MATHEMATICAL INSTITUTE
ACADEMY OF SCIENCES
OF THE CZECH REPUBLIC
2005

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Research Departments

1. Department of Real and Probabilistic Analysis

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1.1. Differential equations and integration theory
1.2. Theory of stochastic evolution equations
1.3. Theoretical probability and mathematical statistics

2. Department of Evolution Differential Equations

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Group:
2.1. Evolution equations

3. Department of Qualitative Methods of Mathematical Analysis

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Groups:
3.1. Function spaces
3.2. Qualitative study of differential equations and variational inequalities

4. Department of Constructive Methods of Mathematical Analysis

Head: *Jan Chleboun*

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Groups:
4.1. Finite element analysis of nonlinear problems
4.2. Efficient approximation schemes to the solution of elliptic and parabolic problems
4.3. Numerical and analytical methods in the theory of relativity and celestial mechanics

5. Department of Topology and Functional Analysis

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Groups:
5.1. Functional analysis–operator theory
5.2 Boolean algebra, topology and functional analysis
5.3 Mathematical methods in continuum mechanics

6. Department of Mathematical Logic, Numerical Algebra, and Graph Theory

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Groups: 6.1. Mathematical logic
6.2. Theory of matrices

7. Department of Didactics of Mathematics

Head: *Marie Tichá*
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Group: 7.1. Didactics of Mathematics

8. Branch in Brno

Head: *Jiří Vanžura*
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Groups: 8.1. Algebraic topology, differential geometry, homological algebra
8.2. Qualitative theory of differential equations

A Brief History of the Institute

When Czech universities reopened their gates in 1945 after the World War II a great number of students applied for admission. The duties of university teachers were extremely high. The shortage in persons qualified for teaching at universities as well as for research was obvious. The leading personalities of Czechoslovak mathematics clearly saw the necessity of making the scientific research in mathematics much more intensive than it was before the War; of course, this required to educate more competent specialists.

The first step that was aimed to help to improve the situation was the foundation of the Institute for Mathematics that started its work on March 14, 1947. The main merit for its foundation goes to Eduard Čech who also became its director. The Institute was a body of the Czech Academy of Sciences and Art and its main task was to organize lectures and seminars for university teachers, graduate students, and other interested persons (for example, secondary school teachers). It was also supposed to take care of international cooperation. All members of the Institute did their work at the Institute apart from their main job. The Institute also started to build its own library.

The Institute for Mathematics was later reorganized and renamed, and it became the Central Mathematical Institute on July 1, 1950. Its head was again E. Čech. The scope of activity of the new Institute was much wider. Its staff was already formed by about ten full-time scientific workers. In 1950 the Institute started the training of the first group of graduate students. Another task of the Institute was to care for publishing mathematical books and journals.

In 1951, the Institute received its own quarters in Žitná Street 25, Praha 1. In autumn 1951, the Institute got as a gift the library of the Union of Czechoslovak Mathematicians and Physicists. This society, which was established in 1862, took active part in the development of mathematics and physics and still works as a learned society.

The Czechoslovak Academy of Sciences was established, by an act of October 29, 1952, on January 1, 1953. The Mathematical Institute of the Academy resulted, already on November 11, 1952, from the Central Mathematical Institute, taking over all its tasks, employees and graduate students.

The lack of research in differential equations, numerical analysis and mathematical statistics was felt as the most serious shortcoming of the development of mathematics in Czechoslovakia in the early fifties. The task of the Mathematical Institute was to start and promote research in the disciplines mentioned above. More abstract branches like functional analysis, topology, and mathematical logic developed in the Institute in the sixties.

In 1969, the Mathematical Institute of the Czechoslovak Academy of Sciences was also established in Brno and Otakar Borůvka (10.5.1899-22.7.1995), famous for his work in the theory of differential equations and graph theory, was appointed its director. The decision on establishment of the Institute took into account the importance of Brno as both industrial and cultural center as well as the tradition and high standards of the Brno mathematical school. The Institute was reorganized in 1972 and since then it forms the Brno Branch of the Mathematical Institute in Praha.

In the seventies, the Mathematical Institute had eight departments: Dept. of Ordinary Differential Equations, Dept. of Partial Differential Equations, Dept. of Constructive Methods for Solving Differential Equations, Dept. of Numerical Methods, Graph Theory, and Mathematical Logic, Dept. of Functional Analysis, Dept. of Probability Theory and Mathematical Statistics, Dept. of Basic Mathematical Structures, and Dept. of Modernization of Mathematical Education. In addition, an integral part of the Institute was the Brno Branch.

The Mathematical Institute is a part of the Academy of Sciences of the Czech Republic since January 1, 1993 when the Czech Republic was established.

The number of mathematicians working in the Institute stabilized round 75 in the seventies and eighties and diminished to approximately 50 during the period 1990-1992. Today, 68 mathematicians work in the Institute. Starting 1996 the Institute opens two positions for visiting scholars from abroad annually.

Members of the Institute have received a number of scientific grants from several Czech as well as foreign grant agencies (see tables in the conclusion of this publication). One grant is concerned with all the members of the Institute: Institutional Research Plan AV0Z101190503 (Research and

development of general mathematical knowledge and its application to other branches of science and practice, 2005-2010). The IRP is supported, through the Academy of Sciences, by the Government of the Czech Republic and is a continuation of Institutional Research Plan A05/98:Z1-019-9-ii (Complex development of all branches of mathematics with regards to the needs of physics and technology, 1999-2004) .

The first lecture in honor of Eduard Čech was delivered by Jaroslav Kurzweil under the title New life of the Riemannian approach to integration on March 31, 2004, the second lecture gave Miroslav Fiedler under the title Matrices, graphs, and geometry on March 29, 2005. The period of such lectures is planned to be a year.

The Institute organizes the Day of Open Door for general public annually since 1998. Most of the visitors are secondary school students. Traditionally the Institute takes part in the organization of secondary school student competition Mathematical Olympiad.

Mathematical Institute Now

The following **monographs** with authors and co-authors from the Institute were published in international publishing houses in the period 2000-2004:

Balcar, B.; Štěpánek, P.: Set Theory. (In Czech.) Prague, Academia 2001, 462 pages.

Došlý, O.; Řehák, P.: Half-linear differential equations. Elsevier, North-Holland Mathematics Studies vol. 202, 2005, 515 pages.

Eck, C., Jarušek, J., Krbec, M.: Unilateral Contact Problems: Variational Methods and Existence Theorems. Chapman & Hall/CRC, Boca Raton 2005, 398 pp.

Fabian, M.; Habala, P.; Hájek, P.; Montesinos, V.; Pelant, J.; Zizler, V.: Functional Analysis and Infinite-Dimensional Geometry. Canadian Math. Books Series. Springer-Verlag 2001, 468 pages.

Feireisl, E.: Dynamics of Viscous Compressible Fluids. Oxford University Press 2004, 211 pages.

Feistauer, M.; Felcman, J.; Straškraba, I.: Mathematical and Computational Methods for Compressible Flow. Oxford University Press 2003, 535 pages.

Fiedler, M.: Matrices and Graphs in Euclidean Geometry. (In Czech.) Prague, DIMATIA 2001, 140 pages.

Hakl, R.; Lomtatidze, A.; Šremr, J.: Some Boundary Value Problems for First Order Scalar Functional Differential Equations. Brno, Folia Fac. Sci. Natur. Univ. Masaryk. Brun. Math. 10, 2002.

Herman, J.; Kučera, R.; Šimša, J.: Equations and Inequalities. New York, Springer-Verlag 2000, 344 pages.

Herman, J.; Kučera, R.; Šimša, J.: Counting and Configurations. Springer Verlag, New York 2003, 392 pages.

Hlaváček, I.; Chleboun, J.; Babuška, I.: Uncertain Input Data Problems and the Worst Scenario Method. Amsterdam, Elsevier 2004, 458 pages.

Jech, T.: Set Theory. Springer-Verlag 2002, 769 pages.

Kiguradze, I.; Půža, B.: Boundary Value Problems for Systems of Linear Functional Differential Equations. Brno, Folia Fac. Sci. Natur. Univ. Masaryk. Brun. Math. 12, 2003.

Koukal, S.; Křížek, M.; Potůček, R.: Fourier Trigonometric Series and the Finite Element Method in Complex Variable. (In Czech.) Prague, Academia 2002, 273 pages.

Křížek, M.; Luca, F.; Somer, L.: 17 Lectures on Fermat Numbers. From Number Theory to Geometry. New York, Springer-Verlag 2001, xxiv+257 pages.

Kufner, A.; Persson, L.-E.: Weighted Inequalities of Hardy Type. Singapore, World Scientific 2003, 357 pages.

Kurzweil, J.: Henstock-Kurzweil Integration: Its Relation to Topological Vector Spaces. Series in Real Analysis Vol. 7. Singapore, World Scientific 2000, 136 pages.

Kurzweil, J.: Integration between the Lebesque Integral and the Henstock-Kurzweil Integral. Its Relation to Local Convex Vector Spaces. Singapore, World Scientific 2002, 140 pages.

Lomtatidze, A.; Mukhigulashvili, S.: Some Two-Point Boundary Value Problems for Second Order Functional Differential Equations. Brno, Folia Fac. Sci. Natur. Univ. Masaryk. Brun. Math. 8, 2000.

Markl, M.; Shnider, S.; Stasheff, J.: Operads in Algebra, Topology and Physics. Mathematical Surveys and Monographs Vol. 96. Providence, RI, AMS 2002, 349 pages.

Müller, V.: Spectral Theory of Linear Operators and Spectral Systems in Banach Algebras. Basel-Boston-Berlin, Birkhäuser Verlag 2003, 381 pages.

Novotný, A.; Straškraba, I.: Introduction to the Mathematical Theory of Compressible Flow. Oxford University Press 2004, 520 pages.

Schwabik, Š.; Ye, Guoju: Topics in Banach Space Integration. World Scientific 2005, 298 str.

Sochor, A.: Classical Mathematical Logic. (In Czech.) Prague, Karolinum 2001, 402 pages.

Šolín, P.; Segeth, K.; Doležel, I.: Higher–Order Finite Element Methods. Boca Raton, FL, Chapman & Hall/CRC 2004, 382 pages + CD ROM.

Further, the following **textbooks** and **conference proceedings** were published in the period 2000-2004:

Černý, R.; Přikryl, P.: Modeling Laser-Induced Phase Change Processes: Theory and Computation. Invited Chapter 3 in: Laser Crystallization of Silicon. (N. H. Nickel, ed.) Amsterdam, Elsevier Science/Academic Press, Semiconductors and Semimetals, Vol. 75, 2003, pp. 43-78.

Colloquium on Differential and Difference Equations 2000. Program, Abstracts, Extended Abstracts. (A. Lomtatidze, J. Vosmanský, eds.) Brno, Masaryk University 2000.

Conjugate Gradient Algorithms and Finite Element Methods. (M. Křížek et al., eds.) Berlin, Springer-Verlag 2004, 361 pp.

