

Self-assessment report

**on the scientific activity of the
Mathematics Institute in Opava
for the period 2017 – 2022**

**Silesian University in Opava
Mathematics Institute in Opava**

September 2022

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Introduction. Mathematics Institute of the Silesian University in Opava was founded as a stand-alone university institute on January 1, 1999. Its predecessor was the Department of Mathematics, which had been one of the constituents of the Faculty of Philosophy and Science since the founding of the faculty in 1991, and which had, thanks to its qualified academic personnel, demonstrated a very rapid development. This was the reason why the Silesian University acquired a doctoral study program as early as in 1994, followed in 1995 by the authorization to perform habilitations and full professor appointments in the field of Mathematics – Mathematical Analysis. At present, Mathematics Institute in Opava is an established and internationally recognized scientific institution. Almost two thirds of its budget are allotted for research activity, and for the most part come from funding distributed on the basis of open competition; similarly, roughly two thirds of its academic staff has parts of their workload allotted to research activity. The main scientific projects in the period 1999-2011 were the so-called Institutional Research Plans MSM4781305904 “Topological and analytical methods in dynamical systems theory and mathematical physics” (2005-2011) and MSM192400002 “Global analysis” (1999-2005). In 2012-2018, the institute was one of the four members of the joint seven-year project “Eduard Čech Institute for algebra, geometry and mathematical physics”, the only center of excellence in the area of mathematics in the Czech Republic. The institute carries out a total of 10 study specializations in the bachelor, master and doctoral study program Mathematics in Czech as well as English languages, and is authorized to perform habilitations or full professor appointments in two areas of mathematics.

a) Orientation and strategic goals: to maintain high level and international renown of the scientific activity of the institute in the areas of basic research, and to do so in all the areas of mathematics cultivated so far, particularly in the theory of dynamical systems, theory of integrable systems, differential geometry and mathematical physics, functional analysis, complex analysis and theory of differential equations. It will be imperative to continually strive to obtain funding from publicly open sources (grant competitions and similar).

b) Management of scientific activity. Since 2005, three-day evaluation sessions are organized twice a year (May and November) for all academic personnel whose salary is at least partly covered from the funds for research, and all doctoral students. The participants report on their scientific activity and results obtained, their envisaged research projects and, if applicable, problems coped with. An integral concluding part of the sessions is also a substantiated public assessment of the academic staff and doctoral students (grades used: outstanding recognition, very satisfactory, satisfactory, partly satisfactory, unsatisfactory).

c) Measures adopted to support the development of scientific activity. The outcomes of the evaluation sessions are used as a basis for salary bonuses from the budget for scientific activity. Additionally, every faculty member or doctoral student can claim a bonus or scholarship, respectively, in the amount of 10.000 CZK for every paper published in an impact-factor journal, irrespective of the number of coauthors; additional bonuses are awarded for papers published in journals ranked in the first quartile and the first decile according to the most recent WoS Journal Citation Reports article influence score (this is in line with the current scheme for research evaluation on the national level). It must be noted that this scheme is not abused. The institute also provides extra funding for research visits to institutions abroad for

the purpose of e.g. joint work on a paper or similar, as well as for inviting people to stay in the institute for purposes of this kind.

d) Interconnection of the scientific activity with the educational activity: analogous to what is standard in the area of mathematics on good-quality tertiary educational institutions abroad. This is witnessed e.g. by impact-factor publications of doctoral, and even some master, students. Publications without coauthors are especially a priority. Since 2017, there were 14 papers by students (mostly doctoral) published in this way, as well as 3 so-called post-master thesis („rigorózní práce“).

e) Academic personnel structure and career advancement. There are 24 academic employees with full-time workload, comprising of 1 full professor, 7 associate professors („docents“, i.e. after habilitation) and 12 assistant professors with the degree of Ph.D. or equivalent; and there are 3 part-time (0.35 – 0.7) employees. This represents a fairly above-average personnel structure within Czech universities. During the period under evaluation, 2 faculty members successfully completed habilitation and 1 obtained the title DSc. (“Doctor of Science”) awarded by the Czech Academy of Sciences as recognition of “outstanding and original scientific work, contributing to the advancement of research in a specific scientific field and characterizing the awardee as a distinguished scientist”. Any faculty member who satisfies the criteria required for habilitation or full professor appointment is encouraged to apply for the corresponding procedure. This especially applies to talented early-stage academic personnel. Within the extent applicable under Czech law, it is a rule that only full professors and those who have completed habilitation (associate professors) can obtain permanent work contract.

f) Scientific activity of students, especially doctoral students. Achieves high level. During the comprehensive evaluation of doctoral degree programs in the Czech Republic by the former Accreditation Commission in 2012, the doctoral program of the Mathematics Institute in Opava was evaluated highly favorably. For additional information about this topic, please see above. All doctoral dissertations are required to contain results that have been published or accepted for publication; at least one such publication must already be published, and at least one must be without co-authors.

g) University, national and international scientific projects. During the period under evaluation, there were in total 4 projects of the Grant Agency of the Czech Republic (GACR) carried out in the institute; among these, in 2 cases the principal investigator was from the institute (M. Engliš). The combined funding acquired in these projects in 2017 – 2022 was 7.6 mil. CZK.

21-27941S Function theory and related operators on complex domains, project duration 2021–2023, total funding 4.538 mil. CZK, principal investigator M. Engliš.

