



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 2019

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.

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1 The Institute

The Institute of Mathematics of the Czech Academy of Sciences, v. v. i. ("the Institute" or "IM"), 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.

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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 (due to December 31, 2019)

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

Deputy Director: Doc. Ing. Miroslav Rozložník, Dr.

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. (Charles University)

Prof. RNDr. Michal Křížek, DrSc.

Prof. Wiesław Kubiś, Ph.D.

RNDr. Šárka Nečasová, DSc.

Prof. RNDr. Ivan Netuka, DrSc. (Charles University)

Ing. Jakub Šístek, Ph.D.

Supervisory Board:

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

Vice-chair: Mgr. Alena Pravdová, Ph.D.

Members at large: Prof. RNDr. Jan Hamhalter, CSc. (Czech Technical University in Prague)

Prof. RNDr. Luboš Pick, CSc., DSc. (Charles University)

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 Miroslav Rozložník, the scientific secretary and project manager Beata Kubiś, head of the Administration Department Jan Bíža, head of the IT Department Martin Jarník and the former director Jiří Rákosník.

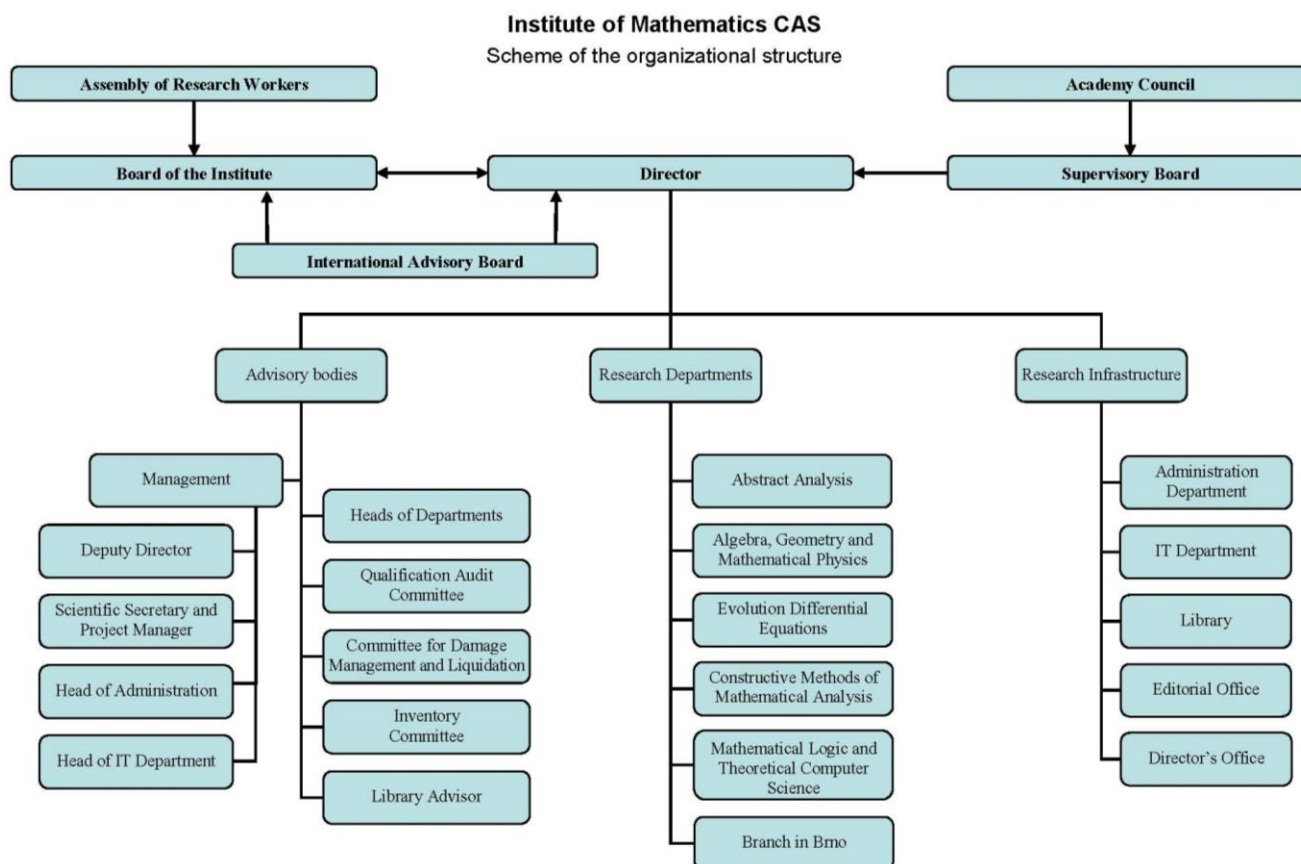
The **Board of the Institute** held seven meetings, four of them remotely. The topics they discussed and approved included among others:

- selection of T. Vejchodský for the position of the director of the Institute for the period from May 2019 to April 2024
- budget of the Institute for 2019 and the medium-term financial outlook for 2019–2021
- annual report on activities and economic management in 2018 and auditor's report on financial statements
- selection of candidates for the postdoctoral positions in the Academy's programme supporting prospective human resources
- recommendation to invite Prof. S. Todorčević (University of Toronto, Canada) for the Eduard Čech Distinguished Visitor position
- proposal of E. Feireisl for the Balzan prize in the field of partial differential equations
- proposal to award the Honorary Bernard Bolzano Medal for Merit in Mathematical Sciences to M. Markl

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 2019, about the annual report on activities and economic management in 2018 and about auditor's report on financial statements
- consent to the announcement of a public tender for the provision of the economic-information system
- approval of lease agreements and amendments extending lease agreements for flats in the Institute's building
- approval of the contract for the lease of space for the SPIN flower shop

1.3 Structure



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 Zentralblatt Editorial Group contributing to the production of the database zbMATH.

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 of 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 consists of 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.

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 or automata theory.

Constructive Methods of Mathematical Analysis

The department focuses on mathematical modelling of complex physical processes that involve an immense amount of data and require advanced implementations on parallel computer architectures. The main topics include theory and applications of numerical methods for partial differential equations, a posteriori error analysis, computational methods of numerical linear algebra, matrix theory and domain decomposition methods. 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/>).

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 differential geometry. The department members also represent the Institute in the centre DIMATIA (<http://dimatia.mff.cuni.cz/>).

2.3 Research centres

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 participating 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 scientists 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 2019, members of the Institute published the total of 155 journal and proceedings papers, including one monograph and one chapter in a monograph. The following 8 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] **Doucha, M.**, Malicki, M. *Generic representations of countable groups*. American Mathematical Society. Transactions 372 (11), 2019, 8249–8277.

The authors study generic homomorphisms of discrete countable groups into certain Polish automorphism groups, building a framework and technology that captures some previously known facts, but also allows to obtain new results, in particular, answering a problem of Kechris and Rosendal.

- [2] Ben-David, S., **Hrubeš, P.**, Shay, M., Shpilka, A., Yehudayoff, A. *Learnability can be undecidable*. Nature Machine Intelligence 1 (1), 2019, 44–48.

The paper gives a relatively natural problem in Machine Learning such that its learnability depends on the cardinality of the continuum. This means that whether the problem is machine-learnable is undecidable from the usual set-theoretical axioms. This can be interpreted as pointing towards a discrepancy between practical machine learning on one hand, and its theoretical foundation on the other.

- [3] **Positselski, L.**, Šťovíček, J. *The tilting-cotilting correspondence*. International Mathematics Research Notices, 2019, 1st online 2.7.2019.

This paper introduces the concept of the n -tilting-cotilting correspondence and explains the key role that contramodules over topological rings play in it. It also poses the problem of precise description of the classes of abelian categories corresponding to each other on the two sides of the tilting-cotilting correspondence. To a big n -tilting object in a complete, cocomplete abelian category A with an injective cogenerator we assign a big n -cotilting object in a complete, cocomplete abelian category B with a projective generator, and vice versa. Then we construct an equivalence between the derived categories of A and B . Under various assumptions on A , which cover a wide range of examples, we show that B is the abelian category of contramodules over a topological ring and that the derived equivalences are realized by a contramodule-valued variant of the usual derived Hom-functor.

- [4] Bremner, M., **Markl, M.** *Distributive laws between the Three Graces*. Theory and Applications of Categories 34 (41), 2019, 1317–1342.