Finite Element Methods: Three-dimensional problems. (M. Křížek, P. Neittaanmäki, eds.) GAKUTO Internat. Ser. Math. Sci. Appl., Vol. 15, Gakkotosho, Tokyo 2001, 340 pp.

Fořt, J.; Neustupa, J.: Partial Differential Equations. (In Czech.) Praha, ČVUT Publisher 2005.

Function Spaces, Differential Operators and Nonlinear Analysis FSDONA 2004 (P. Drábek, J. Rákosník, eds.) Prague, Math. Inst. Acad. Sci. Czech Rep. 2005, 400 pp.

Function Spaces, Interpolation Theory, and Related Topics. Proceedings of the International Conference in honour of Jaak Peetre on his 65th birthday. (M. Cwikel, M. Engliš, A. Kufner, L.-E. Persson, G. Sparr, eds.) Berlin-New York, Walter de Gruyter, 2002, 462 pp.

Kračmar, S.; Neustupa, J.: Colletion of Examples from Mathematics I. (In Czech.) Praha, ČVUT Publisher 2002, 2004.

Křížek, M.; Segeth, K.: Numerical Modelling of Electrical Engineering Problems. (In Czech.) Prague, Karolinum 2001, 197 pp.

Mathematician Pierre de Fermat. (A. Šolcová, M. Křížek, G. Mink, eds.) (In Czech) Prague, Cahiers du CEFRES, Vol. 28, 2002, 209 pp.

Neustupa, J.: Matematika I. (In Czech.) Praha, ČVUT Publisher 2003, 2005.

Neustupa, J.: Matematika II. (In Czech.) Praha, ČVUT Publisher 2002, 2004.

Nonlinear Analysis, Function Spaces and Applications, Vol. 7. Proceedings of the Spring School. (B. Opic, J. Rákosník, eds.) Prague, Math. Inst. Acad. Sci. Czech Rep. 2003.

Přikryl, P.; Brandner, M.: Numerical Methods II. (In Czech.) Pilsen, University of West Bohemia 2000, 184 pp.

Probability and Statistics at High Schools. Proceedings of Seminar for High School Teachers (J. Antoch, D. Hlubinka, I. Saxl, eds.) Praque, Matfyzpress 2005.

Proceedings of Partial Differential Equations and Applications. (Š. Nečasová, H. Petzeltová, M. Pokorný, A. Sequeira, eds.) Math. Bohem. 126 (2001).

Proceedings of EQUADIFF 7, Prague, August 27-31, 2001. (M. Krbec, ed.) Math. Bohem., special issue, Prague 2002.

Proceedings of EQUADIFF 7, Prague, August 27-31, 2001, CD ROM. (M. Krbec, J. Kuben, J. Vosmanský, eds.) Masaryk Univ. Publ. House, Brno 2002.

Programs and Algorithms of Numerical Mathematics 10. Proceedings of the Seminar. (P. Přikryl, K. Segeth, eds.) (In Czech/English.) Prague, Math. Inst. Acad. Sci. Czech Rep. 2000, 219 pp.

Programs and Algorithms of Numerical Mathematics 11. (P. Přikryl, K. Segeth, eds.) (In Czech/English.) Proceedings of the Seminar. Prague, Math. Inst. Acad. Sci. Czech Rep. 2002, 316 pp.

Vanžura, J.: Problems from Mathematical Analysis with Solutions. (In Czech.) Prague, Karolinum 2003.

Vitásek, E.: Selected Topics of the Theory of Numerical Methods for Differential Equations. (In Czech.) Pilsen, University of West Bohemia 2002, 2005 145 pp.

The following researchers of the Institute were **honored** in the period 2000-2005:

Robert Hakl was awarded the Prize of Rector of the Masaryk University in Brno (in 2000).

Štefan Schwabik was awarded the Josef Hlávka Prize for the Best Publications in the Field of Scientific Literature by the Czech Literature Foundation and the Josef, Marie, and Zdeňka Hlávka Foundation (in 2000).

Jiří Sgall was awarded the Junior Prize of the Learned Society of the Czech Republic (in 2000).

Miroslav Engliš was awarded the International Society for Analysis, Applications and Computation Prize for Young Scientists (in 2001).

Pavel Krejčí was awarded the Prize for Research of Minister of Education, Youth, and Sports (in 2001).

Michal Křížek was elected to the Hall of Fame for Engineering, Science and Technology, San Diego, U.S.A. (in 2001).

Jaroslav Kurzweil was granted the Honorary Doctor Degree by the Silesian University in Opava (in 2001).

Jaroslav Kurzweil was granted the Honorary Doctor Degree by the Masaryk University in Brno (in 2001).

Jaroslav Kurzweil was awarded the Josef Hlávka Medal (in 2001).

Pavel Pudlák was awarded the Bernard Bolzano Honorary Medal for Merits in Mathematical Sciences by the Academy of Sciences of the Czech Republic (in 2001).

Pavel Řehák was awarded the Prize of Rector of the Masaryk University in Brno (in 2001).

Miroslav Engliš, Petr Hájek, and Jiří Sgall were awarded the Otto Wichterle Prize for excellent young scientists working in the Academy of Sciences of the Czech Republic (in 2002).

Petr Hájek was awarded the Junior Prize of the Learned Society of the Czech Republic (in 2002).

Martin Markl was awarded the Medal of Minister of Education, Youth and Sports of the 1st degree (in 2002).

Eva Matoušková and Pavel Řehák were awarded the Prize of the Mathematics Section of the Union of Czech Mathematicians and Physicists (in 2002).

Petr Přikryl was nominated International Scientist of the Year 2002 by The International Bibliographic Centre of Cambridge, England, UK.

Antonín Sochor was awarded the Josef Hlávka Prize for the Best Publications in the Field of Scientific Literature by the Czech Literature Foundation and the Josef, Marie, and Zdeňka Hlávka Foundation (in 2002).

Marián Fabian, Petr Hájek, Jan Pelant and Václav Zizler were awarded the Medal of Minister of Education, Youth and Sports of the 1st degree (in 2003).

Miroslav Fiedler was awarded the Golden Medal of the Faculty of Sciences of the P. J. Šafárik University, Košice, Slovakia (in 2003).

Michal Křížek was awarded the Prize for Scientific Achievements of Rector of the Military Academy in Brno (in 2003).

Jaroslav Kurzweil was granted the Honorary Doctor Degree by the University of West Bohemia in Pilsen (in 2003).

Eva Matoušková and Šárka Nečasová were awarded the Otto Wichterle Prize for excellent young scientists working in the Academy of Sciences of the Czech Republic (in 2003).

Filip Roubíček was awarded the Bernard Bolzano Prize of the Charles University in Prague (in 2003).

Karel Segeth was awarded the Memorial Medal of the Faculty of Mathematics and Physics of the Charles University in Prague (in 2003).

Jaromír Šimša was awarded the Prize of Rector of the Masaryk University in Brno (in 2003).

Jiří Vondráček was awarded the Diploma of the Slovak Academy of Agricultural Sciences (in 2003).

Alena Pravdová was awarded Otto Wichterle award for young researchers (in 2004).

Eduard Feireisl was awarded the Prize of the Academy of Sciences of the Czech Republic (in 2004).

Marián Fabian and Petr Hájek were awarded the Prize of the President of the Grant Agency of the Czech Republic (in 2004).

Ivan Straškraba was awarded the Prize of the Minister of Education, Youth, and Physical Training for his monograph Mathematical and Computational Methods for Compressible Flow (in 2004).

Vojtěch Pravda was awarded the Josef Hlávka Prize for young researchers of the Academy of Sciences of the Czech Republic (in 2004).

Robert Hakl and Pavel Řehák were awarded Otto Wichterle award for young researchers (in 2005).

Ivan Hlaváček was awarded the Prize of the Learned Society of the Czech Republic for scientific researchers (in 2005).

Vojtěch Pravda was nominated International Scientist of the Year 2005 by The International Bibliographic Centre of Cambridge, England, UK.

Alois Kufner was awarded the Prize of the Minister of education, Youth, and Physical Training for hos monograph Weighted Inequalities of Hardy Type (in 2005).

The Most Important Results Achieved in 2000-2004

A thoroughgoing study of the topology in the space of Kurzweil–Henstock integrable functions was done with the possibility of constructing a complete topological space in the space of primitives. Theory of the integration in Banach spaces has been enriched by the sum integrals of the Kurzweil–Henstock type. New results concerning boundary value problems for second order ordinary differential equations (existence, multiplicity, impulses) have been reached. (Group 1.1.)

Results on exponential ergodicity of solution to stochastic parabolic equations were obtained. Existence and regularity of solutions to stochastic nonlinear wave equations were proved. Stochastic ergodic and adaptive control problems have been solved in an infinite-dimensional state space. Fractional Brownian motion driven stochastic evolution equations have been studied. (Group 1.2.)

Stochastic simulations of Voronoi tessellations generated by a wide range of pseudo-hard-core and hard-core processes as well as by various cluster fields with applications have been studied: grain size estimation, polycrystalline fracture, spherulite growth, etc. (Group 1.3.)

The existence of global in time weak solutions was proved for the full system of Navier-Stokes equations of compressible viscous and heat conducting fluids. Global strong solutions in L^p - L^q spaces for barotropic fluids with small data were contructed using the property of maximal parabolic regularity. A nonsmooth version of the Simon-Lojasiewicz theorem was verified and applied to a non-local phase-field system. Asymptotic properties of the steady fall of objects in viscous fluids have been studied extensively. Incompressible viscous fluid flows and the generalized impermeability boundary conditions were studied thoroughly. (Group 2.1.)

Optimal Sobolev-type embeddings were characterized. Boundedness of fractional maximal operators between Lorentz-type spaces and weighted Banach function spaces was described. Extrapolation theorems and limiting interpolation theorems were proved. Criteria for Hardy inequalities of higher and fractional order were given. (Group 3.1.)

Smooth dependence on parameters and the existence of smooth bifurcation branches and their direction and stability were described for classes of variational inequalities including a model of a unilaterally supported beam. The existence of solutions to variational inequalities describing dynamic contact problems with Coulomb friction including their thermal aspects was proved. Necessary and sufficient conditions for continuity up to the boundary of a weak solution of the Neumann problem for the Laplace equation were found. (Group 3.2.)

The worst scenario method was devised for solving elliptic and parabolic problems with uncertain input data. Existence proofs for both continuous and approximate problems, together with some results on sensitivity and on the convergence of approximations have been achieved. An application of fuzzy set theory to sets of admissible functions was proposed in the worst scenario method. (Group 4.1.)

A method that generates local refinements of tetrahedral meshes was developed. It has been proved that tetrahedra do not become flat when the mesh size tends to zero. An algorithm producing nonobtuse tetrahedron partitions was proposed. The prediction of explosive crystallization of laser-irradiated amorphous silicon thin films obtained by a new computational model was

subsequently confirmed by real experiments in Hahn-Meitner-Institut, Berlin, Germany. (Group 4.2.)

