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 2020

English summary

The Annual report was discussed by the Supervisory Board of the Institute on May 24, 2021 and approved by the Board of the Institute on May 26, 2021.

Contents

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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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 (as of December 31, 2020)

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

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

Board of the Institute:

Chair:	RNDr. Martin Markl, DrSc.
Vice-chair:	Vojtěch Pravda, Ph.D., DSc.
Members at large:	Prof. RNDr. Zuzana Došlá, CSc., DSc. (Masaryk University)
	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. Wieslaw Kubiś, Ph.D.
	RNDr. Šárka Nečasová, CSc., DSc.
	Doc. Mgr. Milan Pokorný, Ph.D., DSc. (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.

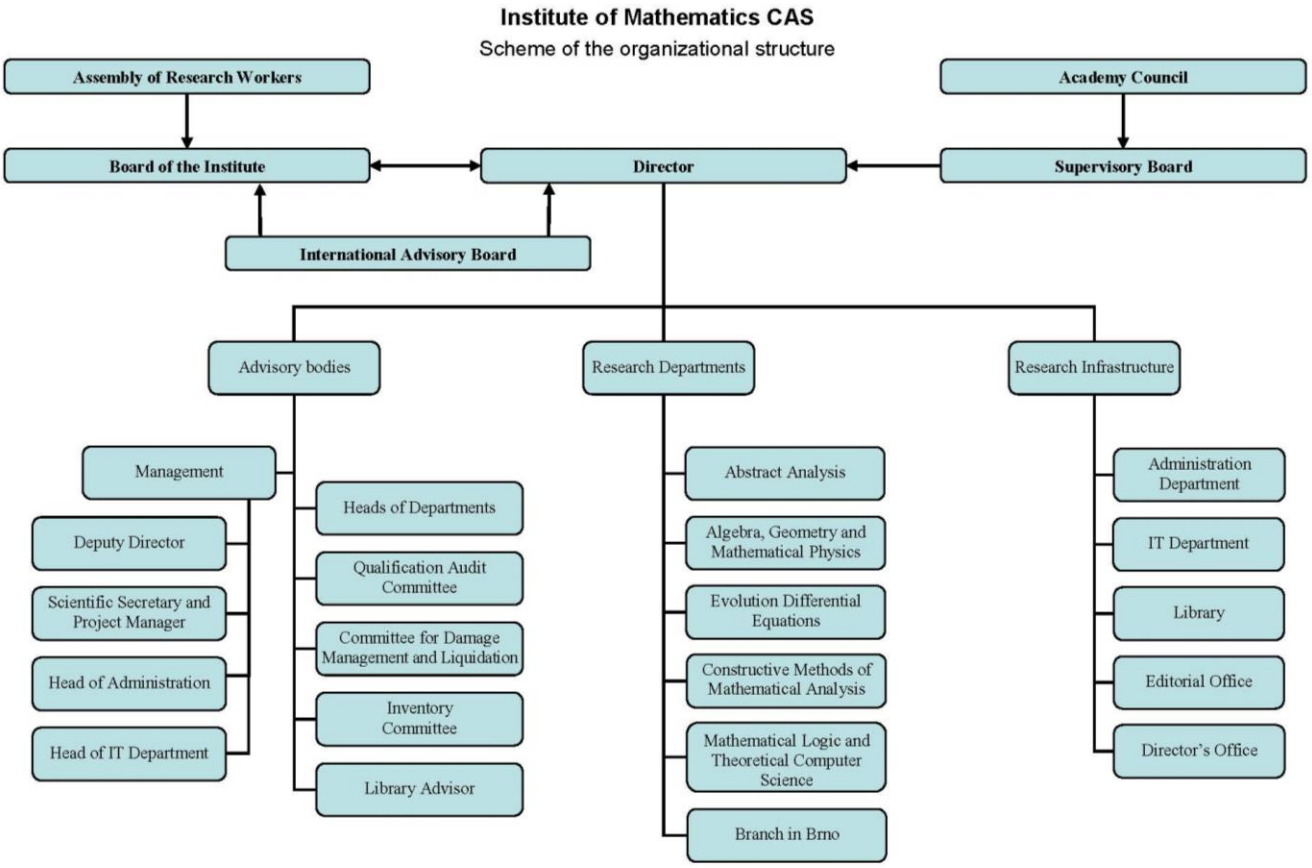
The **Board of the Institute** held five meetings, one of them remotely. The topics the Board discussed and approved included among others:

- budget of the Institute for 2020 and the medium-term financial outlook for 2021–2022
- annual report on activities and economic management in 2019 and auditor's report on financial statements
- change of the Organization structure – the Branch in Brno will be cancelled due to April 1, 2021
- selection of J. M. Barrientos for the postdoctoral positions in the Academy's programme supporting prospective human resources
- recommendation to invite Prof. A. Novotný (Université de Toulon, France) for the Eduard Čech Distinguished Visitor position
- proposal of M. Hrbek for the Otto Wichterle Award to promising young scientists

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

- discussion about the proposal of the budget of the Institute for 2020 and the medium-term financial outlook for 2021–2022, about the annual report on activities and economic management in 2019 and about auditor's report on financial statements
- consent to the Implementation and Service Agreements with the winner of the public tender for the provider of the economic-information system
- approval of lease agreements and amendments extending lease agreements for flats in the Institute's building
- approval of the updates of the contract for the lease of space for the SPIN flower shop

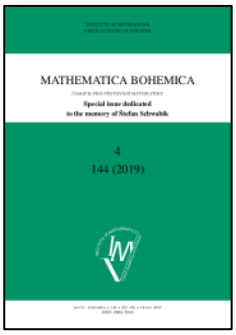
1.3 Structure

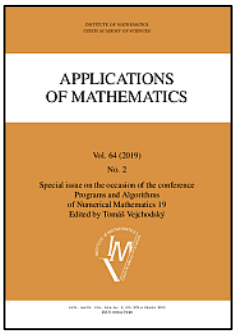


The Institute publishes three internationally recognized mathematical journals:

- 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 https://dml.cz and participates in the development of the European Digital Mathematics Library EuDML accessed at https://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

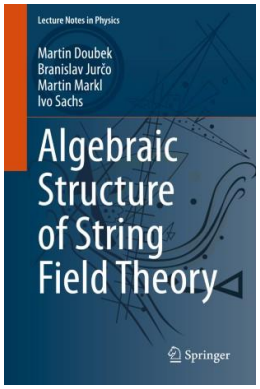
Jindřich Nečas Centre for Mathematical Modeling (http://ncmm.karlin.mff.cuni.cz/) is a consortium of the Institute of Mathematics, the Faculty of Mathematics and Physics of the Charles University, and the Institute of Computer Science CAS. It was established in 2013 to continue the efforts of a joint 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 2020, members of the Institute published the total of 151 journal and proceedings papers, including two monographs and two chapters in a monograph. The following 9 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] Doubek, M., Jurčo, B., **Markl, M.**, Sachs, I. *Algebraic Structure of String Field Theory*. Lecture Notes in Physics, 973. Cham: Springer, 2020.



String field theory is currently the only candidate for Grand Unification, a wished-for theory unifying the four known physical interactions. For that reason, it stays in focus of mathematicians and mathematical physicists. The first part of the monograph explains the physical foundations of that theory, while its second part is devoted to Markl's operadic interpretation of its algebraic structure. The monograph is the first self-contained text explaining the role of operads in string field theory. Its purpose is to serve as an introduction for both students and researchers in related areas.