P201/12/G028 Eduard Čech Institute for Algebra, Geometry and Mathematical Physics, project for the years 2012–2018, total funding for the institute 11.291 mil. CZK, principal co-investigator M. Engliš.

16-25995S Function theory and operator theory in Bergman spaces and their applications II, project for the years 2016–2018, total funding 924 thd. CZK, principal investigator M. Engliš.

15-12227S Analysis of mathematical models of multi-functional materials with hysteresis, project for the years 2015–2017, total funding for the institute 975 thd. CZK, principal co-investigator J. Kopfová.

Additional projects carried out in the institute during the period under evaluation include those funded by the European Commission through the “*Operational*

Program Research, Development and Education” in the total amount of 7.8 mil. CZK:

Support of International Mobility of Researchers on SU,
CZ.02.2.69/0.0/0.0/16_027/0008521, 1.927 mil. CZK

Support for international mobility at the Silesian University in Opava,
CZ.02.2.69/0.0/0.0/18_053/0017871, 0.807 mil. CZK.

Development of R&D capacities of the Silesian University in Opava,
CZ.02.2.69/0.0/0.0/18_054/0014696, 5.056 mil. CZK.

The remaining project category consists of various internal university projects: the Student Grant Competition of the Silesian University in Opava (“SGS”), the Student Grant Foundation of the Silesian University in Opava (“SGF”), the Internal Grant System of the Silesian University in Opava (“IGS”), etc. The combined funding from all these projects in 2017 – 2022 amounted to 6.1 mil. CZK. Further details about these projects are available from the webpage of the institute and in the annual reports of the institute for respective years.

h) National and international collaboration in scientific activity: very broad, as witnessed by publications of the academic staff of the institute with co-authors from abroad. From the period 2017 – 2021 there are about 45 of these in impact-factor journals, with co-authors from about 15 countries (Austria, Brazil, Canada, Chile, China, France, Germany, Italy, Poland, Russia, Slovakia, Sweden, Ukraine, United Kingdom, U.S.A.). Further details are available in annual reports. The institute also systematically tries to create temporary visiting positions to host researchers from abroad; during the period under evaluation, these included 5-30 months positions that attracted 3 long-term scientific visitors as well as 4 postdocs in the evaluation period.

i) Societal relevance of the scientific activity. The activity mostly belongs to basic research in the areas specified in the point a). From the citations of the published outputs it is apparent that the research has been bringing high quality results, which affect scholarly activity both within the country and abroad.

j) Most important results obtained. During the period 2017 – 2022 there have been published more than 80 publications in impact-factor journals.

In the area of dynamical systems and their applications (27 publications): from the results obtained we have to mention the significant results concerning distributional chaos, results on constant slope models in one-dimensional dynamical systems, extensions of results on backward trajectories including alpha-limit sets, or exploration of properties of non-autonomous dynamical systems.

In the area of integrable systems, differential geometry and mathematical physics (33 publications): from the results obtained in this area we have to mention a new approach to group classification of differential equations (the mapping method), and results on conservation laws and/or symmetries for Gibbons-Tsarev, Kawahara, Veronese web and other equations as well as e.g. for isothermal no-slip drift flux model, and on Hamiltonian structures and associated projective-geometric objects for Witten-Dijkgraaf-Verlinde-Verlinde equations.

In the area of functional and complex analysis (18 publications): from the results obtained we have to mention a new method for solving dark Kepler and related force problems, partial proof of uniqueness of balanced metrics on non-compact manifolds, constructions of higher-order Cauchy-Riemann spaces (realizing an old idea of Boutet

de Monvel and Guillemin), description of reproducing kernels and asymptotic expansions on Jordan-Kepler manifolds and analysis of Q - p spaces built with respect to weighted actions of the Moebius group.

In the area of differential equations (10 publications): from the results obtained we have to mention the extensions of the well-known SIR and SEIR models with applications in epidemiology for studying the dynamics of epidemics, and those that are oriented to the study of different types of travelling waves in delayed reaction-diffusion equations.

k) Methods and results of internal evaluation of the scientific activity by the unit evaluated. Methods are specified in the point b). The results for the whole institute are available to all the academic personnel and doctoral students of the institute.

Guide to Annexes

More details about the activity of the institute can be found in the annual reports of respective years 2017 – 2021, which are attached as separate annexes. The reports are in Czech, but it is hoped that due to their simple structure most of the data can be understandable for anyone; a short glossary of chapter headings is given below.

Zpráva o vědecké činnosti	Report on scientific activity
Vědecká rada Matematického ústavu	Scientific Council of the MI
Předseda, Místopředseda, Členové	Chair, Vice-chair, Members
Programy zasedání	Programs of meetings
Kvalifikační a věková struktura	Qualification and age structure
Publikace pracovníků a studentů ústavu	Publications of MI faculty and students
Ohlas prací kmenových pracovníků...	Citations of papers of faculty & students
Grantová a rozvojová úspěšnost	Grants and projects obtained
Vědecké konference a zahraniční ...	Scientific conferences and international collaboration
Další údaje o vědecké spolupráci...	Additional information on scientific activities of the faculty
Institucionální výzkum	Institutional research support
Vybrané publikace	Selected publications
Mezinárodní spolupráce	International collaboration

Note: The reports contain, in particular (in section III), also complete lists of publications by members of the Mathematics Institute for each year.

Opava, September 1, 2022