All 4-dimensional Lorentzian manifolds with vanishing invariants constructed from the Riemann tensor and its covariant derivatives were determined. Algebraic classification of tensors on Lorentzian manifolds of arbitrary dimension was developed. (Group 4.3.)

It was proved that if T is a polynomially bounded operator on a Banach space X, whose spectrum contains the unit circle, then T^* has a nontrivial invariant subspace. In particular, if X is reflexive then T has a nontrivial invariant subspace. (Group 5.1.)

It was proved that a compact space K is uniformly Eberlein if and only if $C(K)$ has a uniformly Gâteaux smooth norm. (Group 5.2.)

In the area of online algorithms, we have obtained new algorithms with improved performance for real-time scheduling of overloaded systems; this solves several open problems in this area. Another recent result gives a simplification and an improvement of a 25 year old algorithm of Gonzales and Sahni for preemptive scheduling. All these results involve active participation of students.

We succeeded to construct a complete infinite Boolean algebra that has no infinite complete subalgebra. Previously, the only such example existed under the assumption of the axiom of constructibility; this was proved by R. Jensen in 1968.

In Bounded Arithmetic we characterized the dual Pigeon-Hole Principle in terms of the existence of functions with high circuit complexity, and described the propositional proof system associated with the theory S_2^1 augmented by this principle. (Group 6.1.)

Duality of linear operators given as the division by (in general nonmonic) matrix polynomials and by the solution of systems of linear differential equations with constant coefficients was proved. As an important tool the extended infinite companion matrix was defined. Systems of inaccurate linear equations were analyzed and a simpler partition of the set of solutions into convex subsets was discovered. (Group 6.2.)

In didactics of mathematics, the features of the process of grasping situations were specified and the structure of this process was described by generalization of the results gained in the course of investigation of specific cases. Possibilities of utilisation transformation between various modes of representation as a diagnostic tool were outlined. Ways of implementation of the results of research in the practice were suggested. (Group 7.1.)

Multisymplectic 3-forms on manifolds of dimensions 6, 7, and 8 were studied. In dimension 6 deep relations with classical geometric structures were found. The investigation of orbits of multisymplectic 3-forms in dimension 6 has revealed geometric structures on these orbits. Many results concerning these structures were obtained.

Formulation of a general theory of homotopically invariant structures in algebra and the study of their applications for the tranfer of concrete algebraic structures have been treated. (Group 8.1.)

New results were established in the thery of boundary value problems and asymptotic theory of ordinary and functional differential equations. Asymptotic behaviour, oscillatory properties of solutions, and the transformation theory of differential and difference systems and dynamic systems on "time scales" were widely investigated. (Group 8.2.)

Visiting Scholar Positions in the Institute

The Institute opens two positions for visiting scholars from abroad annually. The positions are intended for research-oriented mathematicians from any field of pure or applied mathematics and they carry no teaching duties. The positions may be divided among several candidates but the minimum duration of a stay is at least six months. The deadline is usually January 31 for the coming school year. The letter of application should specify, a. o., a member (or members) of the Institute the applicant would like to work with.

Graduate Study

The Institute is accredited by the Ministry of Education, Youth, and Physical Training to provide graduate education in 22 fields of mathematics, computer science, and physics. The graduate study in the Institute is carried out in cooperation with the Faculty of Mathematics and Physics and the Faculty of Education of the Charles University in Prague, the Faculty of Science of the Palacký University in Olomouc, the Faculty of Science of the Masaryk University in Brno, and the Faculty of Applied Sciences of the University of West Bohemia in Pilsen.

At present, there are 17 graduate students in the Institute. Moreover, members of the Institute are advisors to 37 graduate students at the universities listed above and the Mathematical Institute of the Silesian University in Opava, and a number of members of the Institute work in branch committees for graduate study. Graduate students take part in seminars organized by the Institute or in cooperation with universities and attend lectures held by the members of the Institute at universities.

Cooperation

The cooperation with universities is extensive and diversified. Many members of the Institute take part in undergraduate and graduate teaching, in examination commissions, in seminars organized jointly or separately. Moreover, every year of significant proportion research grants with participation of the Institute together with some of the universities is in progress. The representation in scientific councils is mutual. The Institute cooperates with universities in the organization of conferences, summer schools, etc. Moreover, the Institute cooperates with universities on the formulation of projects of education in mathematics of pupils of elementary and secondary schools and in the preparation and organization of their competition Mathematical Olympiad. The systematic cooperation of the library of the Institute with libraries of several universities deserves to be mentioned as well.

As an abstract discipline, mathematics finds its role in the domain of applications in most cases indirectly, in cooperation with some branch of science, technical science, etc. The Institute cooperates in this field with several institutes of the Academy, several faculties of the Charles University, several faculties of the Czech Technical University in Prague and the Technical University in Brno, with the University of West Bohemia in Pilsen, University of South Bohemia in České Budějovice, the Masaryk University in Brno, the Silesian University in Opava, the Palacký University in Olomouc, and also with Hydrosystem Group, Inc., in Olomouc, Masaryk Institute of Oncology in Brno, and other institutions. The topics of cooperation are, e.g., transfer phenomena of convection or diffusion of pollutants, properties of thin layers of metals and isolants on semiconductor surfaces, metastatic activities of tumor cells, further analysis of striation fields on fracture surfaces, and fluid dynamics.

The Institute has a long lasting contract on cooperation with the Friedrich-Schiller-University of Jena (Germany) and very numerous scientific contacts with various institutions the most significant of which are mentioned in the information on working groups. These contacts form a basis for joint applications for grants or fellowships, for invitations to lectures or to the position of a visiting professor or to short-term affiliations.

The Institute organizes or takes part in the organization of several series of international conferences, symposia, summer or winter schools, e.g.,

Prague Topological Symposium (TOPOSYM, 5 year period, since 1961),

Czechoslovak Conference on Differential Equations and their Applications (EQUADIFF, 4 year period, since 1962),

Winter School of Abstract Analysis (every year since 1973),

Winter School of Geometry and Physics (every year since 1981),

Spring School Nonlinear Analysis, Function Spaces and Applications (4 year period, since 1978),

School of Evolution Differential Equations (EVEQ, 4 year period, since 1984),

Function Spaces, Differential Operators and Nonlinear Analysis (every 3–4 years since 1988),

Workshop in Infinite-Dimensional Stochastic Systems (3 year period, on regular basis since 1997).

DIMATIA - Center for Discrete Mathematics, Theoretical Computer Science and Applications

DIMATIA was established in September 1996 at Charles University in Prague as a joint project of Charles University, Academy of Sciences of the Czech Republic and University of Chemical Technology, Prague. The purpose of the center is to foster research in all fields of discrete mathematics and its modern applications and relationship to computer science, operations research and fields as diverse as biology, chemistry, and social sciences. Towards this end the center organizes a continuing program of workshops, conferences and research visits both in Prague and other places together with cooperating institutions.

The activity of the center concentrates in the following directions:
Research workshops and conferences (at this point, about 4 workshops and one large conference are planned per year). The workshops are focused on specific topics and are expected to involve 20–30 researchers. The conferences cover more general issues and audience, expected number of participants is 40–60.
Postdoctoral positions announced and supported jointly with our partner institutions**.**
Short-term visits of senior researches.
Organizationally, the center is related to the Department of Applied Mathematics of Charles University in Prague.

ITI – Institute for Theoretical Computer Science

ITI was founded July 1, 2000 as a joint project of Charles University, Prague, Mathematical Institute and Institute of Computer Science of the Academy of

Sciences of the Czech Republic, Prague, and University of West Bohemia, Pilsen. Financial support is provided by the Ministry of Education, Youth, and Physical Training, project LN00A056 (National Research Center), until June 30, 2004, and continues as a project 1M0021620808 until June 30, 2009. The main aim of ITI is to promote research in theoretical computer science and related fields with emphasis on the work of young researchers. Presently ITI has 18 young researchers who are fully supported from ITI and 11 senior researchers employed in their home institutes and receiving an additional support from ITI. ITI also provides temporary positions for postdocs and distinguished senior researchers. ITI carries out a wide range of activities, in particular: several regular research seminars, including a graduate student research seminar, workshops, a series of colloquium talks, an ITI preprint series, and lectures on modern trends in theoretical computer science.

Eduard Čech Research Center

This new Center exists since April 1st, 2005. It has been organized by the Faculty of Natural Sciences of the Masaryk University in Brno, the Faculty of Mathematics and Physics of the Charles University in Prague, and the Mathematical Institute of the Academy of Sciences of the Czech Republic. The project has been launched within the scheme Centers of Excellence in Basic Research, and the contracting authority is the Czech Ministry for Education, Youth, and Sport. Its aim is to support the development of mathematics in the Czech Republic and to promote the exchange of ideas throughout the Czech and foreign universities and institutes. It should also provide a meeting place for leading experts in the areas of mathematics which combine geometrical and algebraic approaches. Eduard Čech has been chosen in the name of the Center because it was first him who combined geometrical and algebraic thinking in his work, and contributed amazingly to the evolution of all three institutions involved in the project.

At present the Center can offer six postdoc positions per year to young mathematicians. In order to create good research conditions, the Center invites specialists in the relevant research fields to short term visits. Its members are also often sent to international workshops and conferences. The Center organizes regular seminars and in the future intents to organize also specialized scientific meetings. The research of the Center covers the following areas: geometric structures and geometric analysis, algebraic topology, some topics in algebra, some topics in algebraic number theory, logic and proof complexity.

Further information about the Center can be found on http://ecc.sci.muni.cz.

Editorial Unit of Bibliographic Journal
ZENTRALBLATT FÜR MATHEMATIK

Head: *Jiří Rákosník*
Executive Editors: *Jana Bočková, Rostislav Lenker*
E-mail: zbl@math.cas.cz

Zentralblatt MATH is the world's most complete and longest running abstracting and reviewing service in pure and applied mathematics. The Zentralblatt MATH Database contains more than two million entries drawn from more than 2300 serials and journals and covers the period from 1868 to present by the recent integrations of the Jahrbuch database (JFM). In 1997, the Prague Editorial Unit was established in the Institute under the auspices of the Czech Union of Mathematicians and Physicists. Its aim is to cooperate with the editors in the central office in Berlin, to arrange reviewing of mathematical publications, and to prepare corresponding entries for Zentralblatt MATH.

The efforts of the Editorial Unit are compensated with acquisition of several copies of the products of Zentralblatt MATH and of the reviewed publications; they are distributed to universities cooperating with the Unit and bring the mathematical community a big value. The Institute provides a personal, technical and financial support to the Unit.

Journals

The Institute is the publisher of Czechoslovak Mathematical Journal, Mathematica Bohemica and Applications of Mathematics, and of a series of preprints.

