Master of Science Embedded Systems Engineering

Prof. Dr.-Ing. Jürgen Wilde
Faculty of Engineering

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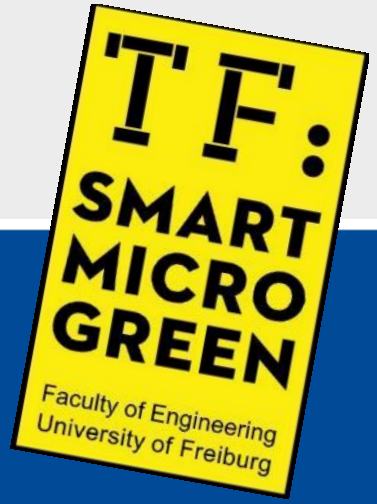
Albert-Ludwigs-Universität Freiburg



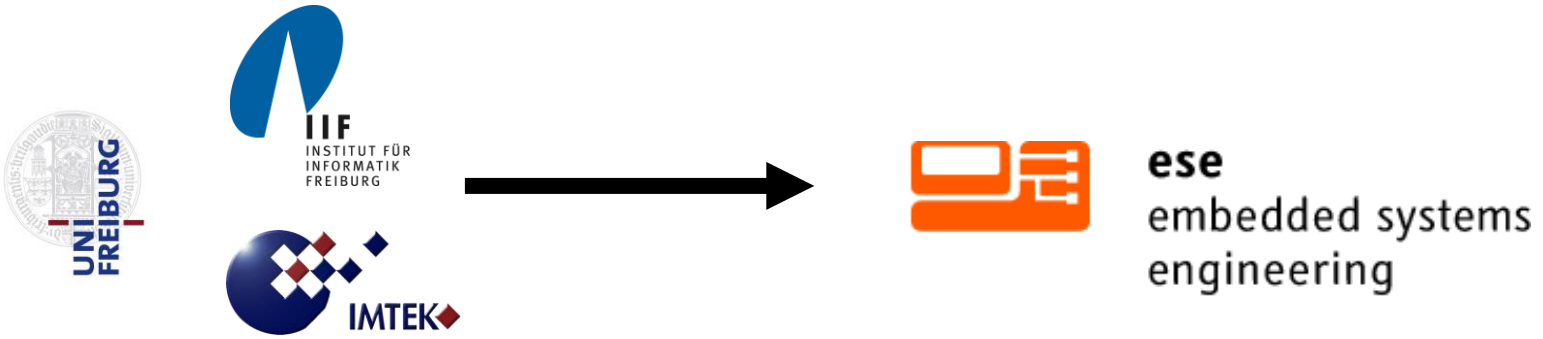
UNI FREIBURG

The Faculty of Engineering

- Founded in 1995
- Faculty of Engineering consists of
  - Department of Computer Science
  - Department of Microsystems Engineering
  - Department of Sustainable Systems Engineering (founded 2015)
- Some statistics
  - 50 professors & group leaders (and still growing)
  - more than 400 employees
  - more than 2200 students
    - Women: ca. 20%
    - Internationals: ca. 36% (more than 50 nations)

Embedded Systems at the Faculty of Engineering

- Embedded Systems Engineering (ESE) touches all of our core competencies
- Cooperation of professors and lecturers from the departments of Computer Science (CS) and Microsystems Engineering (MSE) as well as external experts



22 Laboratories at IMTEK

- **MEMS Applications**
  Prof. Dr. Roland Zengerle
- **Assembly and Packaging Technology**
  Prof. Dr. Jürgen Wilde
- **Bio- and Nanophotonics**
  Prof. Dr. Alexander Rohrbach
- **Biomedical Microtechnology**
  Prof. Dr. Thomas Stieglitz
- **Biomicrotechnology**
  Prof. Dr. Ulrich Egert
- **Chemistry and Physics of Interfaces**
  Prof. Dr. Jürgen Rühe
- **Design of Microsystems**
  Prof. Dr. Peter Woias
- **Electrical Instrumentation and Embedded Systems**
  Prof. Dr. Stefan Rupitsch
- **Gas Sensors**
  Prof. Dr. Juergen Woellenstein
- **Materials Process Technology**
  Prof. Dr. Thomas Hanemann
- **Micro- and Material Mechanics**
  Prof. Dr. Christoph Eberl
- **Microactuators**
  Prof. Dr. Ulrike Wallrabe
- **Microelectronics**
  Prof. Dr. Matthias Kuhl
- **Micro-optics**
  Prof. Dr. Hans Zappe
- **Microsystems Materials**
  Prof. Dr. Oliver Paul
- **Nanotechnology**
  Prof. Dr. Margit Zacharias
- **Optical Systems**
  Prof. Dr. Carsten Buse
- **Process Technology**
  Prof. Dr. Bastian Rapp
- **Sensors**
  Prof. Dr. Gerald Urban
- **Simulation**
  Prof. Dr. Lars Pastewka
- **Smart Systems Integration**
  Prof. Dr. Alfons Dehé
- **Systems Theory**
  Prof. Dr. Moritz Diehl

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20 Chairs/research groups at IIF