[2] **Gavinsky D.** *Bare quantum simultaneity versus classical interactivity in communication complexity*. In: Makarychev, K. Makarychev, Y.; Tulsiani, M.; Kamath, G.; Chuzhoy, J., eds.), Proceedings of the 52nd annual ACM SIGACT symposium on theory of computing, STOC '20, Chicago, IL, USA, June 22–26, 2020. New York, NY: Association for Computing Machinery (ACM) 2020, 401–411.

This work can be seen as an ultimate demonstration of the quantum supremacy in the setting of bipartite communication: here the weakest quantum model (namely, that of simultaneous message passing without shared resources) exhibits exponential advantage over the strongest classical model (namely, two-way interactive communication).

[3] **Hanek, M.**, **Šístek, J., Burda, P.** *Multilevel BDDC for incompressible Navier-Stokes equations*. *SIAM Journal on Scientific Computing*. 42 (6), 2020, C359–C383.

The paper is an outcome of several years of effort of the authors to develop the Multilevel BDDC method for solving systems of linear equations with nonsymmetric matrices. The method is applied to the solution of steady Navier-Stokes equations. Approximation using the finite element method leads to a system of nonlinear equations, which is subsequently linearized by the Picard iteration. This leads to a sequence of systems of linear equations with nonsymmetric saddle-point matrices. We formulate the algorithm of the multilevel BDDC method and explore its applicability for the benchmark problem of lid-driven cavity. Another contribution of the paper is describing the gradual development and application of our BDDC solver and its application to real-world problems of oil flow in hydrostatic bearings. The behaviour of the method is tested on up to five thousand CPU cores of the Salomon supercomputer.

[4] **Feireisl, E.**, Hofmanová, M. *On convergence of approximate solutions to the compressible Euler system*. Annals of PDE 6 (2), 2020, Article ID 11, 24 pages.

We consider a sequence of approximate solutions to the compressible Euler system admitting uniform energy bounds and/or satisfying the relevant field equations modulo an error vanishing in the asymptotic limit. We show that such a sequence either (i) converges strongly in the energy norm, or (ii) the limit is not a weak solution of the associated Euler system. This is in sharp contrast to the incompressible case, where (oscillatory) approximate solutions may converge weakly to solutions of the Euler system. Our approach leans on identifying a system of differential equations satisfied by the associated turbulent defect measure and showing that it only has a trivial solution.

[5] **Jeřábek, E.** *Recursive functions and existentially closed structures*. Journal of Mathematical Logic 20 (1), 2020, Article ID 2050002, 52 pages.

Gödel's incompleteness theorem implies that all sufficiently expressive first-order theories are essentially undecidable: no algorithm can recognize provable statements, even if we first expand the theory with any consistent set of extra axioms. This paper studies relationships among the most common conditions ensuring essential undecidability of a given theory; the main result is the existence of a theory that represents all partial recursive functions, but does not interpret Robinson's theory R. The proof unexpectedly employs methods from model theory (model companions and classification theory).

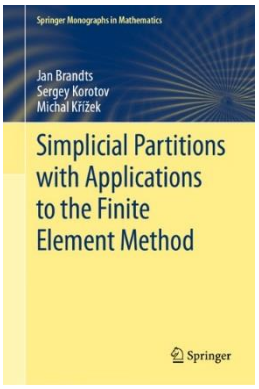
[6] **Positselski, L.**, Slávik, A. *Flat morphisms of finite presentation are very flat*. Annali di Matematica Pura ed Applicata 199 (3), 2020, 875-924.

This paper proves the so-called Very Flat Conjecture, posed by L. Positselski in the February 2014 version of his long preprint on contraherent cosheaves. The proof demonstrates the power of contra-module-related techniques in commutative algebra, and the result can be viewed as a contribution to the foundations of algebraic geometry. It has applications to quasi-coherent sheaves and plays a central role in the context of contraherent cosheaves.

[7] **Ghasemi, S.**, **Kubiś, W.** *Universal AF-algebras*. Journal of Functional Analysis 279 (5), 2020, Article ID 108590, 32 pages.