CZECHOSLOVAK MATHEMATICAL JOURNAL

Editor-in-Chief: *Miroslav Fiedler*
Executive Editor: *Helena Severová*
E-mail: czemathj@math.cas.cz

The journal publishes original research papers of high scientific quality in mathematics, preferably if connected with Czech or Slovak mathematical schools. The papers by authors from the whole world are published in congress languages (mostly in English). Although under a new title, the present Journal forms a continuation of the renowned Časopis pro pěstování mathematiky a fysiky (Journal for Cultivation of Mathematics and Physics) founded in 1872. The fact that the editors wish to continue and maintain the tradition of our old journal is emphasized by the fact that the numbering of volumes has not been changed, e.g. 55(130). The journal is published quarterly in issues containing 272 pages each.

MATHEMATICA BOHEMICA (formerly Časopis pro pěstování matematiky)

Editor-in-Chief: *Štefan Schwabik*
Executive Editor: *Jana Bočková*
E-mail: mathboh@math.cas.cz

The journal publishes, in congress languages (almost exclusively in English), papers of high scientific quality, which bring new mathematical results. Sometimes a few pages are devoted to book reviews and news. The journal is a successor to the original journal Časopis pro pěstování mathematiky a fysiky founded in 1872 (later the journal Časopis pro pěstování matematiky). It is published quarterly in issues containing 112 pages each. Full text of issues older then one year is available from the EMIS servers of the European Mathematical Society http://www.emis.de/journals/MB/index.html

APPLICATIONS OF MATHEMATICS (formerly Aplikace matematiky, founded by Ivo Babuška in 1956)

Editor-in-Chief: *Pavel Krejčí*
Executive Editor: *Helena Holovská*
E-mail: applmath@math.cas.cz

The journal publishes original research papers of high scientific level, which are directed towards applications in different branches of science. Among the areas covered are, in particular, engineering problems (such as mechanics of solids, fluid mechanics, electrical engineering, kinematics, and similar), solution of differential and integral equations related to applications, mathematical physics, optimization, probability, mathematical statistics, etc. Scientific pa-

pers by authors from the whole world are published in congress languages (mostly in English), sometimes a few pages are devoted to book reviews and news. The journal is published bimonthly in issues containing 80 pages each.

General Information about Journals

Manuscripts of papers intended for publication in any of the three journals should be prepared according to the instructions for authors (see: http://www.math.cas.cz/instr.html) and sent to the Editorial Office, Žitná 25, CZ-115 67 Praha 1, Czech Republic.

Orders for Czechoslovak Mathematical Journal and Applications of Mathematics should be placed with Springer, Journals Department, P.O.Box 322, 3300 AH Dordrecht, The Netherlands. Orders and subscriptions from Czech Republic, Albania, Bulgaria, China, Cuba, Hungary, Mongolia, North Korea, Poland, Romania, Slovakia, Vietnam, and from countries of the former Soviet Union and Yugoslavia should be placed with Myris Trade Ltd., P.O.Box 2, V Štíhlách 1311, CZ-142 00 Praha 4, Czech Republic.

Orders for Mathematica Bohemica should be placed with Myris Trade Ltd., P.O.Box 2, V Štíhlách 1311, CZ-142 00 Praha 4, Czech Republic.

Library

Head: *Ivona Petrusová*

E-mail: library@math.cas.cz

The library of the Institute is the largest scientific library in the Czech Republic aimed at mathematical publications. Its funds comprise more than 72 000 bibliographical units. The library is accessible to the public and 85% of the users are external ones. The library takes part in the interlibrary lending service. The cooperation with the library of the Faculty of Mathematics and Physics of the Charles University in Prague and with the library of the Mathematical Institute of the Slovak Academy of Sciences in Bratislava (Slovakia) is very close. The library helps the libraries of the Silesian University in Opava and Ostrava University by transferring its duplicates and multiplicates.

The library and the reading room are open for public on Mondays from 8 to 12 a.m. and from 1 to 3.30 p.m., on Wednesdays from 8 to 12 a.m. and from 1 to 6 p.m., and on Fridays from 8 a.m. to 1 p.m.

Working Groups of the Institute

1.1. Group: Differential equations and integration theory

Members: *Jaroslav Kurzweil,*
Štefan Schwabik,
Milan Tvrdý,
Antonín Slavík (graduate student).

Main research areas**:**

Theory of Perron-type non-absolutely convergent integrals, theory of generalized differential equations, abstract integration theories, boundary value problems.

The contemporary research activity resumes the theories of generalized differential equations and nonabsolutely convergent integrals, which were iniciated by J. Kurzweil during the end of the fifties. A group of mathematicians was created in the department, which deals with the subject. This branch of mathematics has gone through a fast development in the last years. A Czech textbook on elementary aspects of Kurzweil type integration was published in 1999.

Topological aspects of the space of Kurzweil-Henstock integrable functions are studied in the last years and the difficult problem of introducing a topology in this space with the aim to get completeness was solved. A monograph concerning these results authored by Jaroslav Kurzweil was published in 2000 and recently a new monograph with the title “Integration between Lebesque and Henstock-Kurzweil: Their relation to locally convex spaces” has been published by the World Scientifc Publ., Singapore. The problem of intermediate integrations is dealt with in this work together with the topological aspects of the integration theories.

In cooperation with Guoju Ye (Lanzhou, China) the integration of Banach space valued functions was studied thoroughly from the point of view of integration theories based on Riemann type integral sums and the relations between the classical Bochner and Pettis integral have been cleared.

The method of lower and upper functions and its applications to regular and singular periodic boundary value problems for ordinary differential equations of second order (including equations with impulses) are studied.

The research group has scientific contacts with Université Catholique Louvain, University of Palermo, University of Sao Paulo, Ukrainean Academy of Sciences in Kiev and many others.

The most important publications in the last five years:

[1] Kurzweil J.: Henstock-Kurzweil Integration: Its Relation to Topological Vector Spaces. Series in Real Analysis Vol. 7. Singapore, World Scientific 2000, 136 pages.

[2] Kurzweil, J.: Integration between the Lebesgue Integral and the Henstock-Kurzweil Integral. Its Relation to Local Convex Vector Spaces. Singapore, World Scientific 2002, 140 pages.

[3] Rachůnková, I.; Tvrdý, M.; Vrkoč, I.: Existence of nonnegative and nonpositive solutions for second order periodic boundary value problems. J. Differential Equations 176 (2001), 445–469.

[4] Ye, G.; Schwabik, Š.: On the strong McShane integral of functions with values in a Banach space. Czechoslovak Math. J. 51(126) (2001), 819–830.

[5] Ye, G.; Schwabik, Š.: The McShane and the Pettis integral of Banach space-valued functions defined on $\mathbf{R}^m$. Illinois J. Math. 46 (2002), 1125–1144.

1.2. Group: Theory of stochastic evolution equations

Members: *Bohdan Maslowski,*
Martin Ondreját,
Ivo Vrkoč.

Main research areas:

(i) Investigation of the basic qualitative properties of stochastic evolution equations (SEE's) with particular attention paid to existence and regularity of solutions to nonlinear problems, maximal and exponential estimates as well as to long time behaviour, ergodicity, and mixing properties of Markov processes induced by SEE's.

(ii) Investigation of infinite time horizon control problems (of ergodic and discounted types) for stochastic infinite-dimensional systems and research in the field of related infinite-dimensional Hamilton-Jacobi equations. Investigation of adaptive control problems and identification of parameters for stochastic evolution equations.

The theory of stochastic equations has a long tradition in the Institute. In accordance with the development of the discipline the studies were formerly aimed to the finite-dimensional stochastic equations. Presently the general interest was transferred to stochastic evolution equations. The group assumes that this is a long-time trend.

The group has close contacts with other research groups and individuals working in the field of infinite-dimensional stochastic analysis throughout the

world (Universities of Kansas, Nancy, Warwick, Salzburg, Barcelona, Hull, Sydney, Scuola Normale Superiore di Pisa, Polish Academy of Sciences in Warsaw).

The most important publications in the last five years:

[1] Goldys, B.; Maslowski, B.: Uniform exponential stability of stochastic dissipative systems. Czechoslovak Math. J. 51(126) (2001), 745–762.

[2] Maslowski, B.; Nualart, D.: Evolution equations driven by a fractional Brownian motion. J. Funct. Anal. 203 (2003), 277–305.

[3] Maslowski, B.; Seidler, J.: Probabilistic approach to the strong Feller property. Probab. Theory Related Fields 118 (2000), 187–210.

[4] Seidler, J.; Sobukawa, T: Exponential integrability of stochastic convolutions. J. London Math. Soc. 67 (2003), 245–258.

[5] Ondreját, M.: Uniqueness for stochastic evolution equations in Banach spaces. Dissertationes Math. 426 (2004), 63 pp.

1.3. Group: Theoretical probability and mathematical statistics

Members: *Ivan Saxl,*
Jiří Vondráček,
Lucia Ilucová (graduate student).

Main research areas:

Development of multivariate and non-parametric statistical methods and their application in biology and in materials science, theory of random closed sets and their statistical testing (stereology).

The group focused on multivariate statistical analysis, rank tests and their application in the past and will continue these activities in the future as well. Since 1990 the theory and statistics of random closed sets (RCS) in the d-dimensional Euclidean space has also been developed; the attention concentrates on the description of spatial arrangement of RCS components by means of distance methods and by polyhedral analysis (properties and sections of Voronoi tessellations generated by point fields).

Research work of the group is based on an extensive cooperation with and teaching activity at the institutions of applied biological, agrobiological, medical, and materials research (e.g. Physiological Institute of the Academy of Sciences of the Czech Republic in Prague, Institute of Physics of Materials the Academy of Sciences of the Czech Republic in Brno, Thomas Bata University Zlín, Institute of Materials Research of the Slovak Academy of

Sciences in Košice). In the field of the theory, there is also a wide collaboration with several institutions, e.g. with the Charles University and traditionally with the Bergakademie Freiberg (participation on regular workshops on stochastic geometry and image analysis).

The most important publications of the last five years:

[1] Beneš, V.; Saxl, I.: Stereological estimation of the rose of directions from the rose of intersections. In: Recent Advances in Applied Probability. (R. Baeza-Yates, J. Glaz, H. Gzyl, H. Hüsler, J. L. Palacios, eds.) Springer-Verlag 2005, 65-96.

[2] Pelikán, E.; Erben, K.; Vondráček, J.; Dostál, M.; Krejčí, P.; Keder, J.: On the typology of daily courses of tropospheric ozone concentrations. In: Proceedings of Artificial Neural Nets and Genetics Algorithms. (V. Krkov, N. C. Steele, R. Neruda, eds.) Wien, Springer 2001, 461–464.

[3] Saxl, I.; Ponížil, P.: Bernoulli cluster field: Voronoi tessellations. Appl. Math. 47 (2002), 157–167.

[4] Saxl, I.; Ponížil, P.; Sülleiová, K.: Grain size estimation in anisotropic materials. Mat. Sci. Forum 482 (2005), 232-242.

[5] Saxl, I.; Ponížil, P.; Sülleiová, K.: Stereology and simulation of heterogeneous crystalline media. Internat. J. Mater. Product Technol. 18 (2003), 1–25.

