Computational and Applied Mathematics

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Faculty	Faculty of Electrical Engineering and Computer Science
Type of study	Follow-up Master
Language of instruction	Czech
Code of the programme	N0541A170007
Regular period of the study	2 years
Cost	50,000 CZK per semester
Coordinating department	Department of Applied Mathematics
Coordinator	prof. RNDr. Jiří Bouchala, Ph.D.
Keywords	Mathematical Modelling and HPC, Mathematical and Functional Analysis, Variation Methods and FEM, Optimization Methods, Statistics

Study branches

- Applied Mathematics
- Computational Methods and HPC

About study programme

The follow-up Master Study Program is divided into two specializations (Applied Mathematics, Computational Methods and HPC) and is designed for graduates from both technical study programs and natural science study programs. Students that graduate from specialization Applied Mathematics will comprehend connections and continuity between individual fields of mathematics, especially Numerical Analysis, statistics, and Discrete Mathematics. They will learn to employ the above knowledge to deal with practical problems by tracing their underlying mathematical structure. They will learn to design the corresponding mathematical model and solve it using appropriate mathematical methods. Students that graduate from specialization Computational Methods and HPC are focused more to implement parallel mathematical methods effectively on modern computer architectures including supercomputers.

Graduate's employment

The graduate can find his/her application in practically all areas of IT and applied mathematics, regardless of their focus.
Graduates apply not only in IT, science and research, but thanks to a certain universality of mathematics (and computer science) and learned skills to quickly adapt can apply to any field.
Many of the graduates are employed as scientific staff at the IT4Innovations National Supercomputing Center, others work as university teachers, programmers, analysts, consultants, etc.

Graduates can continue their Ph.D. studies in Computational and Applied Mathematics or in parallel computing and HPC.

Study aims

The aim of the study is to educate graduates with practical skills and basic theoretical background in applied mathematics and informatics.

Graduate of the study program "Computational and Applied Mathematics" should be able to understand and solve problems from various other fields (electrical engineering, mechanics, medicine, ...).

Graduate's knowledge

The graduate has a broad knowledge of applied mathematics and informatics. He specializes in the use of modern methods of applied mathematics in various fields. The offer of special subjects, which are not part of state final examinations, enables students to acquire deeper knowledge in selected areas. Due to solid knowledge of applied mathematics and computer science, the graduate has all the prerequisites for flexible adaptation according to practice requirements, including research and development.

The graduate of specialization of Applied Mathematics is able to find mathematical structure in the practical problems and to create and subsequently solve relevant mathematical models, thanks to knowledge of relations and relationships between the various branches of mathematics (especially numerical analyzes, statistics and discrete mathematics).

The graduate of the Computing and HPC specialization is more oriented towards efficient (parallel) implementation of mathematical methods and the use of modern computer architectures, including supercomputers.

Graduate's skills

Graduates of the study program at graduation can independently define and creatively solve a theoretical or practical problem in the field of computational and applied mathematics. Using selected theories, concepts and methods, they can solve a complex problem in a self-contained and creative manner and gain new original information.

Graduate's general competence

Graduates are able to decide independently and responsibly in new or changing contexts, taking into account wider social implications, defining assignments for professional activities, coordinating them, and bearing ultimate responsibility for their results. They have communication skills that enable them to capture the essence of the problem, summarize their opinions and describe the nature of professional problems, present their opinions to experts and the general public in at least one foreign language, usually in English.

Professions

- Konzultant
- Statistik
- Datový analytik
- Specialista HPC
- Pedagog
- Pracovník vědy a výzkumu
- Analytik
- Matematik
- Programátor – specialista

Hard skills

- Reliability theory
- R programming language
- Work with data (big data)
- Fortran
- Statistical methods
- HPC programming
- Optimization methods
- Finite element method
- MPI
- Dynamic systems

- FETI methods
- Quadratic programming
- Parallel programming
- Linear programming
- Regression analysis
- Mathematical methods and analyses
- Numerical modelling
- PETSc
- CUDA
- Knowledge of mathematical models
- Numerical methods
- Matlab
- Shape optimization
- OpenMP
- Parallel data processing
- Statistical data analysis
- OpenFOAM