexity of Recovery Conditions.

– Prof. Dr. Daniel Weiskopf (Universität Stuttgart): Visualization of Astronomical Nebulae.

– Stephan Wenger (TU Braunschweig): Visualization of Astronomical Nebulae.

Stefan Ulbrich

– Graduate School GSC 233: “Computational Engineering”. German Excellence Initiative. Speaker Prof. Dr. Michael Schäfer (Department of Mechanical Engineering, TU Darmstadt).

– Graduate School GSC 1070: “Darmstadt Graduate School of Energy Science and Engineering”. German Excellence Initiative. Speakers Prof. Dr. Wolfram Jaegermann, Prof. Dr. Johannes Janicka (TU Darmstadt).

– Excellence Cluster EXC 259: “Center of Smart Interfaces: Understanding and Designing Fluid Boundaries (CSI)”. German Excellence Initiative. Speaker Prof. Dr.-Ing. Cam Tropea (Department of Mechanical Engineering, TU Darmstadt).

– Prof. Dr. Matthias Heinkenschloss (Rice University, Houston): PDE-Constrained Optimization, Model Reduction.

– Prof. Dr. Michael Herty (RWTH Aachen), Prof. Dr. Günter Leugering, Dr. Martin Gugat (Universität Erlangen-Nürnberg): Optimal control of switched networks for nonlinear hyperbolic conservation laws. Supported by DFG within SPP 1253.

– International Research Training Group IGK 1529: “Mathematical Fluid Mechanics” Speaker Prof. Dr. Matthias Hieber (Department of Mathematics, TU Darmstadt).

– Prof. Dr. Bülent Karasözen (METU, Ankara): DAAD Partnership Project “Optimization theory, methods and applications”.

– Prof. Dr. Jens Lang (TU Darmstadt): Adaptive multilevel SQP-methods for PDAE-constrained optimization with restrictions on control and state. Theory and Applications. Supported by DFG within SPP 1253.

– LOEWE-Center: “AdRIA: Adaptronik - Research, Innovation, Application”. Excellence Initiative of Hesse. Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt).

– LOEWE Research Priority Program: “Cooperative Sensor Communication – Cocoon”. Excellence Initiative of Hesse. Speaker Prof. Dr.-Ing. Abdelhak Zoubir (Department of Electrical Engineering, TU Darmstadt).

– SFB 568: “Flow and combustion in future gas turbine combustion chambers”. Speaker Prof. Dr.-Ing. Johannes Janicka (Department of Mechanical Engineering, TU Darmstadt).

– SFB 666: “Integral sheet metal design with higher order bifurcations - development, production, evaluation”. Speaker Prof. Dr.-Ing. Peter Groche (Department of Mechanical Engineering, TU Darmstadt).

– SFB 805: “Control of uncertainties in load carrying systems of mechanical engineering”. Speaker Prof. Dr.-Ing. Holger Hanselka (Department of Mechanical Engineering, TU Darmstadt).

– Dr. Anton Schiela (TU Berlin): Preconditioning Techniques for PDE-Constrained Optimization.

– Prof. Dr. Michael Ulbrich (TU München): Multilevel Methods for PDE-constrained Optimization.

– zeb/rolfes.schierenbeck.associates (Frankfurt): Mixed-Integer nonlinear optimization for credit portfolio optimization.

Christian H. Weiß

– Prof. Dr. M.C. Testik (Hacettepe University, Ankara): CUSUM Monitoring of Serially Dependent Processes of Counts.

– Prof. Dr. H.-Y. Kim (Korea University, Seoul): Statistical Inference for Binomial AR(1) Processes.

– Prof. Dr. P. Pollet (University of Queensland): Count Data Time Series and Metapopulation Models.

– S. Schweer (University of Heidelberg): Modeling and Diagnosing Overdispersion in Count Data Time Series.

Irwin Yousept

- Prof. Dr. Fredi Tröltzsch (TU Berlin): PDE-constrained optimization in induction heating.
- Prof. Dr. Jürgen Sprekels (HU Berlin, WIAS Berlin): Optimal control in crystal growth.
- Prof. Dr. Michael Hintermüller (HU Berlin): Shape optimization techniques for magnetic induction tomography.
- Prof. Dr. Dirk Pauly (Universität Duisburg-Essen): A posteriori error analysis for Maxwell's equations.
- Prof. Dr. Juan Carlos De Los Reyes (National Technical University Quito): Optimal control of electrorheological fluids.
- Prof. Dr. Daniel Wachsmuth (Universität Würzburg): Hybrid Tikhonov and grad-div regularization.
- Prof. Dr. Christian Meyer (TU Dortmund): Elliptic optimal control problems with nonlocal radiation interface conditions.
- Dr. Sascha Schnepp (ETH Zürich): Discontinuous Galerkin for time optimal control problems of full first-order Maxwell's equations.
- Dr. Antoine Laurain (TU Berlin): Shape optimization techniques for magnetic induction tomography.
- Dr. Pierre-Etienne Druet (WIAS Berlin): Optimal control in crystal growth.
- Dr. Olaf Klein (WIAS Berlin): Optimal control in crystal growth.

Martin Otto and Martin Ziegler

- Anuj Dawar and Arno Pauly (Cambridge): Descriptive Complexity in Fragments of Dependence Logic with Applications to Computable Real Multivalued Functions.