2.1. Group: Evolution equations

Members: *Eduard Feireisl,*
Pavel Krejčí,
Šárka Nečasová,
Jiří Neustupa,
Hana Petzeltová,
Ivan Straškraba
Jan Březina (graduate student),
Soňa Chmelová (graduate student),
Lukáš Poul (graduate student).

Main research areas:

General theory of evolution equations and qualitative properties of their solutions, in particular: theory of integro-differential equations of parabolic and hyperbolic type (equations with memory), mathematical models in fluid dynamics, Navier-Stokes equations, non-smooth and singular evolution problems, nonlinear conservation laws, long time behavior of solutions to

equations of hyperbolic and parabolic type with weak dissipation, time-periodic processes, free boundary problems.

The recent research extends previous activities of the group concentrated mainly on qualitative properties of solutions to nonlinear partial differential equations of evolution. In particular, there has been a significant effort spent on the investigation of time periodic solutions which culminated in the monograph Vejvoda et al.: Partial Differential Equations: Time-Periodic Solutions, Rockville, Sijthoff Noordhoff 1981. Since then, the research interests of the group have been developing towards the directions mentioned above. Besides, the group continues working on problems in the mathematical theory of fluid flow in a broad international collaboration.

The group has close scientific contacts with the University of Pavia, Technical University Munich, Politecnico di Milano, Univ. of Melbourne, Univ. of Pisa, Univ. of Trento, Univ. of Besançon, Univ. of Nancy I, Univ. of Toulon, Univ. of Madrid, Univ. of Lisbon, Weierstrass Institute Berlin.

Joint research continues with the Hydrosystem Group, Inc., Olomouc on problems of fluid dynamics and pump construction. The department organized Workshop on Applied Mathematics together with the Faculty of Nuclear Engineering of the Czech Technical University (30.7. – 2.8.2005, E. Feireisl and M. Beneš).

The most important publications of the last five years:

[1] Feireisl, E.: Viscous and/or heat conducting compressible fluids. In: Handbook of Mathematical Fluid Dynamics, Vol. 1, Chapter 3. Amsterdam, Elsevier 2002.

[2] Feireisl, E.: Dynamics of Viscous Compressible Fluids. Oxford University Press 2004.

[3] Feireisl, E.; Petzeltová, H.; Issard-Roch, F.: A non-smooth version of the Lojasiewicz-Simon theorem with applications to non-local phase-field systems. J. Differential Equations 199 (2004), 1–21.

[4] Novotný, A.; Straškraba, I.: Introduction to the Mathematical Theory of Compressible Flow. Oxford University Press 2004, 520 pages.

[5] Okada, M.; Nečasová, Š.; Makino, T.: Free boundary problem for the equation of one-dimensional motion of compressible gas with density-dependent viscosity. Ann. Univ. Ferrara Sez. VII (N.S.) 48 (2002), 1–20.

3.1. Group: Function spaces

Members: *Amiran Gogatishvili,*
Miroslav Krbec,
Alois Kufner,
Bohumír Opic,
Jiří Rákosník.

Main research areas:

The investigation of the structure of function spaces and of operators on these spaces. Application of the results to the solution of boundary value problems.

The group was initiated in the seventies. The now existing research team, in cooperation with mathematicians of other universities, has continued this work and extended it. A long-lasting task is: to give a possibly complete description of important properties (as, e.g., boundedness, compactness, ...) of integral operators and of embedding in function spaces with a particular emphasize on limiting cases and optimality of the results, to obtain estimates of important quantities describing the behavior of these operators (norms, measures of noncompactness, approximation and entropy numbers), and to apply these results to boundary value problems, in particular to contact problems investigated in Group 3.2.

Intensive collaboration has been going on with both domestic and foreign institutions: Faculty of Mathematics and Physics of the Charles University in Prague, University of Agriculture in Prague, Technical University in Prague, University of West Bohemia in Pilsen, Brock University in St. Catharine, Friedrich-Schiller-Universität in Jena, Technische Universität in Darmstadt, Universität in Bayreuth, Steklov Institute of the Russian Academy of Sciences in Moscow, Technical University in Lulea, University of Sussex, Cardiff University, Universita di Firenze, Universita di Napoli, Mickiewicz University Poznań, University of Coimbra, University of Barcelona, University of Aveiro.

The most important publications in the last five years:

[1] Edmunds, D. E.; Opic, B.: Boundedness of fractional maximal operators between classical and week-type Lorentz spaces. Dissertationes Math. 410 (2002), 1–50.

[2] Edmunds, D. E.; Rákosník, J.: Sobolev embeddings with variable exponent II. Math. Nachr. 246-247 (2002), 53–67.

[3] Garcia-Huidobro, M.; Kufner, A.; Manasevich, R.; Yarur, C. S.: Radial solutions for a quasilinear equation via Hardy inequalities. Adv. Differential Equations 6 (2001), 1517–1540.

[4] Gogatishvili, A.; Pick, L.: Discretization and antidiscretization of rearrangement – invariant norms. Publ. Math. 47 (2003), 311–358.

[5] Krbec, M. Schmeisser, H.-J.: Refined limiting imbeddings for Sobolev spaces of vector-valued functions. J. Funct. Anal. 227 (2005), 372-388.

3.2. Group: Qualitative study of differential equations and variational inequalities

Members: *Jan Eisner,*
Jiří Jarušek,
Milan Kučera,
Dagmar Medková.

Main research areas:

Bifurcation, stability and continuation of solutions to variational inequalities and related problems, applications to problems in mechanics and to reaction-diffusion systems with (boundary or additional) conditions describing some regulation. Existence of solutions of static contact problems with Coulomb friction and dynamic contact problems formulated by the Signorini contact condition. Application of boundary integral equation method to mathematical physics.

The research in bifurcations represents a long time effort to build a bifurcation theory for variational inequalities including problems with nonpotential operators. An original approach to the study of bifurcations for inequalities was found in the beginning of this effort (1977) and it still plays an essential role. In particular, reaction-diffusion systems with unilateral conditions having a biological interpretation are of special interest. In cooperation with L. Recke (Berlin), an attention has been paid to the study of smoothness of bifurcating branches and smooth continuation of solutions to variational inequalities, the equation describing a beam with unilateral obstacles being a model example.

In contact problems the existence of solutions was investigated for dynamic problems with Coulomb friction; thermal aspects and influence of isotrophy of the material are possibly included. The optimization of systems governed by dynamic contact problems has been also studied with a particular success representing the first result in the field of conical differentiability in the literature. Some of these results were awarded the Prize of the Academy of

Sciences. Recently, the dynamic contact with different types of viscosity for von Karman plates as well as for viscoplastic bodies have been studied. In the future, some numerical aspects, possible conservation of energy in dynamic problems, more complex problems, and possible modeling of a dynamic contact of two viscoelastic bodies will be investigated.

Research in the boundary integral equation method has a long tradition in the Academy. J. Král, the retired member of the Institute, is one of the founders of this theory on open sets with a nonsmooth boundary. There are perspectives of a further investigation of boundary value problems for partial differential equations on bad domains by the boundary integral equation method.

Contacts with the University of West Bohemia in Pilsen, Charles University and Czech Technical University in Prague, Humboldt Universität in Berlin, Universität Erlangen-Nurnberg, Moscow State University, and Universität Stuttgart play an essential role.

The most important publications in the last five years:

[1] Eck, C.; Jarušek, J.; Krbec, M.: Unilateral Contact Problems: Variational Methods and Existence Theorems. Pure and Applied Mathematics Vol. 270. Chapman & Hall / CRC, Boca Raton 2005, 398 pp.

[2] Eck, C.; Jarušek, J.: Existence of solutions for the dynamic frictional contact problem of isotropic viscoelastic bodies. Nonlinear Anal. 53 (2003), 157–181.

[3] Eisner, J.; Kučera, M.; Recke, L.: Direction and stability of bifurcation branches for variational inequalities. J. Math. Anal. Appl. 301 (2005), 276–294.

[4] Medková, D.: Continuous extendibility of solutions of the Neumann problem for the Laplace equation. Czechoslovak Math. J. 53 (2003), 377–395.

[5] Recke, L.; Eisner, J.; Kučera, M.: Smooth dependence on parameters of solutions and contact regions in an obstacle problem. J. Math. Anal. Appl. 288 (2003), 462–480.

4.1. Group: Finite element analysis of non-linear problems

Members: *Jan Chleboun,*
Ivan Hlaváček,
Michal Křížek,
Karel Segeth,
Tomáš Vejchodský,
Jakub Šolc (graduate student).

Main research areas:
Mathematical and numerical analysis of nonlinear physical fields by the finite element method optimization techniques.
The nonlinear problems concerned are mathematically described by partial differential equations and inequalities of elliptic or parabolic type. Uncertain input data are considered in some problems. The mathematical as well as numerical tools under research are used to solve wide class of problems that have technologically important applications in practice where linear models or/and definite data are often inadequate.
The working group has close scientific contacts with a lot of researchers in the Czech Republic as well as abroad. Let us name Charles University in Prague, Technical University in Brno, Weierstrass Institut in Berlin, University of Texas at Austin and at El Paso, University of Jyväskylä, University of Amsterdam, University of Westminster, etc.

The most important publications in the last five years:
[1] Babuška, I.; Chleboun, J.: Effect of uncertainties in the domain on the solution of Neumann boundary value problems in two spatial dimensions. Math. Comput. 71 (2002), 1339–1370.
[2] Hlaváček, I.: Unilateral contact with Coulomb friction and uncertain input data. Numer. Funct. Anal. Optim. 24 (2003), 509–530.
[3] Křížek, M.; Němec, J.; Vejchodský, T.: A posteriori error estimates for axisymmetric and nonlinear problems. Adv. Comput. Math. 15 (2001), 219–236.
[4] Šolín, P.; Segeth, K.; Doležel, I.: Higher–Order Finite Element Methods. Boca Raton, FL, Chapman & Hall/CRC 2004, 382 pages + CD ROM.
[5] Vejchodský, T.: On the nonmonotony of nonlinear elliptic operators in divergence form. Adv. Math. Sci. Appl. 14 (2004), 25–33.

4.2. Group: Efficient approximation schemes to the solution of elliptic and parabolic problems

Members: *Michal Křížek,*
Milan Práger,
Petr Přikryl,
Emil Vitásek,
Karel Kolman (graduate student).

Main research areas:
Finite difference and finite element methods, especially in problems connected with higher order approximations to the solutions of linear and nonlinear elliptic and parabolic partial differential equations, with superconvergence phenomena, and with mathematical modeling of melting and solidification processes.
In all the above-mentioned subjects, the research continues from previous years. For the near future, the members of the group intend especially to develop different postprocessing techniques giving superconvergence properties for derivatives of the solution of elliptic problems, to find necessary and sufficient conditions guaranteeing the optimal approximation properties of higher order finite elements and to enhance previously developed models of melting and solidification processes by including turbulent fluid flow in the melt.
The group has close contacts with the University of Jyväskylä, Institute of Systems Science in Beijing, Chalmers University of Technology in Göteborg, Texas A&M University in College Station, Institute of Electronics, Belarussian Academy of Sciences, Minsk, etc.