M. Markl together with M. Bremner classified all algebraic structures emerging from the three most common types of algebras – commutative, associative and Lie – via a distributive law. This article, based on the results obtained by Markl in 1996, was made possible due to the recent progress in computer-aided combinatorial algebra.

- [5] **Feireisl, E.**, Lukáčová-Medvid'ová, M., **Mizerová, H.**, **She, B.** *Convergence of a finite volume scheme for the compressible Navier-Stokes system*. ESAIM: Mathematical Modelling and Numerical Analysis 53 (6), 2019, 1957–1979.

The authors study convergence of a finite volume scheme for the compressible (barotropic) Navier-Stokes system. First they prove the energy stability and consistency of the scheme and show that the numerical solutions generate a dissipative measure-valued solution of the system. Then by the dissipative measure-valued-strong uniqueness principle, they conclude the convergence of the numerical solution to the strong solution as long as the latter exists. Numerical experiments for standard benchmark tests support the derived theoretical results.

- [6] Galdi, G. P., **Mácha, V.**, **Nečasová, Š.** *On the motion of a body with a cavity filled with compressible fluid*. Archive for Rational Mechanics and Analysis 232 (3), 2019, 1649–1683.

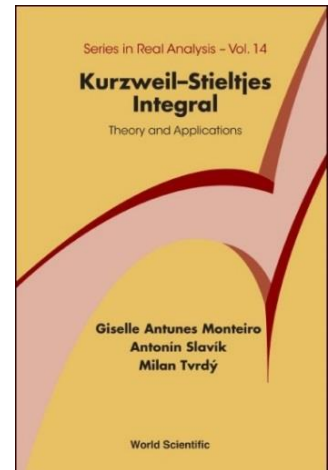
The existence of a solution and its asymptotic behavior for a rigid body system with a cavity filled with compressible fluid was investigated. The existence of a strong solution for small data and the uniqueness of the steady state were proved. Further, the behavior of the system for time going to infinity was studied. In the case of a sufficiently large Mach number, the presence of a compressible fluid has been shown to stabilize movement. Žukovský's hypothesis for compressible fluid was mathematically confirmed.

- [7] Allen, P., Böttcher, J., **Hladký, J.**, Piguet, Diana. *Packing degenerate graphs*. Advances in Mathematics 354 (1 October), 2019, 106739.

By "packing" we mean filling up a host structure by prescribed objects. Packing problems are omnipresent in mathematics. For example, the so-called Kepler's conjecture from 1611, which asks for the most efficient packing of 3-dimensional unit balls (or, more practically, oranges or cannonballs) in the space, was solved only in 1998. The current paper is motivated by the so-called Tree Packing conjectures of Ringel (1963) and Gyarfás-Lehel (1978). We prove that under some natural conditions, one can almost perfectly pack a complete graph with a given family of trees. In fact, the main theorem holds for a larger family of graphs than trees, for graphs of bounded degeneracy.

[8] **Monteiro, G. A., Slavík A., Tvrđý, M.** *Kurzweil-Stieltjes Integral. Theory and Applications*. Series in Real Analysis. Hackensack, NJ: World Scientific 2019.

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.



2.5 Projects

1 project Praemium Academiae funded by the Czech Academy of Sciences

- Operadic categories and their applications (2019–2024, M. Markl)

1 grant project for the support of excellence in basic research EXPRO funded by the Czech Science Foundation:

- 19-27871X Efficient approximation algorithms and circuit complexity (2019–2023, P. Hrubeš)

11 standard grant projects funded by the Czech Science Foundation:

- 19-09659S Exact solutions of gravity theories: black holes, radiative spacetimes and electromagnetic fields (2019–2021, V. Pravda)
- 19-04243S Partial differential equations in mechanics and thermodynamics of fluids (2019–2021, Š. Nečasová)
- 19-05497S Complexity of mathematical proofs and structures (2019–2021, E. Jeřábek)
- 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)
- 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)

4 junior grant projects funded by the Czech Science Foundation:

- 19-05271Y Groups and their actions, operator algebras, and descriptive set theory (2019–2021, M. Douča)
- 19-07129Y Linear-analysis techniques in operator algebras and vice versa (2019–2021, T. Kania)
- 18-01472Y Graph limits and inhomogeneous random graphs (2018–2020, J. Hladký)
- 17-01694Y Mathematical analysis of partial differential equations describing inviscid flows (2017–2019, O. Kreml)