We study the approximately finite-dimensional (AF) C^*-algebras that appear as inductive limits of sequences of finite-dimensional C^*-algebras and left-invertible embeddings. We show that there is such a separable AF-algebra AF which is a split-extension of any finite-dimensional C^*-algebra and has the property that any separable AF-algebra is isomorphic to a quotient of AF. Equivalently, by Elliott's classification of separable AF-algebras, there are surjectively universal countable scaled (or with order-unit) dimension groups. This universality is a consequence of our result stating that AF is the Fraïssé limit of the category of all finite-dimensional C^*-algebras and left-invertible embeddings. With the help of Fraïssé theory we describe the Bratteli diagram of AF and provide conditions characterizing it up to isomorphisms. AF belongs to a class of separable AF-algebras which are all Fraïssé limits of suitable categories of finite-dimensional C^*-algebras, and resemble $C(2^{\mathbb{N}})$ in many senses. For instance, they have no minimal projections, tensorially absorb $C(2^{\mathbb{N}})$ (i.e. they are $C(2^{\mathbb{N}})$-stable) and satisfy similar homogeneity and universality properties as the Cantor set.

[8] Brandts, J., Korotov, S., **Křížek, M.** *Simplicial Partitions with Applications to the Finite Element Method.* Springer Monographs in Mathematics. Cham: Springer, 2020.



This monograph focuses on the mathematical and numerical analysis of simplicial partitions and the finite element method. It contains more than 100 theorems on partitions. Generating of simplicial partitions is at present very active area of research and has become an essential part of numerical solution of equations of mathematical physics, for example, in the study of problems involving heat conduction, linear elasticity, semiconductors, Maxwell's equations, Einstein's equations and magnetic and gravitational fields. These problems require the simulation of various phenomena and physical fields over complicated structures in three and higher dimensions. Since not all real-life structures can be decomposed into simpler objects like d-dimensional rectangular blocks, simplicial partitions are important. An emphasis is placed on angle conditions guaranteeing the convergence of the finite element method for elliptic partial differential equations with given boundary conditions.

[9] **Müller, V.**, Tomilov, Y. *Joint numerical ranges: Recent advances and applications.* Concrete Operators 7 (1), 2020, 133–154.

We introduce new techniques allowing one to construct diagonals of bounded Hilbert space operators and operator tuples under "Blaschke-type" assumptions. This provides a new framework for a number of results in the literature and identifies (often large) subsets in the set of diagonals of arbitrary bounded operators (and their tuples). Moreover, our approach leads to substantial generalizations of the results due to Bourin, Herrero, and Stout having assumptions of a similar nature.

2.5 Projects

1 project Praemium Academiae funded by the Czech Academy of Sciences

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

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

- 20-31529X Abstract convergence schemes and their complexities (2020–2024, W. Kubiś)
- 19-27871X Efficient approximation algorithms and circuit complexity (2019–2023, P. Hrubeš)

11 standard grant projects funded by the Czech Science Foundation:

- 20-14736S Hysteresis modeling in mathematical engineering (2020–2022, G. Monteiro)
- 20-13778S Symmetries, dualities and approximations in derived algebraic geometry and representation theory (2020–2022, L. Positselski)
- 20-01074S Adaptive methods for the numerical solution of partial differential equations: analysis, error estimates and iterative solvers (2020–2022, T. Vejchodský)
- 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)

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. Doucha)
- 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)

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 grant project evaluated on the basis of the LEAD Agency principle funded by the Czech Science Foundation

- 20-22230L Banach spaces of continuous and Lipschitz functions (2020–2022, W. Kubiś)

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.02.2.69/0.0/0.0/18_054/0014664 Institute of Mathematics CAS goes for HR Award
- implementation of the professional HR management (2020–2022, team: L. Bauerová, B. Kubiś, M. Rozložník, K. Strung, T. Vejchodský)
- 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)

