

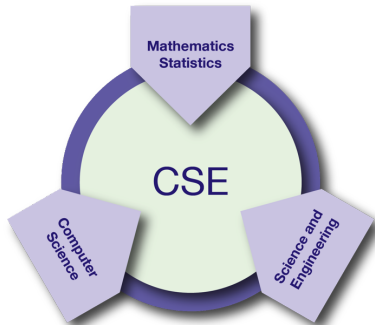
# Computer Simulation for Science and Engineering (COSSE)

An International Double-Degree Master Programme



# COSSE Alumni Meeting 2016





“CSE is devoted to the development and use of **computational methods for scientific discovery** in all branches of the sciences and for the **advancement of innovation in engineering and technology**. It is a broad and vitally important field encompassing methods of HPC and **playing a central role in the data revolution**.”

# Why a Double Degree Programme?

*The double degree programme is more than the sum of two, or more, excellent programmes:*

- It combines **the best of two, or more, universities**
- It provides **international experience** both with respect to research and intercultural exchange
- It provides a **coordinated curriculum**
- The student obtains **two degrees** of the two universities
- The student gains **competitive advantage** for careers in **industry** and **academia**
- At all partners, you will find a **long experience** with international programmes in CSE

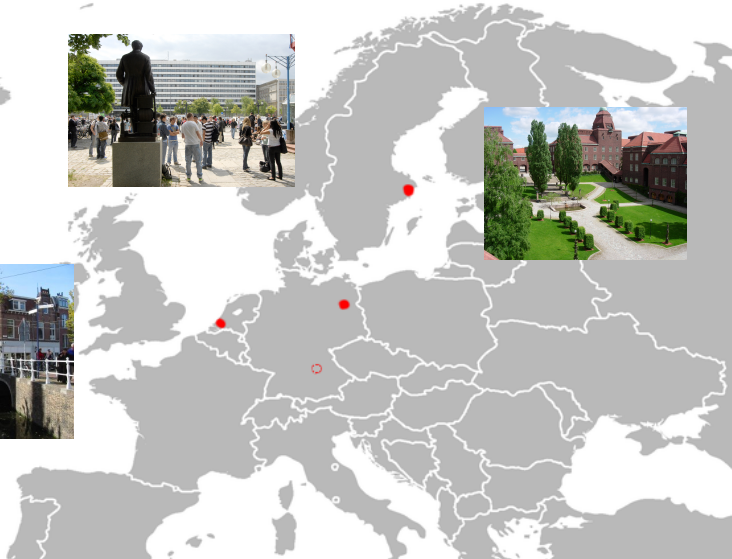


Master's Programme COSSE:

*“Computer Simulation for Science and Engineering”*

- KTH Royal Institute of Technology Stockholm
- Technical University Berlin
- Delft University of Technology

# The Consortium



- An average of 250 applicants per year
- 89 registered students from 28 countries of all continents over 7 years
- 62 graduated students by 2017
- 66 % of graduated students currently with PhD positions both within the consortium universities as well as for example: ETH Zürich, University of Melbourne, University of Leuven, Uppsala University, MIT, Cambridge and Oxford.
- Company employment includes Ericsson, BASF, IBM, Tata Steel, Alten, DeCode Genetics, HERE

# COSSE Students' Origin





- First year at home university (TU Berlin)
  - ca 45 credits basic courses: mostly compulsory
  - ca 15 credits preparation course for exchange: recommended
- Second year at host university (KTH or TU Delft)
  - 30 credits specialization courses: elective
  - 30 credits Master thesis (at university or at partners)

All courses are closely tied with the local master programmes in Applied and Computational Mathematics.

