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Computational Modelling and Simulation • Technische Universität Dresden • Dresden ............. 2
# Master's degree

**Computational Modelling and Simulation**  
Technische Universität Dresden • Dresden

## Overview

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### Languages

This programme is taught in English. However, certain optional modules may be offered in German language, leading to larger selection possibilities. In particular, the "Computational Modelling in Energy Economics" track should only be chosen by students who are proficient in German.

### Programme duration

4 semesters

### Beginning

Winter semester

### Application deadline

For (prospective) degree holders from non-German institutions of higher education:
- 1 April - 31 May: non-EU nationals
- 1 April - 15 July: German or EU nationals

For all other applicants:
- 1 June - 15 July: (prospective) graduates from German institutions of higher education

### Tuition fees per semester in EUR

None

### Combined Master's degree / PhD programme

Yes

### Joint degree / double degree programme

No

### Description/content

The Master’s programme in "Computational Modelling and Simulation" (CMS) is research-oriented, interdisciplinary and international. It is a joint curriculum between TUD's Faculty of Computer Science, the Faculty of Mathematics, and the Center for Molecular and Cellular Bioengineering (CMCB), with participation of the Faculty of Psychology, the Faculty of Medicine, the Faculty of Economics, and the Faculty of Mechanical Engineering. This programme teaches the mathematical and algorithmic foundations and applications of computational modelling (learning models from data/machine learning, inverse problem) and computer simulation (numerical simulation, forward problem). Specialisation is provided in one of the following six application-specific tracks, offering unique flexibility to students:

- Computational Life Sciences (CMCB, Computer Science)
- Computational Mathematics (Mathematics)
Course Details

Course organisation

The programme has a modular structure and consists of:

- the application-independent core area (three foundational theory modules to be selected out of eleven, the transferable skills module, the seminar module, the research project) and
- the application-specific tracks (one track of six must be selected upon application).

The modules contain lectures, exercises, seminars, tutorials, internships, project processing and language courses.

First semester:

- Three foundational modules (15 credits total) that teach the computer science and mathematics basics of modelling and simulation, to be chosen depending on prior knowledge:
  - Statistical Principles and Experimental Design
  - Basic Numerical Methods
  - Parallel Programming and High-Performance Computing
  - Machine Learning and Data Mining
  - Stochastic Modelling and Simulation
  - Data Visualisation
  - Basics of Theoretical Computer Science
  - Problem Solving and Search in Artificial Intelligence
  - Knowledge Graphs
  - Database Management
  - Scientific Software Engineering
  - A soft skills module (5 credits) consisting of language courses and courses on good scientific conduct and philosophy of science
  - Track-specific foundation modules (10 credits)

Second semester:

- Seminar module consisting of two selected transdisciplinary seminars (5 credits)
- Track-specific core modules (25 credits)

Third semester:
Research project module for cross-track application of the acquired knowledge (15 credits)
Track-specific advanced modules (15 credits)

Fourth semester:
Master's thesis project and defence as individual research work (30 credits)

Types of assessment
Module examinations can take place in written or in oral form. The Master's thesis is to be defended.

A Diploma supplement will be issued
Yes

Course-specific, integrated German language courses
Yes

Course-specific, integrated English language courses
No

Costs / Funding

Tuition fees per semester in EUR
None

Semester contribution
Currently, students pay 276 EUR per semester (i.e., for six months). This includes a ticket for public transport in Dresden (bus, tram, ferry, "S-Bahn" suburban train) and regional trains in the Federal State of Saxony. Additionally, students can use a bike rental service all over the city for free for one hour. The contribution also assures concessions in the university cafeterias and offers benefits (e.g., price reductions) for many cultural and leisure activities in Dresden.

Costs of living
Dresden offers high quality of living for very moderate costs. Currently, students should expect to pay around 700 EUR per month including rent, food, insurance, and basic expenses. This figure is relatively low compared to other big German cities.

