Studying in Germany

Ulrich Ruede
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Possibilities to Study in Germany
FAU Erlangen, School of Engineering

Indo - German Winter Academy 2011
December 11 -17, 2010, New Delhi, India
Friedrich-Alexander University
Erlangen-Nürnberg

- Founded 1743
- 5 Schools, 22 Departments, 24 Clinics
- 26
- 30,000 students in ~132 programs
- ~ 500 tenured faculty (full and associate profs)
- ~ 900 PhD and Dr. habil. degrees in 2007
- ~ 92 Mio Euro external funding/ year

School of Engineering founded in 1966
- Currently about 8000 students
### Study Programs at the School of Engineering, Erlangen

- **Electrical, Electronic, and Communications Engineering (Bachelor / Master)**
  Language: German

- **Mechanical Engineering (Bachelor / Master)**
  Language: German

- **Mechatronics (Bachelor / Master)**
  Language: German

- **Energy Engineering (Bachelor / Master projected)**
  Language: German

- **Nanotechnology (Bachelor / Master projected)**
  Language: German, partially English

- **Computational Engineering (Bachelor / Master)**
  Language: Bachelor: German; Master: English

- **Medical Technology (Bachelor, Master projected)**

- **Chemical and Bioengineering (Bachelor / Master)**
  Language: Bachelor: German; Master: German/English

- **Life Science Engineering (Bachelor / Master)**
  Language: German/English (German lecture & English lecture notes and vice versa)

- **Computer Science (Bachelor / Master)**
  Language: German

- **Material Science and Engineering (Bachelor / Master)**
  Language: German

- **Information and Communication Technology (Bachelor / Master)**
  Language: German

- **Industrial Engineering (Bachelor / Master)**
  Language: German
International Study Programs at the School of Engineering I

- General Information for International Master Programs
  - **Duration**: 4 semesters (start annually in October)
  - **Language requirements**: good English language skills
  - International Office of the School of Engineering:
    [http://www.io.techfak.uni-erlangen.org](http://www.io.techfak.uni-erlangen.org)

- Computational Engineering (Master Program and Elite Master/ Master with Honours/ Double Master/ Erasmus Mundus Master/ PhD program)
  - **Topics**: Combination of a **technical subject**, mathematics, and computer science. Fields of activities include simulation of technical processes, scientific visualization, process optimizing, virtual product development, design decisions, development of hardware and software, etc.
  - **Requirements**: successfully accomplished Bachelor degree with good skills in mathematics and computer science
  - **Technical subjects**: Mechatronics, Thermo- and Fluid Dynamics, etc.

- Chemical and Bioengineering (Master)
  - **Topics**: A combination of biotechnology, technical chemistry, process engineering and product design, and thermo fluidics. Fields of activities are sewage treatment, environmental protection measures in big industrial plants, process engineering in biochemical or chemical areas.
  - **Requirements**: completed Bachelor degree, the willingness to learn German, since half of the courses are held in German.
International Study Programs at the School of Engineering II

- **Advanced Materials and Processes (MAP) (Elite Master Program)**
  - **Topics:** Biomaterials and bioprocessing, nanomaterials and nanotechnology, computational materials science and process simulation, advanced processes
  - **Requirements:** Bachelor degree in the fields materials science, bio or chemistry engineering or related fields of study

- **Advanced Optical Technologies (MAOT) (Elite Master Program)**
  - **Topics:** Optical metrology, optical material and processing, optics in medicine, optics in communication and IT, computational optics
  - **Requirements:** outstanding Bachelor degree (or equivalent qualification) in engineering or physics

- **PhD Programs**
  - **Duration:** 3-5 years
  - **Requirements:** good English language skills, qualification equivalent to a German Diplomingenieur (Diploma Engineer), e.g. M.Sc.
  - **Contact:** If interested, please directly contact a professor of the specific field
Graduate Education in Germany