2 MOBILITY projects funded by the Ministry of Education, Youth and Sports:

- 8J20FR007 Mathematics of diffuse interface models (2020–2021, E. Feireisl)
- 8J20AT022 Hysteresis in hypo-plastic models (2020–2021, G. Monteiro)

1 INTER-EXCELLENCE project funded by the Ministry of Education, Youth and Sports:

- LTAUSA19098 Verification and Control of Networked Discrete-Event-Systems (2020–2022, J. Komenda)

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 2020, Section Set Theory and Topology, Hejnice, 25. 1. – 1. 2. 2020. https://www.winterschool.eu/2020

PANM 20 Programs and Algorithms of Numerical Matematics 20, Hejnice, 21.–26. 6. 2020.
http://panm20.math.cas.cz/

Prague Summer School on Discrete Mathematics, Prague (online), 24.–28. 8. 2020,
http://pssdm.math.cas.cz/

Complexity Theory with a Human Face, 2.–4. 9. 2020, Tábor, Czech Republic.
https://users.math.cas.cz/talebanfard/workshop2020/

Cosmology on Small Scales 2020, Prague (online), 23.–26. 9. 2020.
http://css2020.math.cas.cz/

Mathematics in Industry 2020, Praha, 27. 11. 2020.
http://workshop.math.cas.cz/MathInIndustry2020/index.html/

Anniversary seminar dedicated to the 90th birthday of Milan Práger and the 60th birthday of Jan Chleboun, Praha, 18. 9. 2020.
https://calendar.math.cas.cz/content/anniversary-seminar-dedicated-90th-birthday-milan-prager-and-60th-birthday-jan-chleboun

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

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. Tvrdý

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
Mariam Manjikashvili, Tbilisi State University, supervisor S. Mukhigulashvili
David Matejov, Charles University, supervisor I. Khavkine
Ruben Medina, Uvivesidad de Granada, supervisor P. Hájek
Josef Navrátil, Czech Technical University Praha, supervisor M. Kučera
Matěj Novotný, Czech Technical University Praha, supervisor P. Hájek
Andres Quiles, Universidad Politechnica di Valencia, supervisor P. Hájek
Ana Radošević, University of Zagreb, supervisor Š. Nečasová
Jan Scherz, Czech Technical University Praha and Universität Würzburg, cosupervisor Š. Nečasová
Lenka Siváková-Straková, Czech Technical University Praha, supervisor Krejčí
Aravindhan Srinivasan, MFF UK, supervisor M. Ortaggio
Tomáš Tintěra, Charles University, supervisor V. Pravda
Dominik Trnka, Masaryk University in Brno, supervisor M. Markl
George Turner, 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 Hrbek, Otto Wichterle Award, Czech Academy of Sciences. Award given to young scientists under 35 years for achievement of excellent results in their disciplines.

Giselle Antunes Monteiro, Antonín Slavík and **Milan Tvrdý,** Prize of the Dean of the Faculty of Mathematics and Physics, Charles University for the best book publication in 2019 in the category Monographs for the book *Kurzweil-Stieltjes Integral: Theory and Applications* published in the Series in Real Analysis vol. 15, World Scientific, Singapore, 2019.

Martin Jarník, The Letter of Thanks of the President of the Czech Academy of Sciences, prof. Eva Zažímalová for his long-term unselfish and irreplaceable service for the Institute and the Czech Academy of Sciences, February 26, 2020

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 created to attract excellent foreign mathematicians and to further stimulate creative environment at the Institute. The stay of S. Todorčević (University of Toronto, Centre National de la Recherche Scientifique, Paris, and Matematički Institut SANU, Belgrade) did not happen due epidemilogic situation. The next Eduard Čech Distinguished Visitor of the Institute of Mathematics will be A. Novotný (Institut de Mathématiques de Toulon, France), who has agreed to come despite the problematic situation.