- **Algorithms and Complexity**
  Prof. Dr. Fabian Kuhn
- **Bioinformatics**
  Prof. Dr. Rolf Backofen
- **Algorithms and Data Structures**
  Prof. Dr. Hannah Bast
- **Computer Architecture**
  Prof. Dr. Armin Biere
- **Operating Systems**
  Prof. Dr. Christoph Scholl
- **Embedded Systems**
  Prof. Dr. Marco Zimmerling
- **Software Engineering**
  Prof. Dr. Andreas Podelski
- **Programming Languages**
  Prof. Dr. Peter Thiemann
- **Foundations of AI**
  tba
- **Autonomous Intelligent Systems**
  tba
- **Machine Learning**
  Prof. Dr. Frank Hutter
- **Neurorobotics**
  Prof. Dr. Joschka Boedecker
- **Representation Learning**
  Prof. Dr. Josif Grabocka (Jun.Prof.)
- **Robot Learning**
  Prof. Dr. Abhinav Valada (Jun.Prof.)
- **Graphics Data Processing**
  Prof. Dr. Matthias Teschner
- **Computer Vision and Image Processing**
  Prof. Dr. Thomas Brox
- **Databases and Information Systems**
  tba
- **Networks and Telematics**
  Prof. Dr. Christian Schindelhauer
- **Communication Systems**
  tba
- **Gender Studies in STEM**
  Prof. Dr. Anelis Kaiser

+ 4 Adjunct Professors

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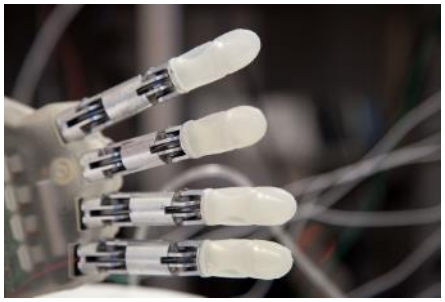
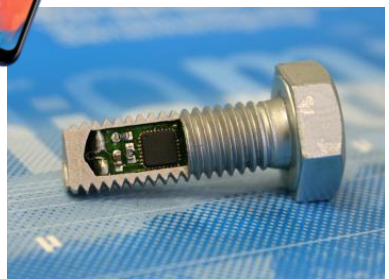
What is special @ the Faculty of Engineering?

- Unique combination of Computer Science and MSE
- Interdisciplinary study program
- Great infrastructure:
  cleanrooms, laboratories, computer pools, WiFi, tele-teaching facilities, own engineering library
- Close contact to
  - Faculties of Biology, Chemistry, Medical Science, Physics, Materials Science
  - Uniklinik (University hospital Freiburg)
  - 5 local Fraunhofer Institutes
  - industrial enterprises
- Numerous contacts to the industry

Embedded Systems and where to find them

- Automotive engineering
- Bio/Medical technology
- Smart homes
- Telecommunications
- Media and consumer electronics
- Controlling and regulation in manufacturing processes
- Aerospace …





Quellen: wikimedia bzw. Uni Freiburg / TF

General program structure

Structural principles of all study programs at the faculty

- Ca. 30 ECTS per semester
- 30 hours work-load per credit point
  → full-time study program with ~900 hours/sem
- All programs are organized in modules
- A module can consist of one or several courses or elements
- Performance evaluation after the semester

The Master program ESE is…

- generally an international study program
  - Most courses are offered in English
  - But some elective courses in German only
- a mixture of “compulsory elective” courses (to build a sound foundation in the area of Embedded Systems) and a big variety of elective courses and concentrations, which allow for individual specialization
- flexible: The study plan provides the frame, which you fill up with courses
  (→ when you do them is up to you)

Structure of the study program
(Overview)

1. Area Computer Science
   - Essential Lectures in Computer Science Bereich
   - Elective Courses in Computer Science
2. Area Microsystems Engineering
   - Advanced Microsystems Engineering
   - Microsystems Engineering Concentration Areas
3. Facultative area Customized Course Selection

Total 1-3: 90 ECTS-credits points

Master module: 30 ECTS

Structure of the study program
table, following rules from PO (exam regulations)

Modules / Area	Semester	ECTS credits
Essential Lectures in Computer Science Select between 3 and 6 from 9 modules	**1 to 3**	**18 to 36**
Elective Courses in Computer Science Choose from • **Specialization Courses in CS** • **Seminars (up to 2: 3 ECTS each)** • **Study Project (1 with 18 ECTS)**	**2 to 3**	**18 to 36**
Advanced Microsystems Engineering Select between 3 and 6 from 9 modules	**1 to 3**	**18 to 36**
Microsystems Engineering Concentrations **1. Circuits and Systems** **2. Materials and Fabrication** **3. Biomedical Engineering** **4. Photonics**	**2 to 3**	**18 to 36** (Choose one with >=18 Optional: More than one ≤ 18)
Optional: Customized Course Selection	**2 and 3**	**≤ 18**
Master thesis + presentation	**4**	**27 + 3**
Overall		**120**

Structure of the study program
(potential courses to start with this semester)

- To achieve 30 ECTS, you can select 5 courses from the list, like:

Microsystems courses	**Computer Science courses**
Modelling and System Identification	Cyber-Physical Systems – Discrete Models
Micro-electronics	Introduction to Embedded Systems
Micromechanics	Computer Architecture
Micro-optics	Machine Learning
Sensors	
MST Technologies and Processes	*(mandatory, if conditional course)*

More details on course structure, exam regulations (PO), etc.

