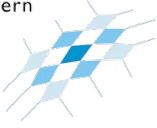Elitenetzwerk Bayern

UNIVERSITÄT BAYREUTH

Scientific Computing

an elite programme of study

The interdisciplinary master's programme Scientific Computing provides special skills in efficient methods for solving differential and integral equations and for analysing large sets of data. At the same time, it will also expand your horizons in other fields.

The interdisciplinary nature of the degree programme is one of its distinguishing features. Its curriculum includes lectures in mathematics along with lectures and labs in the fields of biochemistry, computer science, engineering, and physics.

Solving complex problems numerically.

The numerical simulation of phenomena in technology and the natural sciences has accelerated the development cycles in industry and business considerably. For example, nowadays prototypes are simulated and optimized on computers before they are produced. At the same time, statistical methods for data analysis (big data) are becoming more and more important. These rapid developments were made possible by the future-oriented research field scientific computing, which has been used to tackle a host of highly complex problems. Resolving such problems by understanding their mathematical core, leading to a numerical approximation with less complexity is the focus of this degree programme.

Do you want to help mould the future of numerical simulation? If so, the master's programme *Scientific Computing* – part of the *Elite Network of Bavaria* – could be the right challenge for you!

Located at the intersection of the STEM fields.

The master's programme *Scientific Computing* is a specialized programme for highly talented students. It addresses the development and mathematical analysis of highly efficient numerical processes and takes into account the entire solution chain, including modelling; mathematical, numerical, and statistical analysis; optimization; the implementation of algorithms on high-performance computers; and the visualization of results. The problems for your simulations will be from fields such as biochemistry, physics, computer science, and engineering. During your studies, you will have the chance to work on current research projects. You will be part of a mentoring system and will even have the opportunity to start a doctorate during the master's programme with our fast track option.

Networks with other research groups in Germany and abroad play a central role in the programme. Students are sent to external partners in the scope of their master's theses and dissertations. Travel costs are partly covered.

Five module areas for your specialization.

In Area A, you will focus on the theory and numerics of partial differential equations and integral equations. You will also address the foundations of optimization as well as approximation and control theory. Area B focuses on modelling and simulation. Depending on your interests, you will take courses in biochemistry, engineering, physics, or an advanced course in statistical data analysis. Computer Science in Area C focuses on topics that are indispensable for the efficient application of numerical methods on high-performance computers: algorithms, data structures, parallel systems, and high-performance computing. Area D concerns tackling highly complex problems by understanding their mathematical core, leading to a numerical approximation with less complexity. Area E is dedicated to key skills.

Programme Overview – period of study: 4 semesters.

Numerical and Scientific Computing		ECTS*
A1	Numerical Methods for Differential Equations	8
A2	Advanced Topics in Numerical Mathematics	8
D1	Complexity Reduction Methods	16
D2	Scientific Computing Specialization	4
F	Master's Thesis	30
Total		**66**

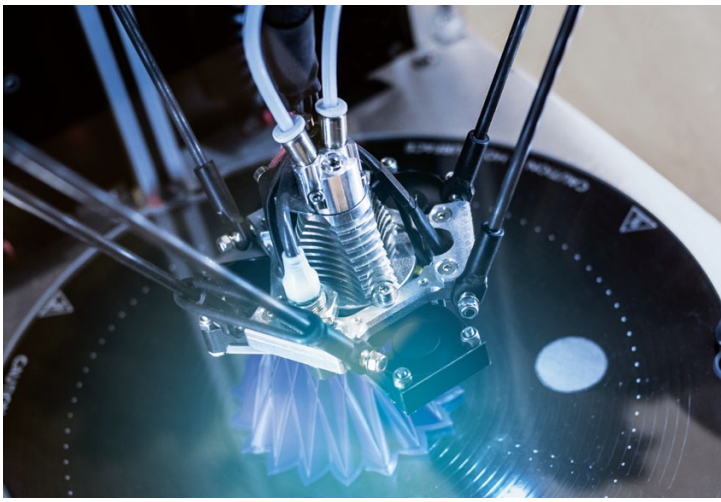| Modelling		ECTS*
B1	Applied Functional Analysis and Differential Equations	8
B2	Core Elective Module "Modelling and Simulation"	12
B3	Internship in Industry or D1 / B2	8
B4	Modelling Seminar	10
Total		**38**

Computer Science		ECTS*
C1	Core Elective Module "High-Performance Computing"	12
C2	Internship "Parallel Numerical Methods"	2
Total		**14**

Key Skills		ECTS*
E	Seminars to develop key skills	2
Total		**2**

Overall total	**120**

*ECTS Credit points are awarded in accordance with *ECTS*. Awarding credit points in accordance with the *European Credit Transfer System (ECTS)* facilitates the international comparability of coursework completed at European higher education institutions.

Specializations in scientific computing are in greater demand now than ever before. Graduates have exciting career prospects in research or in the high-tech industry.

Our campus is the heart of the University. It is where friendships are made, collaboration is initiated, and ideas are conceived. Our rich campus life features regular film screenings, art exhibitions, theatre performances, music performances, our annual "Uni Open Air" Festival, and much more.

In close contact with research, industry and business.

Our "Modelling Weeks" are sure to be a highlight during your studies. Unique compact seminars on modelling are held off-campus and provide you with an opportunity to apply your expertise. Representatives from high-tech companies present issues that are currently being addressed by researchers in the industry and private sector.

Modelling Week concludes with talks presenting the findings, and students have the chance meet prospective employers. Once a year, you will also have the opportunity to report the activities and findings of your own research in a so-called "Status Seminar". In addition, seminars and excursions are frequently offered with the aim of training soft skills and other key skills.

An ideal study environment on campus.

The University of Bayreuth has performed well in the *CHE University Ranking* for years thanks to the strong supervision its students receive in the various subject areas. As a master's student, you will be enrolled in an intensive programme of study in which small groups, first-rate instrumentation, and a friendly working atmosphere between students and instructors are the rule. Students love our charming campus. Everything you need is right at your doorstep, and it's easy to get to know students from other subject areas.

There is also a rich student life outside of the lecture halls. Examples include the University's orchestra, its big band, and the extensive University Sport programme. In addition, life in Bayreuth is not nearly as expensive as it is in many other parts of Germany. The town and surrounding region also provide a great setting for student life, with plenty to do in your free time.

An attractive environment awaits you.

We are pleased that you are interested in the elite pro-gramme of study *Scientific Computing*. To be admitted to the programme, you will need an excellent final grade for your bachelor's degree ("1.9" or better) in mathematics, computer science, physics, or a neighbouring discipline in the natural sciences. You will also need to pass an as-sessment process to determine your aptitude.

The standard period of study is four semesters.

Programme Coordinator

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Additional information is available at

www.scientific-computing.uni-bayreuth.de