The most important publications in the last five years:
[1] Brandts, J.; Křížek, M.: Gradient superconvergence on uniform simplicial partitions of polytopes. JMA J. Numer. Anal. 23 (2003), 489–505.
[2] Černý, R.; Jelínek, P.; Přikryl, P.: Computational modeling of turbulent melt flow in CdZnTe crystal growth. Comput. Mater. Sci. 25 (2002), 316–328.
[3] Kolman, K.: A two-level method for nonsymmetric eigenvalue problem. Acta Math. Appl. Sinica 21 (2005), 1–12.
[4] Korotov, S.; Křížek, M.: Acute type refinements of tetrahedral partitions of polyhedral domains. SIAM J. Numer. Anal. 39 (2001), 724–733.
[5] Práger, M.: Eigenvalues and eigenfunctions of the Laplace operator on an equilateral triangle for the discrete case. Appl. Math. 46 (2001), 231–239.

4.3 Group: Numerical and analytical methods in the theory of relativity and celestial mechanics

Members: *Michal Křížek,*
Vojtěch Pravda,
Alena Pravdová,
Aleš Kropáč (graduate student).

Main research area:

Mathematical and numerical analysis of systems of nonlinear ordinary and partial differential equations describing the *n*-body problem, gravitational potentials, and other related physical quantities.

Nonlinear problems of gravity are modeled by a system of Einstein's partial differential equations of hyperbolic type. Investigations are focused especially on solutions of Eistein's equations with symmetries and problems where the gravity is coupled with other physical fields.

The group has contacts with the Charles University in Prague, Friedrich-Schiller-University in Jena, Department of Mathematics at the Faculty of Sciences in Tours, and Department of Mathematics at the Dalhousie University, Halifax.

The most important publications in the last five years:

[1] Coley, A.; Milson, R.; Pravda, V.; Pravdová, A.: Classification of the Weyl tensor in higher dimensions. Classical Quantum Grav. 21 (2004), L35–L42.

[2] Křížek, M.; Pradlová, J.: On the nonexistence of a Lobachevsky geometry model of an isotropic and homogeneous universe. Math. Comput. Simulation 61 (2003), 525–535.

[3] Pravda, V.; Pravdová, A.: WANDs of the Black Ring. Gen. Rel. Grav. 37 (2005), 1277–1287.

[4] Pravda, V.; Pravdová, A.; Coley, A.; Milson, R.: All spacetimes with vanishing curvature invariants. Classical Quantum Grav. 19 (2002), 6213–6236.

[5] Pravdová, A.; Pravda, V.: Boost-rotation symmetric vacuum spacetimes with spinning sources. J. Math. Phys. 43 (2002), 1536–1546.

5.1. Group: Functional analysis–operator theory

Members: *Calin Ambrozie,*
Miroslav Engliš,
Vladimír Müller,
David Pavlica,
Jan Vršovský (graduate student).

Main research areas:

The operator theory in connection with the theory of Banach algebras and the function theory.

The research in the field of functional analysis has a long tradition in the Institute. It was started in the fifties by V. Pták, who obtained important results concerning the open mapping and closed graph theorems for a class of locally convex spaces (now called the Pták spaces). During the time the main interest has gradually shifted to the operators in Banach and Hilbert spaces and connections with related fields of mathematics, especially Banach algebras and function theory. This remains also the main research area for the future.

The group has been co-operating with many foreign mathematicians. Especially close contacts are with the following universities and institutions: Institute of Mathematics of Polish Academy of Sciences in Warsaw, University of Seville, University of Lund, University of Lille, University of Saarbrücken, UNAM Mexico City, Kansas State University.

The most important publications in the last five years:

[1] Ambrozie, C.; Engliš, M.; Müller, V.: Operator tuples and analytic models over general domains in $\boldsymbol{C}^n$. J. Operator Theory 47 (2002), 287–302.

[2] Ambrozie, C.; Müller, V.: Invariant subspaces for polynomially bounded operators II. J. Funct. Anal., to appear.

[3] Engliš, M.: The asymptotics of a Laplace integral on a Kähler manifold. J. Reine Angew. Math. 528 (2000), 1–39.

[4] Müller, V.: On the Taylor functional calculus. Studia Math. 150 (2002), 79–97.

[5] Müller, V.: Spectral Theory of Linear Operators and Spectral Systems in Banach Algebras. Basel-Boston-Berlin, Birkhäuser Verlag 2003, 381 pages.

5.2. Group: Boolean algebras, topology and functional analysis

Members: *Bohuslav Balcar,*
Marián Fabian,
Petr Hájek,
Kamil John,
Jan Kolář,
Eva Kopecká,
Václav Zizler,
Antonín Procházka (graduate student).

Main research area:

General topology, functional analysis, Boolean algebras.

The research is based on an exceptional impact of the work of Czech mathematicians E. Čech, M. Katětov, L. Rieger, Z. Frolík, and V. Pták.

The investigation of structure properties of Boolean algebras, which will continue, is motivated by results on forcing and connections to topological dynamics. The future goal is the investigation of complete Boolean algebras from the point of view of the convergence topology and Maharam submeasures. In the theory of function spaces, the group is going to investigate, e.g., the Lipschitz structure of spaces of continuous functions equipped with a supremum norm. In the theory of Banach spaces a special attention will be paid to the class of weak Asplund spaces and there are many natural problems arising in this connection. Furthemore, set-theoretical topological properties of function spaces and the theory of continuous selections are investigated.

Close contacts are with the following universities: VU Amsterdam, Technical University in Delft, University of Toronto, York University, McMaster University in Hamilton, University of Edmonton, University of Catania, University of Milan, University of Udine, Penn State University in University Park, University of Warsaw, University of Katowice, University of Wroclaw, University of Helsinki.

The most important publications in the last five years:

[1] Balcar, B.; Štěpánek, P.: Set Theory. (In Czech.) Praha, Academia 2001, 462 pages.

[2] Fabian, M.; Godefroy, G.; Zizler, V.: The structure of uniformly Gâteaux smooth Banach spaces. Israel J. Math. 124 (2001), 243–252.

[3] Fabian, M.; Habala, P.; Hájek, P.; Montesinos, V.; Pelant, J.; Zizler, V.: Functional Analysis and Infinite-Dimensional Geometry. New York, Springer-Verlag 2001, 451 pages.

[4] John, K.; Werner, D.: *M*-ideals of compact operators into l_p. Czechoslovak Math. J. 50 (2000), 51–57.

[5] Matoušková, E.: Lipschitz images of Haar null sets. Bull. London Math. Soc. 32 (2000), 235–244.

5.3. Group: Mathematical methods in continuum mechanics

Member: *Miroslav Šilhavý.*

Main research areas:

Thermodynamics of continuous media, theory of plastic bodies, multipolar viscous fluids, linear and nonlinear elasticity, calculus of variations, elliptic partial differential equations.

The present research is devoted to the following areas:

1. A thermodynamic approach to phase transitions in crystalline bodies. A theory of pseudoelastic hysteresis in shape memory alloys has been developed using first principles and the convexity properties of the stored energies. A future prospect concerns the dynamic aspects of the approach.

2. The convexity properties of isotropic stored energies. Equivalent conditions for the rank 1 convexity in terms of the representation through the singular values have been found and also other convexity properties (ordinary convexity, polyconvexity) have been examined. The future research will use these results to develop efficient iterative procedures for finding the rank 1 convex hulls of isotropic stored energies.

Close contacts exist with the following universities: University of Minnesota, Carnegie-Mellon University, Univ. of Pittsburgh, Univ. of Kentucky, Univ. of Pisa, Istituto CNUCE in Pisa, Univ. of Rome II, Heriot-Watt University, University of Bath, Helsinki University of Technology, Institute of Fundamental Technological Research of the Polish Academy of Sciences in Warsaw.

The most important publications in the last five years:

[1] Šilhavý, M.: Differentiability properties of isotropic functions. Duke Math. J. 104 (2000), 367–373.

[2] Šilhavý, M.: Differentiability properties of rotationally invariant functions. J. Elasticity 58 (2000), 225–232.

[3] Šilhavý, M.: Monotonicity of rotationally invariant convex and rank 1 convex functions. Proc. Roy. Soc. Edinburgh Sect. A 132 (2002), 419–435.

6.1. Group: Mathematical logic

Members: *Tomáš Jech,*
Emil Jeřábek,
Jan Krajíček,
Michal Koucký,
Pavel Pudlák,
Jiří Sgall,
Antonín Sochor,
Stefano Cavagnetto (graduate student),
Tomáš Ebenlendr (graduate student),
Radek Honzík (graduate student),
Pavel Hrubeš (graduate student),
Tomáš Tichý (graduate student).

Main research areas:

Mathematical logic, theoretical computer science.

1. Mathematics of arithmetic. This area promises to give at least some explanatory information about very difficult problems in complexity theory. Members of the group have already obtained important results in this field. They have also worked in complexity of propositional calculus, which is a closely connected field. In a recent paper a new concept of implicit proof system was introduced. Using this concept it is possible to characterize some known propositional proof systems as well as some strong proof systems for which no characterization was known before.

2. Complexity theory. This is one of the most important fields of theoretical computer science. Apart from complexity of propositional proofs, which can also be considered to belong here, the researchers have worked mainly on circuit complexity, more specifically on bounded depth circuits and communication complexity.

3. Combinatorics. Extremal problems on set systems, Ramsey type problems. One of the recent results concerns a conjecture posed by Kushner 20 years ago that in the n-dimensional space with l_p-norm the maximal size of an equilateral set (a set in which every pair of points have the same distance) is $2n$ if $p = 1$, and $n + 1$ if $p > 1$. We proved the strongest result concerning the case of p an odd positive integer. Namely for every such integer p there exists a constant c_p such that the size of every equilateral set is bounded by $c_p\ n\ \log n$.

4. Set theory. The present research is on one hand a continuation of more than 15 year work on the Alternative Set Theory (AST) and on the other hand a continuation of the research of large cardinals and forcing.

5. On-line algorithms. This is one of the growing modern areas of the theory of algorithms. The current research focuses on on-line algorithms for scheduling and other areas.

The present and future orientation:

1. Several results about separation of fragments of bounded arithmetic were obtained in the past, which were based on the standard conjectures of complexity theory. A promising direction is to consider conjectures from cryptography as a basis of such results.

2. In the propositional calculus the group wants to extend current lower bound techniques to stronger systems. Also we want to study various properties of proof systems (automatizability, reflection principles, etc.).

