



Institute of Mathematics CAS, v. v. i.

Identification number: 67985840

Address: 115 67 Praha 1, Žitná 609/25

Annual report on activities and economic management in 2018

English summary

The Annual report was discussed by the Supervisory Board of the Institute on 30 April 2019 and approved by the Board of the Institute on 30 April 2019.

Contents

1	The Institute	3
1.1	Foundation deed	4
1.2	Governing bodies	5
1.3	Structure	6
2	Research activities	7
2.1	Characteristics of the principal activity	7
2.2	Departments	7
2.3	Research centres	8
2.4	Research output	9
2.5	Projects	11
2.6	International conferences and workshops organized by the Institute	12
2.7	International collaboration	12
2.8	Cooperation with universities in education	12
2.9	Awards	13
2.10	Further activities	13
3	Economic management	14
3.1	Assets	14
3.2	Profit and loss	15
3.3	Personnel and salaries	15

1 The Institute

The Institute of Mathematics of the Czech Academy of Sciences, v. v. i. (“the Institute”), is a public research institution according to the Act No. 341/2005 Coll.

The founder of the Institute is the Czech Academy of Sciences seated at Praha 1, Národní street 1009/3, ZIP code 117 20.

The Institute was founded in order to carry out scientific research in the field of mathematics, to contribute to the utilisation of its research results, and to provide the research infrastructure.

Contact:

Institute of Mathematics CAS

Žitná 25

115 67 Praha 1

Tel.: +420 222 090 711

Fax: +420 222 090 701

e-mail: mathinst@math.cas.cz

URL: www.math.cas.cz

IN: 67985840

TIN: CZ67985840

1.1 Foundation deed (unofficial translation)

Based upon Act No. 283/1992 Coll., on the Czech Academy of Sciences, as subsequently amended, and upon Act No. 341/2005 Coll., on public research institutions, as subsequently amended, and further, in accordance with the Statutes of the Czech Academy of Sciences issued on 24 May 2006, the Czech Academy of Sciences (hereinafter CAS) hereby issues the Full Text of the Foundation Deed of the Institute of Mathematics of the CAS (in Czech “Matematický ústav AV ČR, v. v. i.”) dated 28 June 2006 (English version dated 20 December 2006), as subsequently amended by the resolution of the twentieth session of the Academy Council of the CAS held on 15 July 2014 which changed English translation of the name of the CAS from the Academy of Sciences of the Czech Republic to the Czech Academy of Sciences as of 1 January 2015:

I.

(1) The Institute was incorporated into the Czechoslovak Academy of Sciences (hereinafter CSAS) under the name the Mathematical Institute of the CSAS by a resolution of the third plenary meeting of the Government Commission for the Establishment of the CSAS held on 30 March 1952, which took effect on 1 January 1953. Under section 18 (2) of Act No. 283/1992 Coll., the Institute became an entity of the CAS as of 31 December 1992.

(2) Under Act No. 341/2005 Coll., the legal status of the Mathematical Institute of the CAS has been transformed from a state contributory organisation into a public research institution (abbreviated in Czech as v. v. i.) from 1 January 2007.

II.

(1) The Institute of Mathematics of the CAS (hereinafter IM) is established for an indefinite period as a legal entity with identification number 67985840, and is located in Prague 1, Žitná 609/25, Postal Code 115 67.

(2) The founder of the IM is the CAS, an organisational body of the state, identification number 60165171, headquartered in Prague 1, Národní 1009/3, Postal Code 117 20.

III.

(1) The purpose for which the IM has been established is to carry out scientific research in the field of mathematics, to contribute to the utilisation of its research results, and to provide the research infrastructure.

(2) The principal activity of the IM is scientific research in the fields of mathematics and its applications. The IM contributes to raising the level of knowledge and education and to utilising the results of scientific research in practice. It acquires, processes and disseminates scientific information, issues scientific and professional publications (monographs, journals, proceedings, etc.). It provides scientific assessments, professional opinions and recommendations, consulting and advisory services. In cooperation with universities, the IM carries out doctoral study programmes and provides training for young scientists. Within the scope of its activity, the IM promotes international cooperation, including the organisation of joint research projects with foreign partners, participation in exchange programmes for scientists and the exchange of scientific information, as well as the preparation of joint publications. The IM organises scientific meetings, conferences and seminars on the national and international levels and provides the infrastructure for research, including the provision of accommodation for its employees and guests. It pursues its aims both independently and in cooperation with universities and other research and professional institutions.

IV.

(1) The director, the Board and the Supervisory Board are the bodies of the IM. The director is the statutory body of the IM and is entitled to act on behalf of the IM.

(2) Basic organisational units of the IM are scientific departments responsible for research and development, and service departments responsible for provision of the infrastructure.

(3) The detailed organisational structure of the IM is regulated by rules of organisation issued by the director after being approved by the Board.

V.

The foundation deed in its present form took effect on 1 January 2015.

Prof. Jiří Drahoš
President of the CAS

1.2 Governing bodies

Director: RNDr. Jiří Rákosník, CSc.

Deputy Director: Doc. RNDr. Tomáš Vejchodský, Ph.D.

Board of the Institute:

Chair: RNDr. Martin Markl, DrSc.

Vice-chair: Vojtěch Pravda, Ph.D., DSc.

Members at large: Prof. RNDr. Zuzana Došlá, DSc. (Masaryk University in Brno)
Prof. RNDr. Pavel Drábek, DrSc. (University of West Bohemia in Pilsen)
Prof. RNDr. Eduard Feireisl, DrSc.
Prof. RNDr. Stanislav Hencl, Ph.D., DSc. (Univerzita Karlova)
Prof. RNDr. Michal Křížek, DrSc.
Prof. Wiesław Kubiś, Ph.D.
RNDr. Šárka Nečasová, DSc.
Prof. RNDr. Ivan Netuka, DrSc. (Charles University in Prague)
Doc. RNDr. Tomáš Vejchodský, Ph.D.