- … will be provided by the study advisor, Mrs. Nopper, directly after I‘m done here.
- Will be available through video tutorials at: https://www.tf.uni-freiburg.de/en/studies-and-teaching/a-to-z-study-faq/freshers-info
- Topics handled there:
  - Design your personal study plan
  - Administrative matters
  - Quick introduction to rules for examinations
  - Finding information and help
  - Using HISinOne to book your courses and exams

Problems with your studies?

- If you have any questions or problems:
  Act immediately and do not procrastinate!
- Contacts & info sources:
  - Official information sources by university, faculty and study program
  - academic advising
  - Lecturers / assistants /mentors
  - Fachschaft (faculty's student committee)
  - Information centers like the Student Service Center, Office of Student Services etc.
  - fellow students

Some thoughts to share…

- **A Master‘s program in Germany**
  - You have to organize your courses … and your life
  - You have to register for your courses on your own
  - We challenge you from the first day on to assess given knowledge…
  - …and to transfer given knowledge from one course to another
  - We will show you many aspects of embedded systems and their applications to broaden your knowledge and increase the opportunities for an exciting career.
- **That means for you…**
  - YOU have to take the initiative to ASK, ASK and read until you understand!
  - WE give you the overview, YOU have to learn the details.

The art of living

Enjoy being a student!

It is helpful to

- structure your day
- have unstructured free time
- meet colleagues
- keep up with your work
- occasionally relax and get out

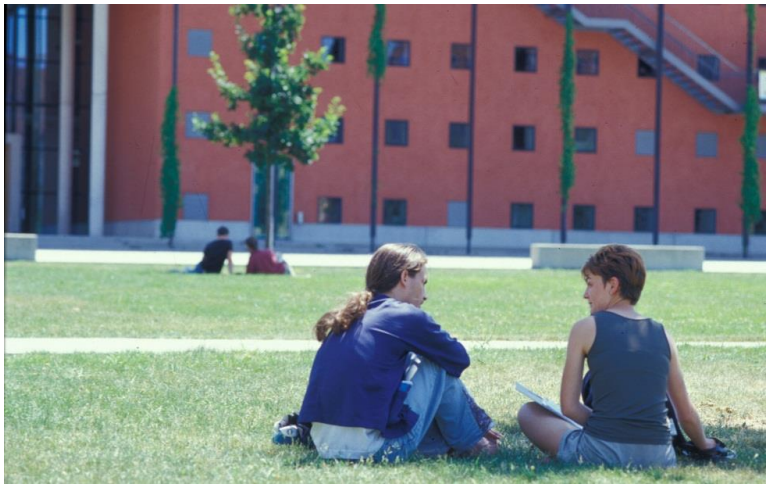
Don‘t forget

- Family
- Friends
- Sports
- Culture
- Autumn leaves…

Quelle: TF / M. Diehl / Mellar

Moreover…

- Buy textbooks
- Contact your mentor
- Form study groups
- Poke around in the laboratories (hiwi-jobs)
- Find a MSc thesis & a supervisor early on
- Stay registered
- Get enough sleep



Quelle: TF

Mentoring

- **Every student has a faculty mentor**
  - A professor as a contact person
  - Assigned by the Dean of Studies

- **Student's contact for:**
  - Problems, questions, clarifications, job searches, recommendations, or just general advising

Also here for your questions: Academic advisors

Contact information:

- Martina Nopper (Dipl.-Inf.)
  Study advisor for computer science and ESE
- Phone: +49 761 203 8169
  Please check the consulting hours for phone calls:
  https://www.tf.uni-freiburg.de/en/study-programs/counseling

Counterpart in the MSE department:

- Frank Goldschmidtböing
- Phone: +49 761 203 7496

Mail (for both):
studienberatung@ese.uni-freiburg.de

Further contact points at our faculty

- Examination Office
  - Susanne Stork & Anne-Julchen Müller
  - https://www.tf.uni-freiburg.de/en/study-programs/counseling
    → Examinations Office Faculty of Engineering
- Student advising on general matters
  - Ursula Epe
  - https://www.tf.uni-freiburg.de/en/study-programs/counseling
    → Program coordination and general study advice
- Fachschaft: (faculty's student committee)
  - http://fachschaft.informatik.uni-freiburg.de

And after graduation?

- **In Industry**
  - Find out what you like during your MSc program
  - Use job portals and company websites to monitor the market
  - Visit career workshops and gather tips how to apply
  - Go to recruiting fairs
- **PhD as research assistant**
  - Perform a research project (on your own)
  - Look for an open position
  - Apply
  - Get hired & paid for the PhD project
  - Take on responsibility as project and lab assistant
  - Support your professor in educational tasks
  - Duration: 3 to 5 years

We wish you
good luck & much success
with your studies!