3. In circuit lower bounds the group wants to consider relations of combinatorial concepts to various measures of complexity. We will also study the complexity of algebraic circuits.
4. In the set theory the group wants to investigate the relation of AST to other theories. Further topics of research will include elementary embeddings, stationary sets, the theory of large cardinals, applications of forcing, and infinitary combinatorics. We also prepare texts for students concerning metamathematics of the classical set theory.
5. In the area of on-line algorithms we plan to focus on the power of randomization in scheduling and other problems.
Close contacts are with the University of Oxford, Pennsylvania State University, University of California at San Diego, University of Califorinia at Riverside, University of Illinois at Urbana-Champain, Boston College, Institute for Advanced Study, Princeton, McGill University, Montreal, Technical University, Eindhoven.

The most important publications of the last five years:

[1] Alon, N.; Pudlák, P.: Equilateral sets in l_p. Geometric and Functional Analysis 13 (2004), 467–482.

[2] Jech, T.: Set Theory. Berlin, Springer-Verlag 2003, 769 pages.

[3] Krajíček, J.: Dual weak pigeonhole principle, pseudo-surjective functions, and provability of circuit lower bounds. J. Symbolic Logic 69 (2004), 265–286.

[4] Chrobak, M.; Jawor, W.; Sgall, T.; Tichý, T.: Online scheduling of equal-length jobs: Randomization and restarts help. In: Proceedings of the 31st Int. Colloquium on Automata, Languages, and Programming (ICALP), Lecture Notes in Comput. Sci. 3142 (2004), 358–370.

[5] Sochor, A.: Classical Mathematical Logic. (In Czech.) Praha, Karolinum 2001, 403 pages.

6.2. Group: Theory of matrices

Members: *Miroslav Fiedler.*

Main research areas:

Theory of matrices, numerical algebra.

1. The work of the present group has lasted from the eighties while the collaboration of M. Fiedler and V. Pták dates back to the late fifties. Structured matrices like Hankel, Bézout, Loewner, etc. are studied since the eighties. In

the nineties, the research concentrates on their generalizations with applications to control theory. Geometric and functional analytic approaches as well as numerical aspects have played an important role from the very beginning.

2. Systems of linear equations and inequalities with vague matrices are studied, too. The concept of a vague matrix enables to discuss various types of inaccuracy including the interval one.

The present and future orientation:

1. Nonnegative matrices, *M*-matrices and their generalizations, positive definite and semidefinite matrices. Several kinds of completion problems are studied.

2. Extensions of linear algebraic problems in various directions: to nonlinear problems, to problems in noncommutative rings etc. At present, the main topic is nonmonic matrix polynomials, their canonical forms, linearizations, and application to systems of linear differential and difference equations with constant coefficients.

3. Methods of describing the solution set of a given vague system are studied.

4. Regularity and positive regularity of a vague matrix are analyzed. We deal with duality theorems for vague systems.

Close contacts exist with the University of South Carolina, Katholieke Universiteit Leuven, and Technische Universität Chemnitz.

The most important publications of the last five years:

[1] Fiedler, M.: Matrices and Graphs in Euclidean Geometry. (In Czech.) Praha, DIMATIA 2001, 140 pages.

[2] Fiedler, M.; Vavřín, Z.: Generalized Hessenberg matrices. Linear Algebra Appl. 380 (2004), 95–105.

[3] Fiedler, M.: Geometry of the Laplacian. Linear Algebra Appl. 389 (2004), 175–181.

7.1. Group: Didactics of mathematics

Members: *Filip Roubíček,*
Marie Tichá,
Jana Macháčková (graduate student).

Main research areas:

Problems of mathematics education of students aged 5-15 years.

The goal of the research is the understanding of processes, which are going on during learning and teaching mathematics, and application of this knowledge to optimisation of mathematical education. Attention is paid to the problems

of contribution of mathematics education to the development of both mathematical and general literacy. The ways are investigated that enable the development of constructive character of mathematics education.
Stress is given on the following areas:
Study of developmental trends in creation of images and understanding the concepts and possibilities of re-education of misconceptions (case of fraction). Investigation of characteristic features of the mechanism of the grasping of both mathematical and nonmathematical situations and of the meaning of problem posing for the development of cognitive abilities. Systematic development of methodology, especially about possibilities of utilization of translations between various modes of representation as a diagnostic tool in the course of study of the level of understanding. Investigation of possibilities of applying semiotic approach to the study (i) of the role of representations in teaching geometry and (ii) of phenomena that concern creation, interpretation and transformation of representations of geometrical objects in communication. Study of the role of individual and joint reflection for the improvement of mathematics classroom culture and professional competences of teachers.
The research is performed in collaboration with colleagues from Charles University in Prague, University of South Bohemia in České Budějovice, and University of Hradec Králové. In frame of Socrates-Comenius project "Understanding of mathematics classroom culture in different countries" the collaboration with colleagues from University of Dortmund, University of Bielefeld and University of Pavia is developed.

The most important publications in the last five years:

[1] Tichá, M.: Following the path of discovering fractions. In: Proceedings SEMT ´03 – International Symposium, Elementary Maths Teaching, plenary lectures. (J. Novotná, ed.) Praha, Faculty of Education of the Charles University 2003, 17–27.
[2] Foubíček, F.: Geometrization, communication and semiotic representations. ICME-10, 2004. http://www.icme-10.dk/, (TSG 25)
[3] Hošpesová, A.; Tichá, M.: Developing mathematics teachers´competence. CERME-4, Sant Feliu de Guíxols (Spain), 2005. http://cerme4.crm.es/ (Papers – working group 12)
[4] Tichá, M.; Macháčková, J.; Hošpesová, A.: Mathematics Classroom and Collective Reflection. In: Proceedings SEMT ´05 – International Symposium, Elementary Maths Teaching. (J. Novotná, ed.) Praha, Faculty of Education of the Charles University 2005, 307–315.

[5] Tichá, M.: Developing mathematical culture of 7-15-year-old students. In: Proceedings CIEAEM 53 – Mathematical Literacy in the Digital Era. (L. Bazzini, C. Whybrow Inchley, eds.) Milano, Ghisetti e Corvi Editori 2002, 213–218.

8.1. Group: Algebraic topology, differential geometry, homological algebra

Members: *Martin Markl,*
Martin Panák,
Jiří Vanžura.

Main research areas:

Algebraic topology (classifying spaces, fiber spaces and bundles, operations, and obstructions), differential geometry (multisymplectic structures), homological algebra (categories and algebraic theories), homological physics (applications of methods of homological algebra and algebraic topology in mathematical physics).

The group cooperates permanently with M. Čadek from the Faculty of Science of the Masaryk University in Brno, and in the field of algebraic topology, and with J. Bureš from the Faculty of Mathematics and Physics of the Charles University in Prague in the field of differential geometry.

It has a growing international cooperation (the University of North Carolina, Bar Ilan University, MacGill University, University of Warsaw, University of Wroclaw, University of Pensylvania, North Carolina State university, Bar Ilan University, University of Haifa, University of Minnesota) and cooperates also intensively with the Charles University in Prague. It influences also the teaching of algebraic topology at the Masaryk University in Brno and the Charles University in Prague.

The most important publications of the last five years:

[1] Blanc, D.; Markl, M.: Higher homotopy operations. Math. Zeitschrift 245 (2003), 1–29.

[2] Bureš, J.; Vanžura, J.: Multisymplectic forms of degree three in dimension 7. Proc. 23rd Winter School Geometry and Physics (Srní, January 12-19, 2002). Rend. Circ. Mat. Palermo, Ser. II, Suppl., 71 (2003), 73–91.

[3] Čadek, M.; Mimura, M.; Vanžura, J.: The cohomology rings of real Stiefel manifolds with integer coefficients. J. Math. Kyoto Univ. 43 (2003), 411–428.

[4] Markl, M.: Loop homotopy algebras in closed string field theory. Commun. Math. Phys. 221 (2001), 367–384.

[5] Markl, M.: Homotopy algebras are homotopy algebras. Forum Matematicum 16 (2004), 129–160.

8.2. Group: Qualitative theory of differential equations

Members: *Ladislav Adamec,*
Robert Hakl,
Jan Komenda,
Alexander Lomtatidze,
Sulkhan Mukhigulashvili,
František Neuman,
Bedřich Půža,
Andrii Ronto,
Pavel Řehák,
Jaromír Šimša,
Jiří Šremr,
Petr Vodstrčil,
Zdeněk Opluštil (graduate student).

Main research areas:

1. Global properties of linear differential equations of higher order. Algebraic, topological, and geometrical methods as well as the theory of functional equations are applied.
2. Boundary value problems for functional differential equations and their systems. Asymptotic behaviours of solutions of differential equations. Partial differential equations of hyperbolic type. Differential equations in the Banach spaces.
3. Qualitative theory of half-linear and quasi-linear differential/difference equations and dynamic equations on time scales.
4. Dynamical systems.
5. Optimal control of asynchronous and timed discrete-event systems.

The group has wide scientific contacts with, e. g., the University of Graz, University of Missouri-Rolla, Mathematical Institute of the Georgian Academy of Sciences in Tbilisi, Mathematical Institute of the Hungarian Academy of Sciences in Budapest, University of Florence, University of Ulm, University of Ioannina, University of Granada, University of Modena e Reggio Emilia, Perm Technical University, Academy of Sciences of the Ukraine Kiev, University of Udine, University of Louvain-la-Neuve, Center for Mathematics and Computer Sciences (CWI), Amsterdam, University of Nebraska, Lincoln; University of Rennes; University of Angers.

The most important publications of last five years:

[1] Agarwal, R.P.; Ronto, A.: Linear functional differential equations possessing solutions with a given growth rate. J. Inequal. Appl., 1 (2002), 49–65.

[2] Došlý, O.; Řehák, P.: Half-linear differential equation. Elsevier, North-Holland Mathematics Studies vol. 202, 2005, 515 pages.

[3] Hakl, R.; Lomtatidze, A.; Šremr, J.: Some Boundary Value Problems for First Order Scalar Functional Differential Equations. Brno, Folia Fac. Sci. Natur. Univ. Masaryk. Brun. Math. 10, 2002, 300 pages.

[4] Kiguradze, I.; Půža, B.: Boundary Value Problems for Systems of Linear Functional Differential Equations. Brno, Folia Fac. Sci. Natur. Univ. Masaryk. Brun. Math. 12, 2003, 108 pages.

[5] Komenda, J.; van Schuppen, J.H.: Control of discrete event systems with partial observations using coalgebra and coinduction. Discrete Event Dyn. Syst., 15 (2005), 257–315.

Mathematical Institute in Numbers

Numbers (as for 31.10.2005)

- of researchers 70
- of graduate students employed in the Institute 17
- of technical and supporting staff 24

Table 1. Age Categories as for 31.10.2005

Age	-30	31-40	41-50	51-60	61-
Number of researchers	6	15	12	17	20

Table 2. Number of Researchers in Working Groups

Group	Researchers as for 31.10.2005	Graduate Students (including employed students) as for 31.10.2005
1.1	3	2
1.2	3	2
1.3	2	1
2.1	6	5
3.1	5	4
3.2	4	0
4.1	5*	6
4.2	4*	4
4.3	3*	1
5.1	4	5
5.2	7	0
5.3	1	0
6.1	7	6
6.2	1	0
7.1	2	2
8.1	3	2
8.2	12	14
Total	70	54

* M. Křížek included in groups 4.1, 4.2, and 4.3.