Supervisory Board:

Chair: Prof. Ing. Michal Haindl, DrSc. (Academy Council of the CAS)

Vice-chair: Doc. Ing. Miroslav Rozložník, Dr.

Members at large: Prof. RNDr. Jan Hamhalter, CSc. (Czech Technical University in Prague)
Prof. RNDr. Luboš Pick, CSc., DSc. (Charles University in Prague)
Ing. Július Štuller, CSc. (Institute of Computer Science of the CAS)

The director of the Institute cooperated with the Board of the Institute and relied on an informal advisory board formed by the chair of the Board Martin Markl, deputy director Tomáš Vejchodský, the scientific secretary and project manager Beata Kubiś, head of the Administration Department Radka Vrkočová and head of the IT Department Martin Jarník.

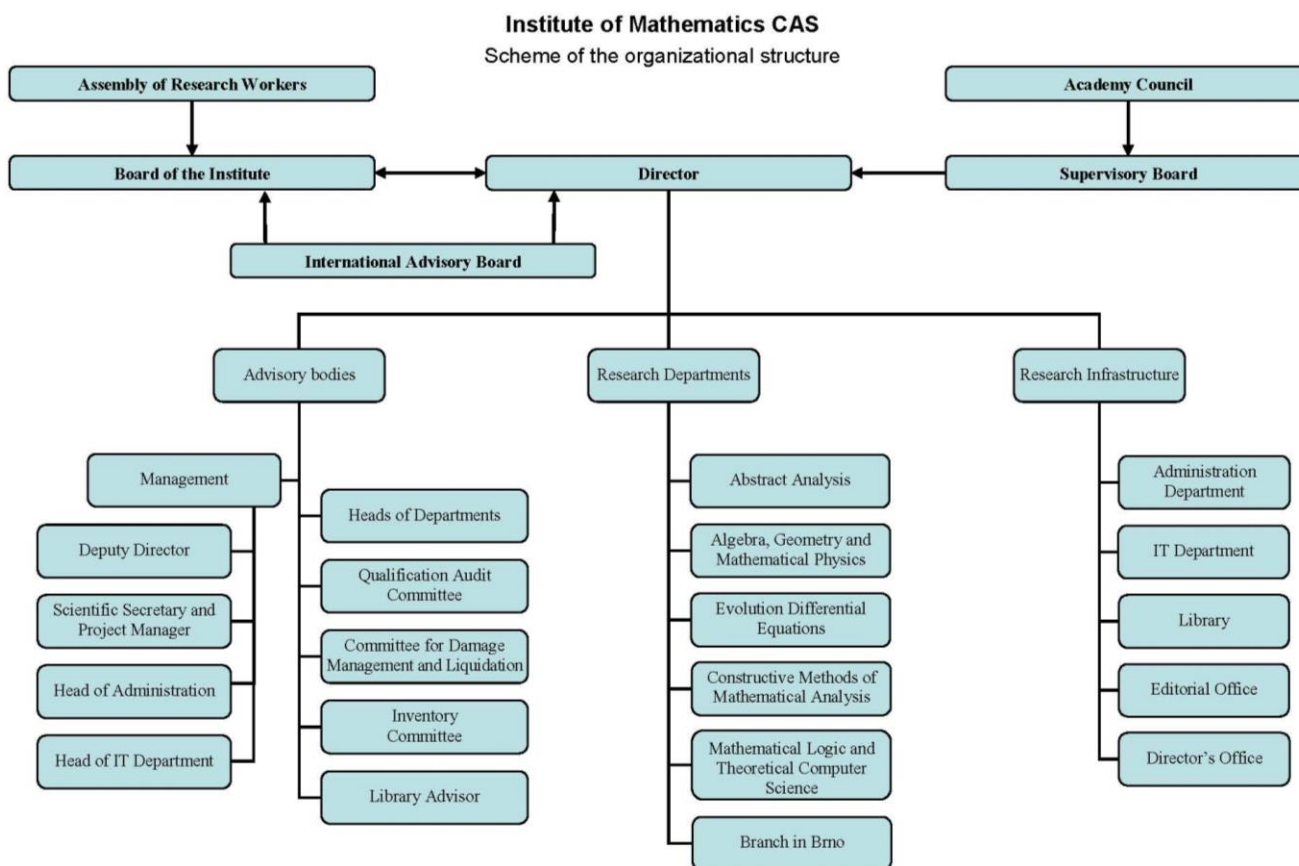
The **Board of the Institute** held six meetings, three of them remotely. The topics they discussed and approved included among others:

- budget of the Institute for 2018
- annual report on activities and economic management in 2017 and auditor's report on financial statements
- change of the Organizational Chart in connection with dissolution of the Department of Didactics of Mathematics and renaming the Department of Topology and Functional Analysis to Department of Abstract Analysis
- proposal to award the Otto Wichterle Premium for young researchers to M. Doucha and V. Mácha (the Academy Council of the CAS approved the Premium for M. Doucha)
- selection of candidates for the postdoctoral positions in the Academy's programme supporting prospective human resources
- recommendation to invite Prof. V. Rödl (Emory University, Atlanta) for the Eduard Čech Distinguished Visitor position
- proposal of awarding M. Markl the prestigious Praemium Academiae (approved by the Academy Council of the CAS for the period 2019–2024)
- proposal to award the Honorary Bernard Bozano Medal for Merit in Mathematical Sciences to Prof. M. Feistauer (Charles University) and A. Novotný (Université Toulon)
- initiation of the selection procedure for the position of the director of the IM CAS for the period May 2019 – April 2024

The **Supervisory Board** held five meetings, three of them remotely. The topics they discussed and approved included among others:

- discussion about the proposal of the budget of the Institute for 2018, about the annual report on activities and economic management in 2017 and about auditor's report on financial statements
- determination of the auditor for financial statements for 2018
- approval of lease agreements and amendments extending lease agreements for flats in the Institute's building
- approval of the new lease agreement for offices for the Union of Czech Mathematicians and Physicists

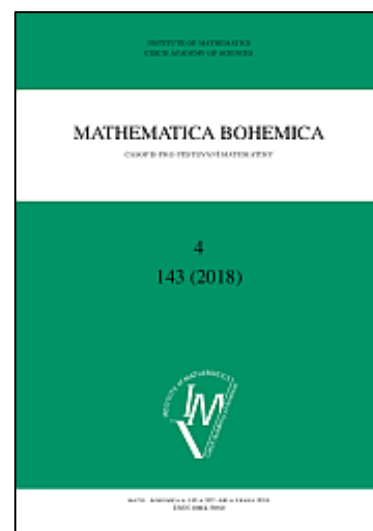
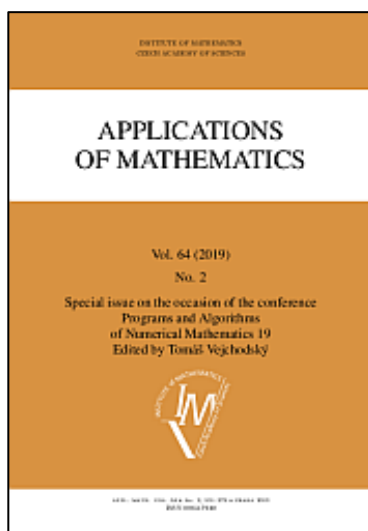
1.3 Structure



The former Department of Topology and Functional Analysis was renamed to Department of Abstract Analysis in order to better reflect the current focus of its members.

The Institute publishes three internationally recognized mathematical journals:

- Czechoslovak Mathematical Journal
- Mathematica Bohemica
- Applications of Mathematics



The director nominates the Editorial Boards and the Editors-in-Chief.

The Institute is maintaining and developing the Czech Digital Mathematics Library DML-CZ accessed at <http://dml.cz> and participates in the development of the European Digital Mathematics Library EuDML accessed at <http://eudml.org>. The Institute operates the Prague zbMATH Editorial Group contributing to the production of the database.

2 Research activities

2.1 Characteristics of the principal activity

The principal activity of the IM is to support fundamental research in the fields of mathematics and its applications, and to provide necessary infrastructure for research. The IM contributes to raising the level of knowledge and education and to utilising the results of scientific research in practice. It acquires, processes and disseminates scientific information including scientific publications (journals, proceedings, monographs etc.). In cooperation with universities, the IM carries out doctoral study programmes and provides training for young scientists. The IM promotes international cooperation, including the organisation of joint research projects with foreign partners and participation in exchange programmes. The IM organises scientific meetings, conferences and seminars on the national and international levels.

Research in the Institute focuses on mathematical analysis (differential equations, numerical analysis, functional analysis, theory of function spaces), algebraic and differential geometry, mathematical physics, mathematical logic, complexity theory, combinatorics, set theory, numerical linear algebra, general and algebraic topology, optimization and control.

2.2 Departments

Abstract Analysis

Main research themes of the department members can be described as the study and classification of mathematical structures, using advanced methods of logic, set theory, and category theory, as well as modern tools from mathematical analysis and algebra. Abstract analysis refers to these areas of science where mathematical logic plays a significant role, even though it is not the main object of study. These areas include descriptive set theory, topology, Banach space theory, and the theory of C^* algebras.

Algebra, Geometry and Mathematical Physics

The department was formed in 2014 from researchers interested in algebraic and differential geometry and in closely related areas of mathematical physics. The research is focused on mathematical aspects of modern theoretical models of physics of microcosmos and cosmology related to logical correctness of physical hypotheses and mathematical models aiming at understanding the nature of matter and space. Research topics include representation theory and its applications to algebraic geometry, homological algebra, algebraic topology, applied theory of categories, tensors classification, generalized theory of gravitation, and study of Einstein equations. Members of the department were involved in two excellence centres in 2018: the Eduard Čech Institute for Algebra, Geometry and Physics (<http://eci.math.muni.cz/>) and the Albert Einstein Centre for Gravitation and Astrophysics (<http://www.albert-einstein-center.cz/>).

Branch in Brno

The core research performed in this section in collaboration with several members of the Department of Evolution Differential Equations concerns qualitative properties of ordinary and functional differential equations. Such equations describing development of finite dimensional systems find important applications in biology and physics. The theoretical study of their solutions helps to discover mathematical causalities in real systems including singularities in time and space variables as well as in discontinuous processes. These features are modelled by means of the Kurzweil-Henstock integral and equations on time scales. Another important topic concerns methods of optimal control of complex processes.

Constructive Methods of Mathematical Analysis

The department continues the long tradition of investigation and use of numerical methods established at the Institute by the world-leading specialist Prof. Ivo Babuška. The importance of such methods is growing with the development of computational and experimental techniques. Mathematical modelling of complex physical processes involving immense amount of data requires

new methods of communication with computers, namely for optimal employment of their ever growing capacity, and for increasing speed and controlling rigour of computation by means of superconvergence and a posteriori error estimates. The main topic concerns analysis and optimization of the finite element method for solving partial differential equations describing physical processes in solid matters and fluids. Members of the department are involved in the Jindřich Nečas Centre for Mathematical Modeling (<http://ncmm.karlin.mff.cuni.cz/>) and in the network for industrial mathematics EU-MATHS-IN.CZ (<http://www.eu-maths-in.cz/>), part of the European network EU-MATHS-IN (<http://eu-maths-in.eu/>).