Funding opportunities within the university
No

Requirements / Registration

Academic Admission Requirements
- First university degree qualifying for professional activity in Computer Science, Mathematics, Natural Science, Economics/Finance or Engineering (BSc or higher, including MSc, German "Diplom", BSc [Hons], etc.)
- Proficiency in computer programming in (at least one) sequential programming language
- Calculus of functions in one and multiple variables (partial derivatives, integrals, etc.)
- Basics of linear algebra (matrix and vector operations, matrix inversion, decomposition)
- Basics of probability (distributions, elementary probabilities, axioms)
- Basics of physics (classical mechanics, basic electromagnetism, optics)
- Basics of biology (components of a cell, theory of evolution, ecosystems)
- Basics of chemistry (atoms, periodic table, organic molecules [proteins, DNA, ...])

The CMS programme focuses on teaching the computer science and mathematics foundations of modelling and simulation and assumes familiarity with the above basics of the respective disciplines. Completed lectures on one or several of the following topics would be helpful but are
not strictly requested:
- Parallel Programming / High-Performance Computing
- Numerical Methods / Numerical Algorithms / Numerical Analysis
- Stochastics / Probability / Stochastic Algorithms
- Visualisation / Computer Graphics / Rendering Methods
- Statistics / Experimental Design / Inference Methods
- Theory of Computing / Logic
- Algorithms and Data Structure
- Machine Learning / Data Mining / Artificial Intelligence

Language requirements
- Knowledge of English corresponding to at least level B2 of the European Framework of Reference for Languages is required.
- Non-native speakers must prove sufficient knowledge of English by submitting test results or language certificates.

Application deadline
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1 April - 15 July: German or EU nationals

For all other applicants
1 June - 15 July: (prospective) graduates from German institutions of higher education

Submit application to
(Applicants from non-German institutions of education)
Technische Universität Dresden
c/o uni-assist e.V.
11507 Berlin
Germany

(Applicants from German institutions of education)
See: https://selma.tu-dresden.de/

Services

Possibility of finding part-time employment
Possibility of paid research assistant or teaching assistant activities

Accommodation
It is quite easy to find accommodation in Dresden. Accommodation is available either via the "Studentenwerk Dresden" or on the private market. Monthly rent for a single room in a student residence is approx. 250 EUR.
Private housing can be found online. We recommend that students move into a hall of residence at the beginning of their stay in Dresden. Subsequently, they can find a place on the private market or in a shared apartment, known as a "Wohngemeinschaft" in German.

Career advisory service
TU Dresden's Career Service offers plenty of opportunities to prepare for the job market with general and job specific workshops, career fairs and one-on-one counselling, with a special adviser for international students and their specific problems and questions about the German job market.
In addition, every CMS student is assigned a university teacher as personal mentor who is available for individual career advice and advice on curricular choices.
Specific specialist or non-specialist support for international students and doctoral candidates

- Welcome event
- Tutors
- Specialist counselling
- Visa matters
- Other

Support programmes for international students

We provide first-grade support to students on all levels, in particular including the following:
- The CMS administrator is the first contact for all enquiries related to CMS.
- The personal mentor is available for individual advice and curricular choices.
- TUD provides administrative services, support and formal counselling for international students. The offices offer social and psychosocial counselling, counselling for students with special needs, counselling for students for part-time jobs, services for students with children and advice for study exchange stays abroad.
- The Service Centre for International Students of the Faculty of Computer Science provides assistance with respect to all questions related to examinations.

Supervisor-student ratio

Each student is assigned a personal mentor who is available for individual advice and help with curricular choices. Every mentor has about three to four mentees. Typical class sizes are between 20 and 30 students and projects are done in teams of two to four students. Every professor supervises on average three to four student theses projects. In total, there are 60 to 70 students in the programme (30 to 35 per batch) and 18 professors as teachers and supervisors.

Contact

Technische Universität Dresden
Fakultät Informatik
Institut für Künstliche Intelligenz
Professur für wissenschaftliches Rechnen für Systembiologie

Prof Ivo Sbalzarini

01062 Dresden

Tel. +49 3512102555
cms-admin@mailbox.tu-dresden.de
Course website: https://tu-dresden.de/inf/ma-cms

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Editor
DAAD - Deutscher Akademischer Austauschdienst e.V.
German Academic Exchange Service
Section K23 – Information on Studying in Germany
(responsible: Judith Lesch)
Kennedyallee 50
D-53175 Bonn
www.daad.de

GATE-Germany
Consortium for International Higher Education Marketing
www.gate-germany.de

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