Table 3. Graduate Students of Members of the Institute

Group	Advisors	Students
1.1	Š. Schwabik	A. Slavík
	M. Tvrdý	Z. Halas
1.2	B. Maslowski	J. Pospíšil
		M. Vyoral
1.3	I. Saxl	L. Ilucová
2.1	E. Feireisl	J. Březina
		S. Chmelová
		J. Černý
		R. Erban
		L. Poul
3.1	A. Kufner	K. Kuliev
		G. Kulieva
	M. Krbec	P. Milar
		M. Otavová
4.1	J. Chleboun	P. Harasim
	I. Hlaváček	V. Krištof
	M. Křížek	J. Šolc
	K. Segeth	V. Vlček
		P. Novák
		M. Zítka
4.2	M. Křížek	K. Kolman
	P. Přikryl	M. Lazar
		A. Satklichov
		J. Slovan
4.3	M. Křížek	A. Kropáč
5.1	M. Engliš	R. Otáhalová
		P. Kolovrat
		J. Tichavský
	P. Hájek	A. Procházka
	V. Müller	J. Vršovský
		P. Imrýšek
6.1	T. Jech	R. Honzík
	J. Krajíček	S. Cavagnetto
	P. Pudlák	M. Bílková
		P. Hrubeš

	J. Sgall	T. Ebenlendr
		J. Tichý
7.1	M. Tichá	D. Fialová
		J. Macháčková
8.1	J. Vanžura	M. Provazníková
		M. Tihlaříková
8.2	J. Šimša	J. Elbelová
		Z. Hencová
		R. Smýkalová
		B. Šťastná
	A. Lomtatidze	Z. Opluštil
		L. Polák
		H. Štěpánková
	B. Půža	K. Daňková
		J. Konečná
		G. Kraváčková
		M. Kuchyňková
		L. Maňásek
		S. Sukovych

Table 4. Long-Time Visitors

Group	Name	Country	Since	Till
1.1	Marcia FEDERSON	Brazil	20.5.2005	31.8.2005
2.1	Daria APUSHKINSKAYA	Russia	1.12.1999	31.12.1999
	Alexander ZLOTNIK	Russia	25.9.2000	31.8.2001
	Martin BROKATE	Germany	1.5.2002	31.5.2002
	Antonín NOVOTNÝ	France	1.3.2001	31.8.2001
	Patrik PENEL	France	28.3.2003	31.8.2003
3.1	Amiran GOGATISHVILI	Georgia	1.10.1998	30.9.2000
	Takuya L.SOBUKAWA	Japan	1.4.2000	12.12.2000
	Lasha EPHREMIDZE	Georgia	10.10.2000	31.8.2002
	George JAIANI	Georgia	1.12.2001	31.5.2002
	Petteri HARJULEHTO	Finland	15.1.2004	14.6.2004
	Vladimir OVCHINNIKOV	Russia	6.9.2004	31.8.2005
	Yulia NAMLYEYEVA	Ukraine	5.10.2005	31.3.2006
3.2	Pavel KRUTITSKII	Russia	19.6.2002	14.7.2002
4.1	Liping LIU	China	1.9.1996	31.12.1996
	Jan BRANDTS	The Netherlands	1.10.1997	31.8.1998
	Wei CHEN	China	4.3.2004	31.8.2004
	Lawrence SOMER	U.S.A.	17.10.2005	30.6.2006

4.2	Jaroslav KAUTSKÝ	Australia	1.8.1997	31.10.1997
4.3	Florian LUCA	Romania	10.9.1999	14.4.2000
5.1.	Darko MILINKOVIĆ	Yugoslavia	1.9.1997	28.2.1998
	Calin-Grigore AMBROZIE	Romania	1.9.1998	28.2.1999
	Calin-Grigore AMBROZIE	Romania	1.9.2002	30.5.2003
	Calin-Grigore AMBROZIE	Romania	6.10.2003	31.8.2004
5.2	Stevo TODORČEVIĆ	Canada	1.6.1996	31.8.1996
	Camillo COSTANTINI	Italy	1.10.2001	30.9.2002
6.1	Armin HAKEN	U.S.A.	1.1.1996	31.5.1996
	Jui-Lin LEE	Taiwan	1.2.1997	30.9.1997
	Adam H. LEWENBERG	U.S.A.	15.5.1997	15.8.1997
	Oleg VERBITSKY	Ukraine	1.4.1998	31.8.1998
	Antonina KOLOKOLOVA	Ukraine	12.10.2004	28.2.2005
	Joost. J. JOOSTEN	The Netherlands	1.9.2005	31.8.2006
	Neil. D. THAPEN	Great Britain	2.9.2005	31.8.2005
	Allan R. SKELLEY	Canada	26.9.2005	31.8.2006
8.1	Steven SCHNIDER	Israel	1.5.1997	30.6.1997
	Mamoru MIMURA	Japan	1.9.1998	31.5.1999
	Aleksandre ELASHVILI	Georgia	7.12.2001	30.6.2002
	Elisabeth REMM	France	5.11.2003	31.1.2004
	Rafal WALCZAK	Poland	12.9.2005	31.8.2006
8.2.	Alexander LOMTATIDZE	Georgia	1.1.1998	31.12.1999
	Sulkhan MUKHIGULASHVILI	Georgia	15.9.2003	30.9.2004
	Andrii RONTO	Ukraine	1.8.2003	31.1.2004

Table 5. Grants in 2005. Grant Agency of the Academy of Sciences

Group	Principal Investigator	Number	Duration till	Support to the MI in 2005 (thousands of CZK)
2.1	E. Feireisl	A1019302	2005	136
2.1	Š. Nečasová	A100190505	2007	165
3.2	M. Kučera	A100190506	2007	146
4.1	M. Křížek	A1019201	2006	373
4.3	V. Pravda	B1019403	2006	153
5.1	M. Engliš	A1019304	2006	133
5.2	M. Fabian	A1019301	2005	117
5.2	P. Hájek	A100190502	2007	190
6.1	P. Pudlák	A 1019401	2008	423
6.1	T. Jech	A100190509	2009	132
8.2	P. Řehák	B1019407	2006	92
	Total			2167

Group	Co-principal Investigator	Number	Duration till	Support to the MI in 2005 (thousands of CZK)	Principal Investigator
1.3	I. Saxl	A100110502	2009	59	J. Janáček[1]
3.2	J. Jarušek	A1075402	2007	105	J. Outrata[2]
	Total			164	

[1] Institute of Physiology AS CR
[2] Institute of Information Theory and Automation AS CR in Prague

Table 6. Projects in 2005: National Research Programme - Information Society

Title	Czech Digital Mathematical Library
Number	1ET200190513
Duration till	2009
Investigator	J. Rákosník
Working Group	3.1
Support to the MI in 2005 (thousands of CZK)	437

Table 7. Grants in 2005. Czech Science Foundation.

Group	Principal Investigator	Number	Duration till	Support to the MI in 2005 (thousands of CZK)
1.1	Š. Schwabik	R201040690	2006	240
1.2	B. Maslowski	R201040750	2006	246
2.1	E. Feireisl	R201050164	2007	568
3.1	B. Opic	R201052033	2007	379
4.1	K. Segeth	R201041503	2006	1125
5.1	M. Engliš	R201030041	2005	231
5.2	M. Fabian	R201040090	2006	474
6.1	J. Sgall	R201050124	2007	360
8.1	M. Markl	R201052117	2007	918
	Total			4541

Group	Co-principal Investigator	Number	Duration till	Support to the MI in 2005 (thousands of CZK)	Principal Investigator
1.1	Š. Schwabik	R20103H152	2007	108	J. Smítal[1]
1.1	M. Tvrdý	R201041077	2006	100	I. Rachůnková[2]
1.3	I. Saxl	R201030946	2005	128	V. Beneš[3]
2.1	I. Straškraba	R101030229	2005	110	W. Kolarčík[4]
2.1	I. Straškraba	R201050005	2007	125	M. Feistauer[3]
5.2	B. Balcar	R201030933	2005	154	M. Hušek[3]
7.1	M. Tichá	R406052444	2007	181	A. Hošpesová[5]
	Total			906	

[1] Mathematical Institute of the Silesian University in Opava
[2] Faculty of Science of the Palacký University in Olomouc
[3] Faculty of Mathematics and Physics of the Charles University in Prague
[4] Hydrosystem Group, Inc., in Olomouc
[5] University of South Bohemia in České Budějovice

Table 8. Grants in 2005. Czech Science Foundation. Post-Doc Grants

Group	Post-Doctoral Investigator	Number	Duration till	Support to the MI in 2005 (thousands of CZK)	Supervisor
4.1	T. Vejchodský	R20104P021	2006	100	M. Křížek
4.3	V. Pravda	R20203P017	2005	171	M. Křížek
7.1	F. Roubíček	R40603D052	2006	190	M. Tichá
8.2	M. Panák	R20105P008	2007	86	
8.2	J. Šremr	R20104P183	2006	74	A. Lomtatidze
	Total			621	

Table 9. Contact Project Grants in 2005. Ministry of Education (Czech Republic) – National Science Foundation (USA)

Title	Homotopy invariant algebraic structures
Number	ME 603
Duration till	2005
Investigator	M. Markl
Working Group	8.1
Project Partner	T. Lada[1]

[1] North Carolina State University, USA

Table 10. Contact Project Grants in 2005. Ministry of Education (Czech Republic) – National Science Foundation (USA)

Title	Fermat numbers and their applications
Number	ME 749
Duration till	2008
Czech Principal investigator	M. Křížek
Working Group	4.2
US Principal Investigator	L. Somer[2]

[2] Catholic University of America, Washington, D.C., USA

Table 11. Czech-German project between AS CR and DAAD SRN.

Title	Fluid flow around rotating and moving obstacles
Number	D-CZ 3/05-6
Duration till	2006
Czech Principal investigator	Š. Nečasová
Working Group	2.1
German Principal Investigator	R. Farwig[3]

[3] TH Darmstadt, Germany

Table 12. Slovenian-Czech Intergovernmental S&T Cooperation Programme

Title	The spectral theory of linear operators
Number	31/2005-06
Duration till	2006
Czech Principal investigator	V. Müller
Working Group	5.1
Slovenian Principal Investigator	M. Omladič[4]

[4] Institute of Mathematics, Physics and Mechanics, Ljubljana, Slovenia

Table 13. European Social Fond – programme Human Resources Development

Title	Mathematics teachers and their participation in the school curriculum preparation
Number	CZ.04.1.03/3.1.15.1/0237
Duration till	31.8.2007
Czech Principal investigator	V. Sýkora[5]
Coworkers from MI	M. Tichá, F. Roubíček
Working Group	7.1

[5] Union of Czech Mathematicians and Physicists