- Master (or German „Diploma“) required as prerequisite for PhD
- PhD versus Dr.-Ing.
  - traditional German PhD is „thesis research only“ (plus seminars, etc.)
  - no coursework
- Master consists of
  - 3 semesters of coursework
  - 1 semester of thesis
- Consider German graduate education system as
  - 3 semesters of (intensive) coursework
  - 1 semester for a „prospectus“ for your PhD work
  - 3 years of thesis research (with intensive supervision)
- Advantages
  - MSc awarded as „extra benefit“ after 4 semesters
  - more flexibility to change topics
Advantages of Graduate Study in Germany

- National and international academic network
- Infrastructure
- Industrial Relations (many joint projects)
  - Specific to Erlangen/Nürnberg
    - Siemens Energy
    - Siemens Health Care
    - Siemens Industry
    - Areva
    - Audi, BMW, Opel, ...
    - Chemical: BASF, ...
    - Electrical: Infineon, Electrolux, Lucent, ...
    - Software: SAP, Electrobit, Ansys, ...
    - Adidas, Puma
    - ...
- Excellent equipment (e.g. supercomputers)
  - and give students access to it (!)
- Solving problems more important than acquiring lots of particular knowledge
Graduate Study in Germany

- Interdisciplinary programs
- Project oriented work
- Industrial relevance
- Combined with fundamental research
- Large research groups
  - Example: Walberla LBM project:
    - Currently 10 PhD students
    - + master students / research assistants / thesis work
    - + undergraduate projects
  - 200,000 lines of program
    - Can only done by large team (total > 40 person years)
  - Research groups built around chairs that reach critical mass
Computational Engineering at Erlangen

- Interdisciplinary, combining
  - Computer Science
  - Applied Mathematics
  - Choice of an Engineering Discipline
    - Fluid Dynamics
    - Mechatronics
    - Optics
    - Material Science
    - Information Technology

- Program Setup
  - Undergraduate program (requires German)
  - International Master program (taught in English)
  - Bavarian Graduate School of Engineering
    - was awarded extra through the state Government ~10,000 Euro annually
  - Double MSc program jointly with KTH Stockholm
  - augemented PhD program
Computational Engineering – Concept

Problem formulation, modeling.

CE

Application field

Mathematics

Computer Science

Foundation and methods for problem solving.

Algorithms for simulation, software design and implementation.
## CE Master Degree

<table>
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<tr>
<th>Possibility</th>
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<tbody>
<tr>
<td>Regular CE Master Studies</td>
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<tr>
<td>BGCE Elite program</td>
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<tr>
<td>DAAD Double Degree with KTH Stockholm</td>
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<tr>
<td>ERASMUS MUNDUS Program “COSSE”</td>
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</table>
Possibilities in CE Master Studies

CE Master Degree

- Regular CE Master Studies
- BGCE Elite program
- DAAD Double Degree with KTH Stockholm
- ERASMUS MUNDUS Program “COSSE”
International CE Students 1997-2009

Männer: 256 +
Frauen: 96 + 11*)

Σ = 352 + 40*)
aus 56 Ländern

*) Started in 2009
Total 120 ECTS in 4 (3+1) Semesters:

- 30 ECTS: Mathematics:
  Numerics, PDEs, Optimization.

- 30 ECTS: Computer Science:
  Simulation, Computer Graphics, High-Performance Computing …

- 30 ECTS: Technical Application Field:
  thermo and fluid dynamics, mechatronics, computational optics,
  mechanics and dynamics, automation & control, information technology.