2 international grant projects funded by the Czech Science Foundation

- 19-06175J Compositional Methods for the Control of Concurrent Timed Discrete-Event Systems (2019–2021, J. Komenda)
- 18-01953J Geometric methods in statistical learning theory and applications (2018–2020, H. V. Le)

- 1 international project evaluated on the basis of the LEAD Agency principle funded by the Czech Science Foundation
 - GF17-33849L/I 3081-N35 Filters, Ultrafilters and Connections with Forcing (2017–2019, D. Chodounský)
- 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 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 the section Research / Grants.

2.6 International conferences and workshops organized by the Institute

Winter School in Abstract Analysis 2019, section Set Theory & Topology, Hejnice, 26. 1. – 2. 2. 2019
<http://www.winterschool.eu/2019/>

EMS School in Applied Mathematics: Mathematical Aspects of Fluid Flows, Kácov, 26.–31. 5. 2019
<http://essam-maff.cuni.cz/>

Meeting Dresden–Prague–Wrocław, Praha, 25.–27. 9. 2019
<http://workshop.math.cas.cz/MDPW/>

MAT TRIAD 2019, International Conference on Matrix Analysis and its Applications, Liblice, 8.–13. 9. 2019
<https://matriad.math.cas.cz/>

Logic Colloquium 2019, European Summer Meeting of the Association for Symbolic Logic, Praha, 11.–16. 8. 2019
<https://lc2019.cz/>

22nd Colloquiumfest, Praha, 6.–9. 12. 2019
<http://users.math.cas.cz/kubis/2019/22colloquiumfest/>

Czech–Georgian Workshop on Boundary Value Problems 2019, Brno, 27.–30. 5. 2019
<http://czge.math.cas.cz/2018/>

High Performance Computing in Science and Engineering 2019, Soláň, 20.–23. 5. 2019
<http://hpcse.it4i.cz/HPCSE19/>

Modelling 2019, Olomouc, 16.–20. 9. 2019
<http://www.ugn.cas.cz/actually/event/2019/modelling/>

Joint Workshop on Sound and Vibration Simulations in Earthmoving Equipment, Doosan Bobcat, Dobříš, 19.–21. 11. 2019
<https://calendar.math.cas.cz/content/joint-workshop-sound-and-vibration-simulations-earthmoving-equipment>

Mathematics in Industry 2019, Praha, 11. 12. 2019
<http://workshop.math.cas.cz/MathInIndustry2019/>

Workshop in Honour of Professor Milan Pokorný and His Fiftieth Birthday, Praha, 21. 11. 2019
<http://workshop.math.cas.cz/Pokorny/>

Seminar on Differential Equations and Integration Theory – Special Session in Honour of the 75th Birthday of Milan Tvrdý, Praha, 10. 10. 2019
<http://www.karlin.mff.cuni.cz/~slavik/seminar.html>

Diderot Mathematical Forum: Mathematics and Architecture, Praha, 8. 6. 2019
<http://www.cim.pt/diderot>

Workshop in Occasion of 70th Birthday of Professor Jiří Neustupa, Praha, 23. 4. 2019
<http://workshop.math.cas.cz/Neustupa/>

Antonín Novotný and His Contribution to PDEs, Praha, 6. 2. 2019
<http://workshop.math.cas.cz/Tonda/>

2.7 International collaboration

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

- 99 visitors to the Institute
- 369 research visits abroad
- 16 international conferences and meetings organized or co-organized by the Institute
- 59 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 3 undergraduate students and 27 PhD students. The Institute is accredited for 18 PhD programmes jointly with the Charles University and the University of West Bohemia.