## *Compulsory courses*

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Numerical Linear Algebra  
Numer Methods for Engineers  
Scientific Computing  
Differential Algebraic Equations  
Project Numerical Analysis  
Numerical Mathematics II

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## *Elective courses*

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Advanced Numerical Linear Algebra  
Nonlinear Optimization  
Variational Methods and Optimal Control  
Optimal Control of PDEs  
Machine Learning I  
Machine Learning II

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- An algebraic multilevel Krylov solver for large scale sparse problems, *Rainer Hartmann (Germany)*
- The role of pairwise and higher-order correlations in feedforward inputs to neural networks, *David Hübner (Germany)*
- Numerical Reconstruction of Fundamental Solutions of the Stokes System with Finite Elements, *Jacob Snoeijer (The Netherlands)*
- Modeling turbulent two-phase stratified flow, *Berkcan Kapusuzoglu (Turkey)*
- Implementation of the Particle Mesh Ewald method on a GPU, *Alexei Iupinov (Russia)*

- Interaction waves for real-time ship simulation, *Akash Mittal (India)*
- A patient specific poroelastic model of a brain with a subdural hematoma, *Carolyn Langen (Canada)*
- Predicting Electromagnetic Noise in Induction Motors, *Nguyen Minh Khoa (Vietnam)*
- On the edge of regional climate models, *Maria Kootte (The Netherlands)*
- Impact of static sea surface topography variations on ocean surface waves, *Yik Keung Ying (Hong Kong)*
- Efficiency improvement of panel codes for the maritime industry , *Yun Mei Eliza Ang (Singapore)*



- The KTH Master's Programme Scientific Computing was **established in 1997**
- Programme hosted by the Department of Mathematics since 2012
- Now part of the Master Programme Applied and Computational Mathematics
- Active Member of SeRC, the **Swedish e-Science Initiative** (a Strategic Research Area financed by VR)
- Master's thesis in academia and at companies like ABB, Volvo PV, SAAB, Comsol, Biovitrum, Ericsson
- *In the latest (2018) Shanghai ARWU ranking, the Math Department of KTH is ranked 22th*

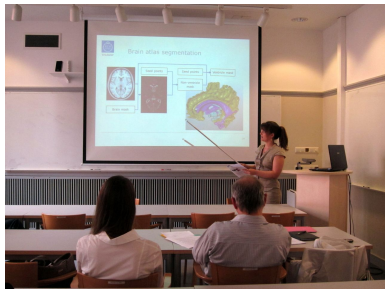


- Bachelor/Master programmes in Mathematical Engineering (Techno-Mathematik) and Scientific Computing **established in 2006**
- Main partner of the Research Centre **MATHEON** (“**Mathematics for Key Technologies**”)
- German Research Foundation Centre of Excellence (since 2002)
- Main partners: TUB, FUB, HUB, ZIB, WIAS
- application-driven research in close collaboration with partners from industry, economy and science
- Most master’s thesis projects within this centre, in Interdisciplinary Priority Programmes, or in direct cooperation with industry partners



- Master programme in Applied Mathematics hosted by the [Delft Centre for Computational Science and Engineering](#) (interdisciplinary conglomerate of Delft research groups)
- Part of the [3TU Applied Mathematics Institute](#)
- Many of the master's thesis projects are carried out in research departments of large companies like Shell, Philips, Deltares, Marin, etc.

# Some The First COSSE Graduates





- Meeting of all involved in COSSE
- Courses, lectures by world-known researches
- Industry visits
- *Have fun!*
- Topics:
  - 2011: Mathematics in Waterland (Delft)
  - 2012: Simulation in Health Care (Erlangen)
  - 2013: Mathematics and Papermaking (Stockholm)
  - 2014: Mathematics in Key Technologies (Berlin)
  - 2015: Ultrascale Simulation (Erlangen)
  - 2016: Mathematics and Energy (Delft)
  - 2017: COSSE Alumni Meeting



# Joint Workshops



- **Coordinator:** [KTH Stockholm](#), [cosse-master@kth.se](mailto:cosse-master@kth.se) (Prof Dr Michael Hanke, Ms My Delby)
- **At TU Berlin:** Prof Dr Reinhard Nabben, [nabben@math.tu-berlin.de](mailto:nabben@math.tu-berlin.de)
- **At TU Delft:** Prof Dr ir Cornelis (Kees) Vuik ([c.vuik@tudelft.nl](mailto:c.vuik@tudelft.nl))

<https://www.kth.se/en/studies/master/cosse>