Martin Ziegler

- Akitoshi Kawamura (University of Tokyo) and Norbert Müller (Universität Trier): Quantitative Theory and Practice of Exact Real Computation.
- Takakazu Mori (Kyoto Sangyo University): Computability in Stochastics.

6.6 Secondary Schools and Public Relations

The department of mathematics is involved in various activities for schools, secondary school students, and public relations. In addition to printed information material, the department of mathematics presents itself to the public on its web pages. These are clearly structured and provide quick links for several target groups as well as links leading to specific topics in research and teaching at the department.

To inform our students about our study programmes in Mathematics, the department publishes a comprehensive study guide ("Informationsbroschüre"). The guide "Mathematik — Warum? Was? Wozu? Wer? Wie? Wo? Weiteres?", authored by Prof. Kümmerer, informs prospective students about different facets of mathematics and corresponding study programmes. In 2012, a new leaflet about our Teacher programme was created, and the existing leaflets for our Bachelor programmes were updated in 2011. The guides and leaflets are also distributed in schools, on fairs and through our widespread network with student service centers at universities all over Germany and regional employment centers. The web pages with information for our prospective students have been further improved in 2011 and 2012.

The following is a list of further public relations activities.

Activities for secondary school students and prospective students

- Presentation of the department with a stall and several talks at the job and study information fair HoBIT, Hochschul- und Berufsinformationstage, three days every January: about 17.500 participants during the fair in 2012; with a stall staffed by Dr. Weiß (student advisor), professors, academic staff and students (talks by Prof. Kohlenbach, Dr. Weiß in 2011, and by Prof. Joswig, Prof. Kümmerer, Dr. Weiß in 2012)

- Presentation of the department and its study programmes at the university information day, TUDay, every May: with talks by the student advisor, sample lectures and tutorial classes, meetings with students of the department; about 80 participants over the course of the day in 2012 (lectures by Prof. Ziegler, PD Kraußhar in 2011, and by PD Kraußhar, PD Jahnke in 2012)

- Annual organization of an afternoon with several talks about mathematics for secondary school students , "Darmstädter Schülerinnen- und Schülernachmittag zur Mathematik" (organization: Prof. Kohler; talks by Prof. Kohlenbach, Prof. Kohler, Dr. Pinkernell, Prof. Scheithauer in 2011, and by Prof. Betz, Prof. Kohler, Prof. Pfetsch, Prof. Ziegler in 2012)

- Annual presentation of the department at the information days for female students, "Schnuppertage für Schülerinnen", with a talk by the student advisor, a sample lecture and talks with female mathematicians, about 30 participants in each year (organization: Ms Cosulich in 2011 and Ms Schubotz in 2012; talk: student advisor Dr. Weiß; lectures by Ms Kürsten in 2011 and PD Jahnke in 2012)

- Support of the annual organization of the Mathematikolympiade Hessen (third level) in cooperation with the Center for Mathematics Bensheim for all grades (about 25 participants per grade each year) (Prof. Kiehl, academic staff and students).
  As part of the final rounds in 2011 and 2012, mathematical afternoon lectures were delivered by Prof. Kiehl and Prof. Scheithauer.

- Hosting of the Internet portal for secondary school students mathe-zirkel.de with information and encouragement for interested secondary school students, including a quarterly contest for secondary school students in grade 7 and upwards (Prof. Bruder).

- Organization of the Mathematical Modeling Week for secondary school students in grade 12 in cooperation with Center for Mathematics Bensheim each October (40 participants each year) (Prof. Kiehl).
- Involvement in the annual German Maths Contest (Bundeswettbewerb Mathematik) (Prof. Alber, Prof. Roch)
- 3-day special programme including lectures, exercises and supervised group work dedicated to the topic of *Logic and The Modelling of Information and Knowledge* (September 13-15 in 2011, and September 18-20 in 2012) for the year 12 Mathematik Leistungskurs/Tutorium of Edith-Stein-Schule (2011) and of Edith-Stein-Schule, Eleonorenschule and Alfred-Delp-Schule (2012), respectively (devised and taught by Prof. Ziegler and tutors).
- In connection with the project course "Teaching in Mathematics: Problem Solving" (Prof. Bruder, StR Böhnke and participating students, winter semester 2012/13), diverse mathematical "Knobelstraßen" for secondary schools were developed and conducted at several schools in Darmstadt and Frankfurt.

Other activities

- Talk entitled "Mathematik, die beleidigte Königin der Wissenschaften" at the Heinrich-Mann Schule in Dietzenbach (March 16, 2011, Prof. Kümmerer)
- Annual Graduation Event: celebration with friends and family of the graduated students (organisation: Prof. Alber and staff in 2011, Prof. Kohlenbach and staff in 2012).
- Ernst-Schröder-Colloquia and other activities of the "Ernst-Schröder-Zentrum für Begriffliche Wissensverarbeitung".

7 Contact

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Women's Representative (until August 2011)

Laura Cosulich
Left TU Darmstadt

Women's Representative (from September 2011 until September 2012)

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Women's Representative (from October 2012)

Claudia Alfes, Silke Horn, Priska Jahnke and Nicole Lehmann
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Students Represantatives

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