Spring (VT) courses in Numerical Analysis

Mengwu Guo

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All are *advanced* courses in half pace for 7.5 credits:

- NUMN26 Simulation Tools – VT1
- NUMN28 Numerical Simulations of Flow Problems – VT2
- NUMN33 Numerical Methods for Partial Differential Equations – VT1
- BERN07 Computational Science: Uncertainty Quantification & Data-driven Modelling – VT2

NUMN26 Simulation Tools – VT1

Primary learning goals:

- Modeling with with Scientific Computing knowledge and programming skills
- Experience with industrially relevant computational problems for complex mechanical systems
- In-depth knowledge of advanced numerical methods for ODEs, nonlinear systems, etc.
- Team work for computational projects

Main prerequisites: knowledge corresponding to

- NUMA01 Computational Programming with Python
- NUMN32 Numerical Methods for Differential Equations

NUMN33 Numerical Methods for PDEs – VT1

Primary learning goals:

- Deepened knowledge on numerical approximations for PDEs: Weak theory for elliptic PDEs, finite elements, domain decomposition, adaptivity, Unified Form Language (UFL), ...
- Simulation problems governed by PDEs and software (DUNE-FEM)

Main prerequisites: knowledge corresponding to

- NUMA01 Computational Programming with Python
- NUMN32 Numerical Methods for Differential Equations

NUMN28 Numerical Simulations of Flow Problems – VT2

Primary learning goals:

- Knowledge on modern numerical methods for non-linear conservation laws, especially in Computational Fluid Dynamics (CFD)
  Aircraft design, wind turbines, climate systems, ...
- Numerical skill with advanced methods: such as
  Discontinuous Galerkin, Krylov subspace with preconditioning, Jacobian-free Newton-Krylov, multigrid, ...

Main prerequisites: knowledge corresponding to

- NUMN32 Numerical Methods for Differential Equations

BERN07 Uncertainty Quantification & Data-driven Modelling – VT2

Course in Computational Science

Primary learning goals:

- Advanced concepts and methods in *modern* scientific computing for modeling and simulation under uncertainties
- Interdisciplinary taste across *numerical analysis*, *applied statistics*, and *machine learning* with applications to *physics* and *mechanics*
- Project work close to forefront research

Main prerequisites: knowledge corresponding to

- NUMA01 Computational Programming with Python
- MASA02 Mathematical Statistics, Basic Course
- NUMN32 Numerical Methods for Differential Equations

Master's programme in Computational Science

- Using computational methods to solve modern scientific problems
- Integrating theoretical knowledge with practical skills
  Modeling, simulations, programming
- Interdisciplinary approaches combing elements from
  scientific computing, data science, advanced programming and
  various natural science disciplines such as physics and geoscience
- Critical thinking, problem-solving, and analytical skills
- Diverse and inclusive environment with participants from various countries and cultural backgrounds
- Career prospects: academia, industry, government sectors ...
  Research, technology, healthcare, finance, software development, data science, environmental science ...

Master's programme in Computational Science

Master's Programme in Computational Science

Computations are becoming more and more important in research and industry. To make predictions, analysis or to replace experiments, we make use of numerical simulations and machine learning on large computers. We generate and store large amounts of data and use data science to search for patterns, connections and trends.

In the master's programme, you gain in-depth knowledge of computational science methods with regard to natural science subjects. You learn to study various complex scientific processes and how computational science can contribute to the development of knowledge in society.

The programme, which started for the first time in the fall semester 2023, has three separate specializations:

- Geoscience
- Physics
- Scientific Computing

Programme coordinator

Patrik Edén

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Application

Application deadline: January 15

More about this programme and application at Lund University's website:

- Geoscience
- Physics
- Scientific Computing

Scientific Computing Group at Mathematics NF

- **Philipp Birken**, Professor
  Scientific Computing for a Sustainable World
  Iterative Solvers, coupled problems, compressible flows
- **Robert Klöfkorn**, Associate Professor
  Open-Source Software for High-Performance Computing
  High-performance computing, software framework DUNE for PDEs
- **Mengwu Guo**, Associate Professor
  Scientific Machine Learning under Uncertainties
  Data-driven modeling, probabilistic numerical methods, digital twins

All active in teaching courses and supervising degree projects in both Numerical Analysis and Computational Science!

Feel free to contact us!

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