Evolution Differential Equations

The scope of this department covers qualitative aspects of the theory of partial differential equations in mechanics and thermodynamics of continuum, in biology and in other sciences. The research aims at verification of correctness of mathematical models and at the possibility to provide theoretical predictions of future development of a system without the full knowledge of the initial state. The work focuses on investigation of equations describing fluid flow including heat exchange and interaction with solid bodies. Attention is paid also to processes in solid matters focusing on mathematical modelling of memory in multifunctional materials, on dynamical behaviour of bodies in a contact with an underlay, and on phase transitions. Several members cooperate with the Branch in Brno investigating the integration theory and ordinary differential equations. Members of the department are involved in the Jindřich Nečas Centre for Mathematical Modeling (<http://ncmm.karlin.mff.cuni.cz/>) and in the network for industrial mathematics EU-MATHS-IN.CZ (<http://www.eu-maths-in.cz/>). In 2014–2018, E. Feireisl was the principal investigator of the prestigious ERC Advanced Grant *Mathematical Thermodynamics of Fluids* ([MATHEF](#)) devoted to the development of mathematical theory of thermodynamics of compressible viscous fluids.

Mathematical Logic and Theoretical Computer Science

The research programme of this section is connected with the questions of information processing. The main topic is the theory of computational complexity that is used for classification of algorithmic problems and plays an important role in coding and electronic communication security. Further important research fields concern general questions of logical foundations of numbers and set theory, combinatorics and matrix theory. In 2014–2018, several members of the department were involved in the prestigious ERC Advanced Grant *Feasibility, Logic and Randomness in computational complexity* ([FEALORA](#)) devoted to study of basic open problems in computational complexity, such as the P versus NP problem. They also represent the Institute in the centre DIMATIA (<http://dimatia.mff.cuni.cz/>) and the research centre Institute of theoretical informatics (<http://iti.mff.cuni.cz/>).

2.3 Research centres

The centre of excellence **Institute of Theoretical Informatics** (ITI, <http://iti.mff.cuni.cz/>) was a consortium established for a joint project of the Faculty of Mathematics and Physics of the Charles University, the Institute of Mathematics, the Institute of Computer Science CAS, the Faculty of Applied Sciences of the University of West Bohemia in Pilsen and the Faculty of Informatics of the Masaryk University in Brno, funded by the Ministry of Education, Youth and Sports in 2005–2011. Its activity continued within a joint project supported by the Czech Science Foundation in 2012–2018. The principal aim of ITI was to promote research in theoretical computer science and related fields with emphasis on the work of young researchers, and to provide temporary positions for postdocs and distinguished senior researchers. The activity of ITI was formally terminated with the end of funding of the project.

Jindřich Nečas Centre for Mathematical Modeling (<http://ncmm.karlin.mff.cuni.cz/>) is a consortium of the Institute of Mathematics, the Faculty of Mathematics and Physics of the Charles University, and the Institute of Computer Science CAS. It was established in 2013 to continue the efforts of a joint project funded by the Ministry of Education, Youth and Sports in 2005–2011. Its general goal is to establish a strong research team in the field of mathematical properties of models in continuum mechanics and thermodynamics, developed by an intensive collaboration of important research groups at both institutions and their goal-directed collaboration with top experts from abroad. Organization of lecture courses and the everyday interaction with PhD and undergraduate students

aims at upbringing new generation of competent scientist and forming a basis for a strong and stable research team.

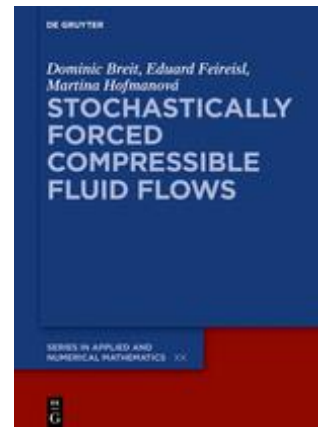
DIMATIA – Centre for Discrete Mathematics, Theoretical Computer Science and Applications (<http://dimatia.mff.cuni.cz/>) is a consortium of the Faculty of Mathematics and Physics of the Charles University, the Institute of Mathematics and the Institute of Chemical Technology in Prague. It was established in 1996 with the aim 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. The centre organizes a continuing programme of workshops, conferences and research visits, postdoctoral positions announced and jointly supported by the partners and short-term visits of senior researches. DIMATIA created an extensive international network with 13 further research institutions.

2.4 Research output

In 2018, members of the Institute of Mathematics published the total of 158 journal and proceedings papers, 5 monographs and 6 chapters in monographs. The following 7 results were selected to illustrate the output. The detailed information about all publications is available at Institute's web site <http://www.math.cas.cz/> in section Research / Publications.

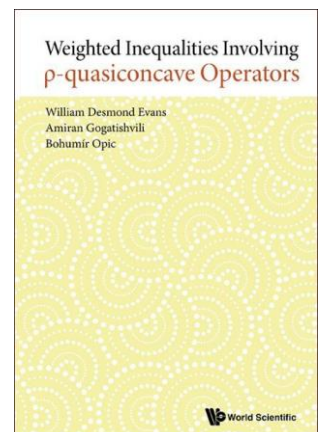
- [1] D. Breit, **E. Feireisl**, M. Hofmanová: *Stochastically Forced Compressible Fluid Flows*. De Gruyter Series in Applied and Numerical Mathematics 3. Berlin: De Gruyter 2018.