The Institute organized traditional Open Houses as a part of the scientific festival Week of Science and Technology. Due to the pandemic situation, the talks were given remotely via Zoom. The presentations were recorded and they are available on Youtube. According to the Zoom statistics during four days in November 937 high-school students and other visitors watched 11 lectures broadcasted from 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 2020 was 43,673 thousand CZK, its remaining book value was 20,629 thousand CZK.

Further tangible fixed assets is formed mostly by devices and IT equipment with the book value 8,641 thousand CZK to the date 31 December 2020, remaining book value was 657 thousand CZK.

3.2 Expenses and revenues

Principal entries (in thousands of CZK)

Total expenses	**107,847**
Purchases of materials, electricity, gas	3,686
Maintenance and reconstructions	410
Travel expenses	1,813
Other services	4,958
Personal expenses	95,357
Other expenses	497
Depreciation	1,076
Total revenues	**107,847**
Sales of periodicals	2,611
Other revenues	2,920
Institutional subsidies (from the budget of the Czech Academy of Sciences)	64,113
Grants	38,202
Earnings before taxes	**0**

The total revenues compared to the previous year, increased by 10.5%. This was mainly due to the success in the Czech Science Foundation competition for research grants, thanks to the funding of the HR project by the Ministry of Education, and due to the raised institutional subsidy from the Czech Academy of Sciences.

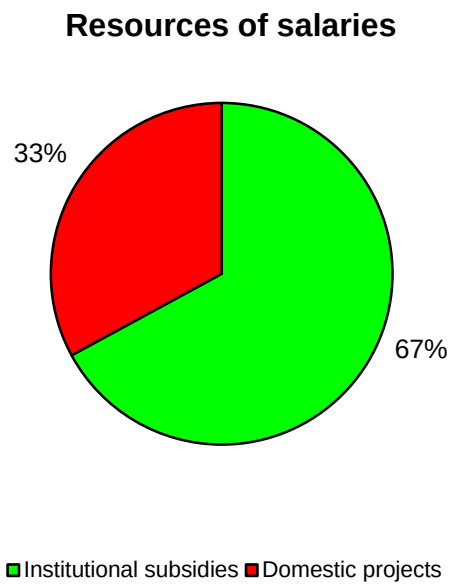
3.3 Personnel and salaries

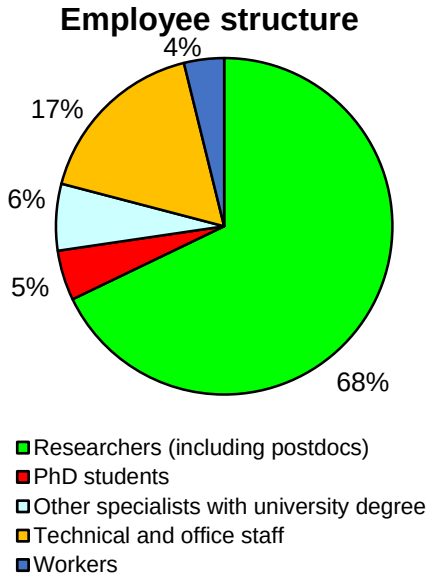
The average number of employees amounted to 96.17 FTE (annual increase of 7%).

The personnel expenses of 95,357 thousand CZK represented 88,4% of total operating expenses.

The average monthly salary from all resources – institutional, project and commercial – was 59,839 CZK. This represents a substantial increase of 12.1% compared to the previous year and it was mainly due to the success in external funding competitions. However government funding of the Academy is still the inadequate, it is considerably below the level at Czech universities.

During 2020, 13 vacancies (2 research fellows, 8 postdocs, 3 Ph.D. students) were filled, with exception of research fellow positions mostly for two-year contracts. Two researchers, 7 postdocs and 3 Ph.D. students terminated employment in 2020.





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.

Tomáš Vejchodský

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