

A Master Degree Course in Computational Engineering at University of Warsaw

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Interdisciplinary Centre for Mathematical and Computational Modeling, University of Warsaw



- University of Warsaw is the largest university in Poland
 - funded in 1816
 - about 2,900 academic staff
 - over 50,000 students
 - 18 faculties, 32 disciplines
 - over 100 teaching programs



- Interdisciplinary Centre for Mathematical and Computational Modeling (ICM)
 - founded in 1993
 - research center in computational sciences
 - HPC center
 - resources: Cray XC40, PC clusters



Master degree program in Computational Engineering – motivation

- Computer science students are the most numerous group divided into a field of study (in Poland)
- Market demand significantly exceeds the number of graduates
- Demand for IT specialists is diverse and changes with the emergence of new technologies
- Education does not keep up with the demand
- Particularly visible in the field of technologies related to computer simulations, large-scale calculations or the processing of large data
- HPC centers including ICM have significant problem to recruit personnel with proper skills

Master degree program in Computational Engineering – overview

- 3 semester postgraduate program (2nd level study)
- Master degree in computer science
- More than 50% of lectures is in the form of practical classes
- For engineers or masters (eng or master degree required)
 - directed primarily at non-IT specialists
 - majority of applicants with degree received out of University of Warsaw
- 15 students, starts every semester (2 times a year)
 - Acceptance rate 61%
- Study program entirely defined based on the learning outcomes
 - fully compliant with applicable regulations and industry trends

Master degree program in Computational Engineering – courses

- Obligatory courses – 1st semester
 - Math (6 ECTS),
 - Introduction to HPC (9 ECTS)
 - Parallel programming (6 ECTS)
- Obligatory courses – 2nd semester
 - Simulations in natural sciences (3 ECTS)
 - Simulations in social sciences (3 ECTS)
- Internship (obligatory)
 - 3 month internship (12 ECTS) (mostly at ICM)
- Other courses (student has to take 3 such courses)
 - Visualization (6 ECTS),
 - Simulations in various areas (physics, medicine, transportation, etc.)
 - AI, DL, etc.