This is the first monograph addressing compressible fluid flows subject to random effects. It contains the complete theory for compressible Navier–Stokes equations with random data including the driving force in form of the white noise. There are presented results on equality of weak and strong solutions, singular limits and existence of stationary solutions. The problems require a brand new approach based on the so called random distributions and generalization of the classical representation theory of Skorokhod type. Weak solutions are considered in both probabilistic and analytic sense. It is shown that the time development of energy can be controlled by the initial energy. The behaviour of solutions is analyzed for short time intervals, the case in which there exists a unique smooth solution. Similarly, the behaviour is studied for long time intervals in cases when a stationary solution exists. In addition, asymptotic behaviour of solutions with respect to several model parameters is studied by means of energy inequalities. The book was written in collaboration of D. Breit from Heriot-Watt University in Edinburgh, E. Feireisl from the IM, and M. Hofmanová from Universität Bielefeld.



- [2] W. D. Evans, **A. Gogatishvili**, B. Opic: *Weighted Inequalities Involving ρ -quasiconcave Operators*, World Scientific Publishing, Hackensack, NJ, 2018.

Some problems in mathematical analysis, namely in theory of function spaces and in approximations theory or in interpolation theory, lead to weight inequalities for certain class of quasiconcave functions on $I = (a, b) \subseteq \mathbb{R}$. The book contains an general analysis of the class $Q_\rho(I)$ of ρ -quasiconcave functions with the aim to derive results needed for complex understanding the weight inequalities in $Q_\rho(I)$. The results are illustrated on weighted inequalities of Hardy type, on weighted inequalities of Hardy type with a supremum and on reversed forms of such inequalities. The book was written in collaboration of W. D. Evans from the University of Cardiff, A. Gogatishvili from the IM and B. Opic from the Charles University.



- [3] G. P. Galdi, **J. Neustupa**: *Steady flows around moving bodies*. In Handbook of Mathematical Analysis in Mechanics of Viscous Fluids, ed. Y. Giga and A. Novotný, Springer Int. Publishing 2018, 341–417.

This is a chapter in the extensive *Handbook of Mathematical Analysis in Mechanics of Viscous Fluids* published in 2018 by Springer. The chapter devoted to mathematical models of the flow of viscous incompressible fluid around moving bodies contains a number of fundamental results on the

existence, uniqueness regularity, bifurcations and stability of solutions including many original results of the authors.

[4] **D. Medková:** *The Laplace Equation*. Cham: Springer 2018.

The book contains the most relevant results about the Laplace and Poisson equations. Summarizing fundamental properties of solutions, it deals with the Dirichlet, Neumann, and Robin problems, the transmission problem, problems with cracks, obstacle problem, mixed problems, etc. The book studies these problems in various sense and compares the results. It studies the classical potential theory, solutions in the sense of non-tangential limit, and the classical solutions. In the case of bounded domain, solutions in Sobolev and Besov spaces are studied. Since such approach is not possible in unbounded domains, solutions on the outer domains are found in the homogeneous Sobolev spaces. The book explains even the most difficult results in an easy way, understandable for students.

[5] **G. A. Monteiro, A. Slavík, M. Tvrđý:** *Kurzweil-Stieltjes Integral. Theory and Applications*. Series in Real Analysis. Hackensack, NJ: World Scientific 2018.

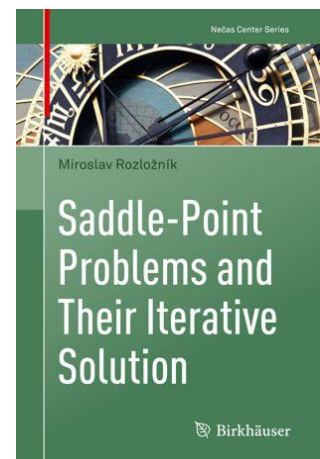
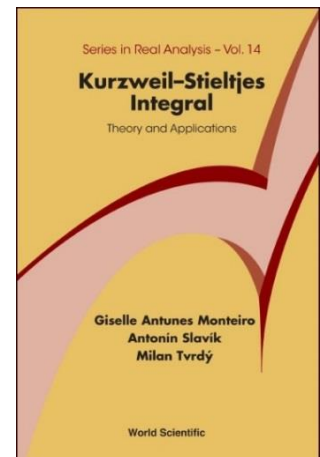
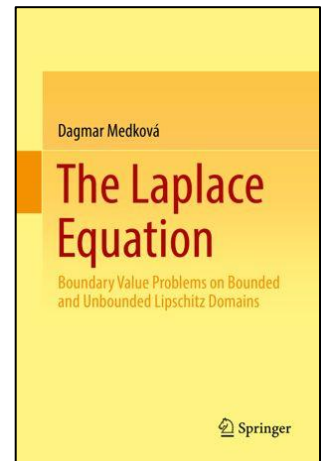
The book is devoted to development of the theory of the Kurzweil-Stieltjes integral. It is partly based on the published works by the authors and Štefan Schwabik. However, the major part of the result, namely about the relationship between the Kurzweil–Stieltjes and the Lebesgue–Stieltjes integrals or the classes of functions adjoint with respect to the integral are new. Two chapters are devoted to applications of the Kurzweil-Stieltjes integral in the functional analysis, theory of distributions, generalized elementary functions, generalized differential equations in the Kurzweil sense, including dynamical equations on time scales. In addition, the book contains new results and proofs concerning the properties of the classical Riemann–Stieltjes integrals. The book was written in cooperation of G. A. Monteiro and M. Tvrđý from the IM, and A. Slavík from the Charles University.

[6] **M. Rozložník:** *Saddle-Point Problems and Their Iterative Solution*. Basel: Birkhäuser 2018.

The book is based texts about solutions of large linear saddle-point systems arising in a wide range of applications and often pose computational challenges in science and engineering. The book focuses on special properties of such linear systems and provides an overview of algebraic methods for their solution, with an emphasis on iterative methods and preconditioning. Besides theoretical results, it contains a case study of modelling the flow of contaminated groundwater after chemical exploitation of uranium in northern Bohemia. The book is intended mainly for students of applied mathematics and scientific computations but it contains also results interesting for researchers and engineers from various fields of research and applications.