- 30 ECTS: Master Thesis.
Possibilities in CE Master Studies

CE Master Degree

- Regular CE Master Studies
- BGCE Elite program
- DAAD Double Degree with KTH Stockholm
- ERASMUS MUNDUS Program “COSSE”
Joint program with TU Munich within the Elite Network of Bavaria: [http://www.elitenetzwerk.de](http://www.elitenetzwerk.de)

- Started in 2005 and has recently been extended until 2015.
- For exceptionally talented and motivated students.
- Motto: “Do more, get more!”
- Awarded with degree “Master of Science with Honours“.
- Regular CE master program plus additionally 30 ECTS:
  - 10 ECTS for project work,
  - 10 ECTS for CE specific lectures and
  - 10 ECTS for soft skill courses.
Possibilities in CE Master Studies

CE Master Degree

- Regular CE Master Studies
- BGCE Elite program
- DAAD Double Degree with KTH Stockholm
- ERASMUS MUNDUS Program “COSSE”
DAAD Program – Study Plan

Students beginning at Erlangen

FAU Erlangen-Nürnberg

Core Courses (taught at both universities)

15 ECTS Numerical Analysis
15 ECTS Applied Mathematics
15 ECTS Scientific Computing

Joint Workshop – in depth advising of students to prepare the transfer

15 ECTS Preparatory Courses for Specialization (partly given by Guest Prof. from KTH)
15 ECTS Preparatory Courses for Specialization (partly given by Guest Prof. from FAU)

Transfer

Choice of Specialization in
15 ECTS Visualization and Image Processing
15 ECTS High Performance Computing
15 ECTS Electives

30 ECTS Master Thesis
conducted at host university
co-supervised by instructor from home-university

Students beginning in Stockholm

KTH Stockholm

Choice of Specialization in
15 ECTS Bio-Modelling
15 ECTS Computational Fluid Dynamics
15 ECTS Electives
DAAD Program – The 1st Year’s Graduates
Possibilities in CE Master Studies

CE Master Degree

- Regular CE Master Studies
- BGCE Elite program
- DAAD Double Degree with KTH Stockholm
- ERASMUS MUNDUS Program “COSSE”
COSSE – Computer Simulation for Science and Engineering

- Erasmus-Mundus: EU-Project
  - about 1 Billion Euro, mostly stipends:
    - for 3rd country students (type A),
    - for European students (type B).
  - „Double mobility“ required:
    - Master studies must be done in two different countries, but not in the country where the bachelor degree was achieved.

- COSSE is a joint project between:
  - KTH Stockholm (Coordinator), TU Delft, TU Berlin and FAU Erlangen
COSSE – Further Informations


- Tuition annually:
  - 8000 (type A)
  - 4000 (type B)

- Stipends:
  - covers tuition,
  - monthly allowance:
    - 1000 Euro (type A) or
    - 500 Euro (type B).

- Application deadline (for fall 2012): November 30, 2012
  - Online application only!
Contact & Informations

- Prof. Dr. Ulrich Rüde ruede@infomatik.uni-erlangen.de
- Dr. Harald Köstler harald.koestler@informatik.uni-erlangen.de
- Daniel Ritter, M.Sc. daniel.ritter@informatik.uni-erlangen.de
- Chair for System Simulation: http://www10.informatik.uni-erlangen.de
- CE: http://www.ce.uni-erlangen.de/
- BGCE: http://www.bgce.de
- DAAD Program: http://www10.informatik.uni-erlangen.de/de/Misc/KTH/
- COSSE: http://www.kth.se/studies/master/em/cosse?l=en_UK
International Study Programs at the School of Engineering III

Graduate School of Advanced Optical Technologies (SAOT)
- Structured PhD program
- Topics:
  - Optical Materials & Systems
  - Computational Optics
  - Optical Material Processing
  - Optics in Medicine
  - Optical Metrology
  - Optical Materials & Systems
  - Optics in Communication & Information

Additional Information: [http://www.aot.uni-erlangen.de](http://www.aot.uni-erlangen.de)
### Further Information

- **General Information for Studying in Germany:**
  - German Academic Exchange Service (DAAD): [http://www.daad.de](http://www.daad.de)