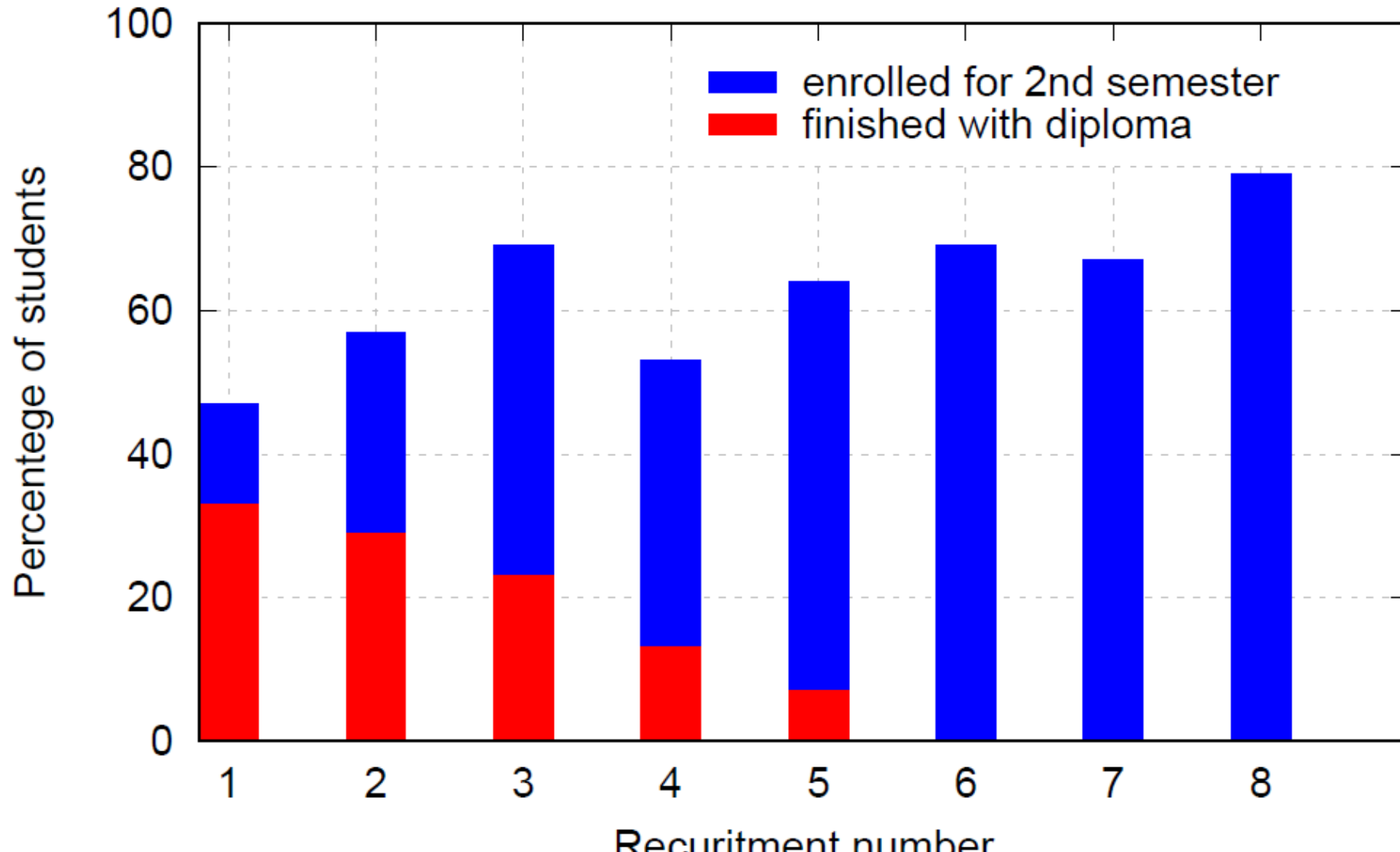
Master degree program in Computational Engineering – selected topics

- Introduction to high performance computing systems
- Basic computer architectures, processors, networks, and data storage systems
- Queuing systems and their use in practice
- Code compilation, profiling technologies and code optimization
 - scalar and vector.
- Installation of software and numerical libraries
- Introduction to grid and cloud technologies, virtualization
- Computing portals
- Parallel computing (PGAS, MPI, OpenMP, GPU)
- Hadoop, Spark
- Quantum Computing

Master degree program in Computational Engineering – students

- Students are well motivated, well prepared
- Students profile similar to the user profile of HPC centre
- Interdisciplinary studies, students with different background
 - most of them has not studied computer science / informatics
 - strong background in physics, chemistry, engineering
 - some students with other background (linguistics, medicine)
- Students are using HPC resources at ICM
 - treated as other HPC users
 - resource usage is about 500,000 CPU-hours / year
 - each year several students perform summer internships at ICM

Master degree program in Computational Engineering – students' performance



Students' achievements

- ICM students are taking first places in the HPC hackatons organized at ICM (3 editions)
 - Good teamwork skills
 - Teams benefit from multidisciplinary background
 - Experience in using HPC systems (already after 1 semester)
- Alumni and ICM students are employed at the ICM University of Warsaw
 - open competitions
 - preparation and predispositions of computational engineering students are much better than other candidates

Conclusions

- Computational engineering studies are second-level (master degree) computer science program
- Studies are offered first to non-computer science specialists and not only to those with technical education
- Studies have a practical profile
- Equips students with the skills and in-format competences in the field of large IT infrastructures
- Student achievements clearly show that the adopted education model is correct
- Particularly positive are students' skills in parallel programming
- Studies educate people for employment in supercomputing centers, including ICM

Thank you

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