[7] R. Švarc, J. Podolský, **V. Pravda, A. Pravdová:** *Exact black holes in quadratic gravity with any cosmological constant*. Phys. Rev. Lett. 121, 231104 (2018).

The authors found a new explicit solution of field equations of quadratic gravity describing spherical black hole. It differs from the known Schwarzschild black hole by an additional geometric parameter, which, for instance, influences the motion of nearby objects and causes potentially measurable perturbations. The new black hole space-time can contribute to better understanding of quadratic corrections of the Einstein theory and their role in the developing full theory of quantum gravity.



2.5 Projects

- 2 ERC Advanced Grants, 7th Framework Programme, SP2–Ideas
 - 320078 MATHEF (2013–2018, E. Feireisl)
 - 339691 FEALORA (2014–2018, P. Pudlák)
- 10 standard grant projects funded by the Czech Science Foundation
 - 16-03230S Thermodynamically consistent models for fluid flows: mathematical theory and numerical solution (2016–2018, Š. Nečasová)
 - 16-07378S Nonlinear analysis in Banach spaces (2016–2018, P. Hájek)
 - 17-00941S Topological and geometrical properties of Banach spaces and operator algebras II (2017–2019, M. Fabian)
 - 17-27844S Generic objects (2017–2019, W. Kubiś)
 - 17-01747S Theory and numerical analysis of coupled problems in fluid dynamics (2017–2019, J. Neustupa)
 - 18-00580S Function spaces and approximations (2018–2020, A. Gogatishvili)
 - 18-00496S Singular spaces from special holonomy and foliation (2018–2020, H. V. Le)
 - 18-09628S Advanced flow-field analysis (2018–2020, J. Šístek)
 - 18-07776S Higher structures in algebra, geometry and mathematical physics (2018–2020, M. Markl)
 - 18-05974S Oscillations and concentrations versus stability in the equations of mathematical fluid dynamics (2018–2020, E. Feireisl)
- 2 junior grant project funded by the Czech Science Foundation
 - 17-01694Y Mathematical analysis of partial differential equations describing inviscid flows (2017–2019, O. Kreml)
 - 18-01472Y Graph limits and inhomogeneous random graphs (2018–2020, J. Hladký)
- 1 international grant projekt funded by the Czech Science Foundation
 - 18-01953J Geometric methods in statistical learning theory and applications (2018–2020, H. V. Le)
- 2 international projects evaluated on the basis of the LEAD Agency principle funded by the Czech Science Foundation
 - GF16-34860L/I 2374-N35 Logic and Topology in Banach spaces (2016–2018, W. Kubiś)
 - GF17-33849L/I 3081-N35 Filters, Ultrafilters and Connections with Forcing (2017–2019, D. Chodounský)
- 2 projects for support of excellence funded by the Czech Science Foundation
 - 14-37086G Albert Einstein Center for Gravitation and Astrophysics (2014–2018, V. Pravda)
 - 12/G061 Centre of Excellence – Institute for Theoretical Computer Science (CE-ITI) (2012–2018, P. Pudlák)
- 2 projects in the MOBILITY programme of the Ministry of Education, Youth and Sports
 - 7AMB17FR053 Dynamics of mutli-component fluids (2017–2018, E. Feireisl)
 - 7AMB16PL060 Flow of viscous fluid in time dependent domain (2017–2018, Š. Nečasová)
- 1 project in the Structural Funds Operational Programme Research, Development and Education, funded by the European Commission, operated by the Ministry of Education, Youth and Sports
 - CZ.02.2.69/0.0/0.0/16_018/0002713 Doctoral School for Education in Mathematical Methods and Tools in HPC (2017–2022, T. Vejchodský)
- 1 project in the cooperation programme Bilateral mobility projects between Consiglio Nazionale Delle Ricerche (CNR) and the CAS:
 - CNR-16-08 Phenomenological modeling of polymeric smart foams with behavior controlled by the magnetic field. (2016–2018, P. Krejčí)
- 1 project of the CAS programme for support of international cooperation of starting researchers
 - Structure and localizations of the derived category of a commutative ring (2018, M. Hrbek)
- 1 Neuron Impuls Junior grants funded by the Neuron Fund for Support of Science
 - Guaranteed bounds of eigenvalues and eigenfunctions of differential operators (2017–2019, T. Vejchodský)

A detailed information on the projects is available at the Institute's web site <http://www.math.cas.cz/> in section Research / Grants.

2.6 International conferences and workshops organized by the Institute

Winter School in Abstract Analysis 2018, section Set Theory & Topology, Hejnice, 27. 1. – 3. 2. 2018.

<http://www.winterschool.eu/2018/>

Minisymposium on the Navier-Stokes equations, Praha, 12.–16. 2. 2018. <http://mnse.math.cas.cz/>

EMS School in Applied Mathematics: Mathematical Modelling, Numerical Analysis and Scientific Computing, Kácov, 27. 5. – 1. 6. 2018. <http://essam-masc.cuni.cz/>

Ninth Czech-Israeli Workshop on Functional Differential Equations, Brno, 9.–13. 7. 2018.

<http://czil.math.cas.cz/2018/>

Nonlinear Analysis, Function Spaces and Applications 11, Praha, 9.–14. 7. 2018.

<http://www.nafsa11.cz/>

Prague Summer School on Discrete Mathematics, Praha, 16.–20. 7. 2018. <http://pssdm.math.cas.cz/>

Applications of Mathematics 2018, Praha, 22.–24. 8. 2018. www.am2018.math.cas.cz/

Waves in flows, Praha, 27.–31. 8. 2018. <http://www.prague-sum.com/>

2nd Chinese-Czech Conference on Mathematical Fluid Mechanics, Praha, 16.–23. 9. 2018.