- **Information for Studying in Erlangen**
  - Central Office of International Affairs: [http://www.uni-erlangen.org/international/aaa/index.shtml](http://www.uni-erlangen.org/international/aaa/index.shtml)
  - International Office of the School of Engineering Sciences: [http://www.io.techfak.uni-erlangen.org](http://www.io.techfak.uni-erlangen.org)

- **Internships in Germany**
  - International Association for the Exchange of Students for Technical Experience (IAESTE): [http://www.iaeste.de](http://www.iaeste.de)
  - DAAD Program for IIT bachelor students between 3rd and 5th year! Deadline Nov 30, 2010 for 1 to 3 month; support 650 € per month
  - Necessary: Application form, offer for a research assistantship, motivation letter, CV, summary of project, IIT transcript, certificate of enrolment, letter of invitation, letter of reference

- **Internships at LEB/IISB**
  - Duration: approx. 3 months
  - Financial Support: approx. 400 € per month and refund of travel expenses
  - Free accommodation
  - Contact: ryssel@iisb.fraunhofer.de

- **Similar at LSS**
<table>
<thead>
<tr>
<th>Chair of Electron Devices (LEB)</th>
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<tbody>
<tr>
<td>Head: Prof. Dr.rer.nat. Lothar Frey</td>
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<tr>
<td>Retired Head: Prof. Dr.-Ing. Heiner Ryssel</td>
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<tr>
<td>Staff: 30 (70% scientists)</td>
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<tr>
<td>Research: New materials, processes, and devices for micro and nano electronics, incl. equipment and simulation (transistors, memories), power electronics (processes and devices, Si and SiC, electronics for hybride car drives)</td>
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<tr>
<td><a href="http://www.leb.eei.uni-erlangen.de">http://www.leb.eei.uni-erlangen.de</a></td>
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<tr>
<td>Cooperation with Fraunhofer IISB: Head: Prof. Dr.rer.nat. Lothar Frey Retired Head: Prof. Dr.-Ing. Heiner Ryssel Staff: 115 (60% scientists) Semiconductor processing technology, equipment, simulation, crystal growth, power electronic systems</td>
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<td><a href="http://www.iisb.fraunhofer.de">http://www.iisb.fraunhofer.de</a></td>
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</table>
Chair of Fluid Mechanics (LSTM)

- Head: Prof. Dr. Antonio Delgado, retired Prof. Dr. Dr. h.c. Franz Durst
- Staff: 70 (74% scientists)
- Research:
  Aerodynamics and turbulence,
  flows with chemical reactions,
  process automation for flows in medical technology and biotechnology,
  high pressure processes,
  combustion processes,
  instationary fluid dynamics, theoretical fluid dynamics,
  numerical simulation
- http://www.lstm.uni-erlangen.de
- Prof. Durst now also at CAFM
Chair of System Simulation (LSS)

- Head: Prof. Dr. Ulrich Rüde
- Staff: 30 (75% scientists)
- Research:
  Modeling, efficient simulation, and optimization of complex systems in science and technology with focus on design and analysis of algorithms and tools, e.g., metal foams, semiconductor lasers, energy management, bioelectric fields, free-surface flows, environmental risks, nano technology

- [http://www10.informatik.uni-erlangen.de](http://www10.informatik.uni-erlangen.de)
Industry Cooperations (examples only!)

- Siemens
  - Energy
  - Health Care
  - Industry
  - Corporate Research

- Areva
- Puma, Adidas

- Software Industry
  - MSC Software
  - Ansys
  - Elektrobit
  - ...

- Car manufacturers
  - BMW
  - Audi
  - Opel
  - ...

- Chemical Industry
  - BASF
  - ....
<table>
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<tr>
<td>- Please give feedback</td>
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<tr>
<td>- Please be critical</td>
</tr>
<tr>
<td>- Please be constructive</td>
</tr>
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</table>
Thanks for your attention!

Questions?

Slides, reports, thesis, animations available for download at:
www10.informatik.uni-erlangen.de