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

David Adamadze, I. Javakhishvili Tbilisi State University, supervisor A. Gogatishvili

Jiří Balun, Palacký University Olomouc, supervisor T. Masopust

Danica Basarić, Technische Universität Berlin, supervisor E. Feireisl

Francesco Bussola, Università di Pavia, supervisor I. Khavkine

Matěj Dolník, Technical University Brno, supervisor A. Lomtatidze

Martin Fencl, University of West Bohemia Plzeň, supervisor M. Kučera

Lukáš Folwarczný, Charles University, supervisor P. Pudlák

Jan Grebík, Charles University, supervisor D. Chodounský

Martin Hanek, Czech Technical University Praha, supervisor J. Šístek

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

Nilasis Chaudhuri, Technische Universität Berlin, supervisor E. Feireisl

Rahele Jalali Keshavarz, Charles University, supervisor P. Pudlák

Erfan Khaniki, Charles University, supervisor P. Pudlák

Ziemowit Kostana, Uniwersytet Warszawski, supervisor W. Kubiś

Jan Kubíček, Charles University, supervisor A. Pravdová

Martin Kuchynka, Charles University, supervisor A. Pravdová

Martin Mach, Charles University, supervisor L. Positselski

Maria Carolina Stefani Mesquita Macena, Universidade Federal de São Carlos, supervisor M. Tvrđý

Josef Navrátil, Czech Technical University Praha, supervisor M. Kučera

Matěj Novotný, Czech Technical University Praha, supervisor P. Hájek

Ana Radosević, University of Zagreb, supervisor Š. Nečasová

Tomasso Russo, Università degli Studi di Milano, supervisor P. Hájek

Jan Scherz, Czech Technical University Praha and Universität Würzburg, cosupervisor Š. Nečasová

Lenka Siváková, Czech Technical University Praha, supervisor Krejčí

Amirhossein Akbar Tabatabai, Charles University, supervisor P. Pudlák

Tomáš Tintěra, Charles University, supervisor V. Pravda

Dávid Uhrik, Charles University, supervisor D. Chodounský

Xingchen Yu, Nanjing University of Information Science and Technology, supervisor R. Hakl

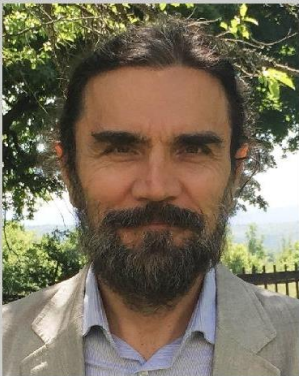
2.9 Awards

Michal Křížek, Josef Hlávka Prize for scientific literature for the book by M. Křížek et al: Abel Prize – the Highest Award in Mathematics, Czech Literature Foundation and Foundation of Josef, Marie and Zdeňka Hlávkoví.

Jiří Neustupa, Honorary medal of the Union of Czech Mathematicians and Physicists for contributions to the development of mathematics, international scientific collaboration and education of young generation, Union of Czech Mathematicians and Physicists.

2.10 Further activities

The sixteenth prestigious annual **Eduard Čech Lecture** devoted to the memory of the eminent Czech mathematician and founder of the Institute was delivered on 3 December 2019 by Stevo Todorčević (University of Toronto, Centre National de la Recherche Scientifique, Paris, and Matematički Institut SANU, Belgrade) on *From generic continuity to Galvin's conjecture*. Stevo Todorčević is also the third Eduard Čech Distinguished Visitor of the Institute of Mathematics.



Stevo Todorčević



Eduard Čech

Matematický ústav AV ČR
zve všechny zájemce
na přednášku

From generic continuity to Galvin's conjecture

kterou prosloví

Stevo Todorčević
University of Toronto
Centre National
de la Recherche Scientifique, Paris
Matematički Institut, SANU, Beograd

v úterý 3. prosince 2019
v 10:30 hod.
ve velké posluchárně
Matematického ústavu AV ČR,
Žitná 25, Praha 1.



Jde o šestnáctou přednášku konanou
v rámci cyklu reprezentančních přednášek
organizovaných na počest

prof. Eduarda Čecha,
jednoho z nejvýznamnějších českých
matematiků novodobé historie
a zakladatele
Matematického ústavu AV ČR.

Tomáš Vejchodský, ředitel

From generic continuity to Galvin's conjecture

A compactum K satisfies Namioka's generic continuity principle if for every separately continuous function $f: K \times B \rightarrow \mathbb{R}$, where B is some Baire space, there is a dense G_δ subset G of B such that f is jointly continuous on $K \times G$ (recall that Baire space is a topological space in which no nonempty open set is meager). When B is a complete metric space this principle is true for every compact space K , a famous theorem of I. Namioka. The more general principle was introduced as a useful tool for comparing weak and strong topologies on Banach spaces which in turn is needed when studying Fréchet differentiability, the Radon-Nikodým property, or the existence of smooth renormings in this context.