<http://ccmfmath.cas.cz/>

Cosmology on Small Scales 2018 – Dark Matter Problem and Selected Controversies in Cosmology, Praha, 26.–29. 9. 2018. www.CSS2018.math.cas.cz/

FEALORA Workshop 2018, Špindlerův Mlýn, 4.–7. 11. 2018.

<http://workshop.math.cas.cz/fealora/fealora-workshop.html/>

2.7 International collaboration

An extensive international collaboration in 2018 is documented by the following facts:

- 64 visitors to the Institute
- 271 working trips abroad
- 11 international conferences and meetings organized or co-organized by the Institute
- 57 memberships in editorial boards of international scholarly journals

The Institute is a corporate member of the following organizations:

- The Union of Czech Mathematicians and Physicists
- The European Mathematical Society
- ERCOM (European Research Centres on Mathematics)
- European Digital Mathematics Library Initiative
- EU-MATHS-IN (European Service Network of Mathematics For Industry and Innovation) – through the national network EU-MATHS-IN.CZ

2.8 Cooperation with universities in education

Members of the Institute held a number of courses for students at Czech and foreign universities, supervised 6 undergraduate students and 25 PhD students. The Institute is accredited for 10 PhD programmes jointly with the Charles University and the University of West Bohemia.

PhD students trained in the Institute in cooperation with the universities:

Danica Basarić, Technische Universität Berlin, supervisor E. Feireisl

Matěj Dolník, FSI VUT v Brně, supervisor A. Lomtadze

Martin Fencel, FAV ZČU v Plzni, supervisor M. Kučera

Lukáš Folwarczný, MFF UK, supervisor P. Pudlák

Jan Grebík, MFF UK, supervisor D. Chodounský

Martin Hanek, FS ČVUT v Praze, supervisor J. Šístek

Umi Mahnuna Hanung, University of Amsterdam, supervisor M. Tvrdý

Anna Horská, MFF UK, supervisor P. Pudlák

Nilasis Chaudhuri, Technische Universität Berlin, supervisor E. Feireisl

Rahele Jalali Keshavarz, MFF UK, supervisor P. Pudlák

Ziemowit Kostana, Uniwersytet Warszawski, supervisor W. Kubiś

Jan Kubíček, MFF UK, supervisor A. Pravdová

Martin Kuchynka, MFF UK, supervisor A. Pravdová

Alberto Melati, University of Trento, supervisor I. Khavkine
 Maria Carolina Stefani Mesquita Macena, Universidade Federal de São Carlos, supervisor M. Tvrđý
 Josef Navrátil, FJFI ČVUT v Praze, supervisor M. Kučera
 Matěj Novotný, FEL ČVUT v Praze, supervisor P. Hájek
 Ana Radosević, University of Zagreb, supervisor Š. Nečasová
 Tomasso Russo, Università degli Studi di Milano, supervisor P. Hájek
 Vincent Schlegel, Universität Zürich, supervisor U. Schreiber
 Lenka Siváková, FSv ČVUT, supervisor Krejčí
 Amirhossein Akbar Tabatabai, MFF UK, supervisor P. Pudlák
 Tomáš Tintěra, MFF UK, supervisor V. Pravda
 Dávid Uhrik, MFF UK, supervisor D. Chodounský
 Marta Walczynska, Uniwersytet Śląski w Katowicach, supervisor W. Kubiś

2.9 Awards

Michal Doucha, Prize of the Czech Mathematical Society for Young Mathematicians

Michal Doucha, Otto Wichterle Premium for Young Researchers, awarded by the Czech Academy of Sciences

Jan Grebík, Josef Hlávka Prize for the best students and graduates of the Prague public universities and of the Technical University in Brno, and for young gifted researchers of the Czech Academy of Sciences




Václav Mácha, Prize of the Czech Mathematical Society for Young Mathematicians

Martin Markl, Praemium Academiae, awarded by the Czech Academy of Sciences

Karel Segeth, Honorary membership in the Union of Czech Mathematicians and Physicists

2.10 Further activities

The fifteenth prestigious annual **Eduard Čech Lecture** devoted to the memory of the eminent Czech mathematician and founder of the Institute was delivered on 6 December 2018 by Vojtěch Rödl (Emory University, Atlanta) on *Quasi-Randomness and the Regularity Method in Hypergraphs*. V. Rödl was also the second Eduard Čech Distinguished Visitor of the Institute of Mathematics.

	<p>Matematický ústav AV ČR zve všechny zájemce na přednášku</p>	<p>Quasi-Randomness and the Regularity Method in Hypergraphs</p>
<p>Vojtěch Rödl</p>	<p>Quasi-Randomness and the Regularity Method in Hypergraphs</p>	<p>The probabilistic method is one of the most successful techniques in combinatorics. It enables one to prove results about nonrandom objects by immersing them into specially designed probability spaces. Another important concept in combinatorics, which appeared more recently, is quasi-randomness. A quasi-random object is an object that shares properties that are "typical" for random objects. One of the most applicable results is the well-known Szemerédi Regularity Lemma, which asserts, roughly speaking that every graph can be decomposed into a small number of quasi-random graphs.</p>
	<p>kterou prosloví</p>	<p>In this lecture we will mention connections of problems about arithmetic progressions with results about regularity. Then we will describe a generalization of the Szemerédi Regularity Lemma to hypergraphs. (Hypergraphs are structures generalizing graphs consisting of hyperedges, subsets of a fixed size > 2, instead of edges, which are subsets of size 2.) Finally, we will outline how Szemerédi's Theorem, which implies the existence of arbitrarily long arithmetic progressions in subsets of natural numbers of positive density, can be deduced from the hypergraph regularity lemma.</p>
	<p>profesor Vojtěch Rödl Emory University, Atlanta, USA</p>	
	<p>ve čtvrtek 6. prosince 2018 v 10:30 hod. ve velké posluchárně Matematického ústavu AV ČR, Žitná 25, Praha 1.</p>	
		
	<p>Jde o patnáctou přednášku konanou v rámci cyklu reprezentačních přednášek organizovaných na počest</p>	
<p>Eduard Čech</p>	<p>prof. Eduarda Čecha, jednoho z nejvýznamnějších českých matematiků novodobé historie a zakladatele Matematického ústavu AV ČR.</p>	
	<p>Jiří Rákosník, ředitel</p>	

The Institute organized traditional Open Houses as part of the scientific festival Week of Science and Technology. During five days in November 1,826 high-school students and other interested people visited 38 lectures and workshops in the Institute.

The Institute continued in providing professional and financial support to the Mathematical Olympiad, particularly in preparation of the national representatives to the International Mathematical Olympiad.

3 Economic management

3.1 Assets

The Institute owns the estate, parcel no. 2120, and the building, house no. 609/25, on that land. Total area of residential and non-residential premises is 3,341 square metres. Part of the ground floor in the front building of 64 square metres is leased for commercial purpose; further two rooms and one storeroom are leased for non-commercial purpose to the Union of Czech Mathematicians and Physicists. In the rear building there are five flats leased mostly to employees of the Institute. All other spaces in both buildings (2,836 square metres in total) are used for the purpose of the Institute.

The book value of the compound to the day of 31 December 2018 was 43,673 thousand CZK, its remaining book value was 22,218 thousand CZK.

Further tangible fixed assets is formed mostly by devices and IT equipment with the book value 9 711 thousand CZK to the date 31 December 2018, remaining book value was 1,042 thousand CZK.

3.2 Expenses and revenues

Principal entries (in thousands of CZK)

Total expenses	94,570
Purchases of materials, electricity, gas	2,024
Maintenance and reconstructions	1,229
Travel expenses	5,524
Other services	5,619
Personal expenses	70,091
Other expenses (including grant overheads)	8,982
Depreciation	1,101
Total revenues	94,570
Sales of periodicals	2,127
Other revenues	4,639
Institutional subsidies (from the budget of the Czech Academy of Sciences)	56,029
Grants	31,775
Earnings before taxes	0

The total revenues compared to the previous year, increased by 11.4%. This was mainly due to the remarkable success in the Czech Science Foundation competition for research grants, and partly also due to the raised institutional subsidy from the Czech Academy of Sciences, and the use of own funds.

3.3 Personnel and salaries

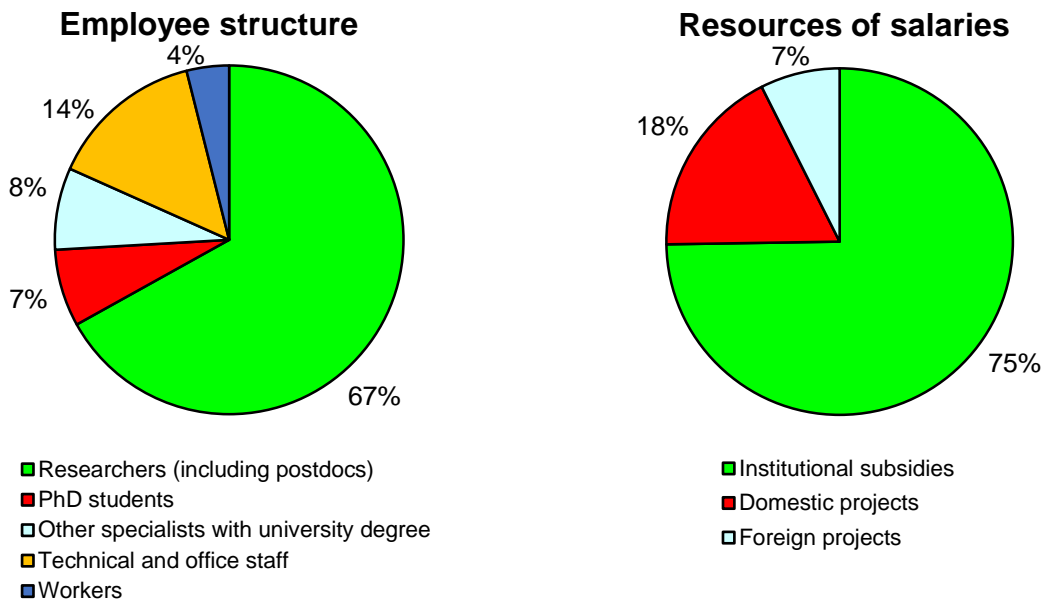
The average number of employees amounted to 81 FTE (annual increase of 4%).

The personnel expenses of 70,091 thousand CZK represented 73% of total operating expenses.

The average monthly salary from all resources – institutional, project and commercial – was 54,023 CZK (annual increase of 5.6%). This was the highest average monthly salary among the institutes of the Czech Academy of Sciences. Yet, due to unsatisfactory funding of the Academy by

the government, it is considerably below the level at the Czech Universities and the rate of the annual increase is lower than in the country as whole.

During 2018, 18 vacancies (10 researchers, 5 postdocs, 3 Ph.D. student) were filled, mostly for two-year contracts. One researcher, 9 postdocs and 4 Ph.D. students terminated employment in 2018. We regret that František Neuman, emeritus scientist of the Czech Academy of Sciences, passed away.



In line with the general approach of the Czech Academy of Sciences, research staff in the Institute is employed on fixed-term contracts. The research staff is recruited in open competitions advertised at the Institute's web site and at the job server of the European Mathematical Society. Applicants are directed to the web site with detailed information and to the specialised web system for submitting applications and reference letters (<https://application.math.cas.cz/Positions.html>). The system enables a preliminary remote discussion of the heads of departments and of the selection committee members and facilitates the subsequent assessment of applications.


RNDr. Jiří Rákosník, CSc.
Director