The lecture will first survey a solution to a problem of Richard Haydon from the 1980's about Namioka's generic continuity principle that led us isolate the general notion of universally meager space and connect it with ideas from a quite different areas of mathematics, the theory of large cardinals. In very recent joint work with D. Raghavan we have further explored this connection showing that it can be applied to an even older conjecture of F. Galvin from the topological Ramsey theory. Some ideas from this work will be presented as well as a list of problems that could be reachable using the new methods.



The Institute organized traditional Open Houses as a part of the scientific festival Week of Science and Technology. During five days in November 1,227 high-school students and other interested people visited 39 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 2019 was 43,673 thousand CZK, its remaining book value was 21,424 thousand CZK.

Further tangible fixed assets is formed mostly by devices and IT equipment with the book value 9 635 thousand CZK to the date 31 December 2019, remaining book value was 804 thousand CZK.

3.2 Expenses and revenues

Principal entries (in thousands of CZK)

| | |
|--|---------------|
| Total expenses | 97,588 |
| Purchases of materials, electricity, gas | 2,489 |
| Maintenance and reconstructions | 928 |
| Travel expenses | 4,826 |
| Other services | 6,264 |
| Personal expenses | 79,362 |
| Other expenses (including grant overheads) | 2,640 |
| Depreciation | 1,079 |
| Total revenues | 97,588 |
| Sales of periodicals | 2,926 |
| Other revenues | 2,559 |
| Institutional subsidies (from the budget of the Czech Academy of Sciences) | 61,466 |
| Grants | 30,637 |
| Earnings before taxes | 0 |

The total revenues compared to the previous year, increased by 3.2%. This was mainly due to the success in the Czech Science Foundation competition for research grants, and due to the raised institutional subsidy from the Czech Academy of Sciences which included funding of the large project Praemium Academiae of M. Markl and a special support for stabilization of core researchers.

3.3 Personnel and salaries

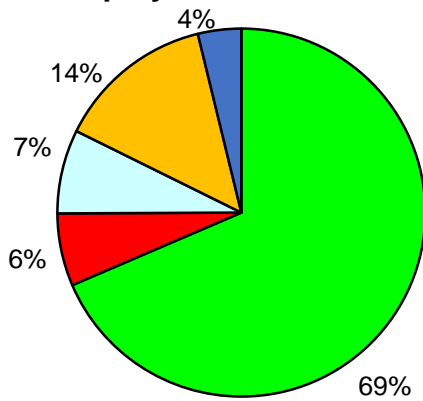
The average number of employees amounted to 89,6 FTE (annual increase of 10%).

The personnel expenses of 79,362 thousand CZK represented 81% of total operating expenses.

The average monthly salary from all resources – institutional, project and commercial – was 53,386 CZK. The slight decrease of 1.1% compared to the previous year was mainly due to the salary decrease of former team members of ERC grants and also due to the increased number of young researchers. Because of the inadequate government funding of the Academy, it is considerably below the level at Czech universities.

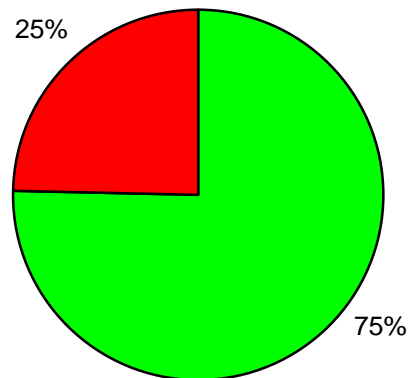
During 2019, 13 vacancies (9 postdocs, 4 Ph.D. students) were filled, mostly for two-year contracts. On recommendation of the Qualification Audit Committee, four postdocs and one research assistant were promoted to the researcher position. Three researchers, 4 postdocs and 2 Ph.D. students terminated employment in 2019.

Employee structure



- Researchers (including postdocs)
- PhD students
- Other specialists with university degree
- Technical and office staff
- Workers

Resources of salaries



- Institutional subsidies
- Domestic projects

In line with the general approach of the Czech Academy of Sciences, research staff in the Institute is employed on fixed-term contracts and 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.

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