Master of Science
Embedded Systems Engineering

Prof. Dr.-Ing. Jürgen Wilde
Faculty of Engineering
April 21st 2022

Albert-Ludwigs-Universität 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)
- More than
  - 50 professors & group leaders
  - more than 450 employees
  - more than 2300 students
    - Women: ca. 20%
    - Internationals: ca. 33% (~40 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
## 21 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**
  - Prof. Dr. Bernhard Nebel
- **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.)
- **Cognitive Computation**
  - apl. Prof. Dr. Marco Ragni
- **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
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 …
General program structure

Structural principles of all study programs at the faculty

- Ca. 30 ECTS per semester
- 30 hours work load per credit point
- 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)
Overview

1. Area Computer Science
   - Essential Lectures in Computer Science Bereich
   - Elective Courses in Computer Science

2. Area Mikrosystems 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>
<thead>
<tr>
<th>Module / Area</th>
<th>Semester</th>
<th>ECTS credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area Essential Lectures in Computer Science</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 3 to 6 from 9 modules</td>
<td>1 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td><strong>Elective Courses in Computer Science</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choose from</td>
<td></td>
<td></td>
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<tr>
<td>• Specialization Courses in CS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seminars (up to 2, 3 ECTS each)</td>
<td>2 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td>• Study Project (1 with 18 ECTS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Area Advanced Microsystems Engineering</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 3 to 6 from 9 modules</td>
<td>1 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td><strong>Microsystems Engineering Concentrations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Circuits and Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Materials and Fabrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Biomedical Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Photonics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Choose one with &gt;=18 Rest ≤ 18)</td>
<td>2 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td><strong>Customized Course Selection (optional)</strong></td>
<td></td>
<td>≤ 18</td>
</tr>
<tr>
<td><strong>Master thesis + presentation</strong></td>
<td>4</td>
<td>27 + 3</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>
More details on course structure, exam regulations etc.

- ... will be provided by the study advisor, Mrs. Nopper, directly after I’m done here.
- Is also available through video tutorials at: https://www.tf.uni-freiburg.de/en/studies-and-teaching/a-to-z-study-faq/freshers-info
  → Further information and tutorials
- Topics handled there:
  - Building your study plan
  - Administrative things
  - Rules for Examinations
  - Finding information and help
  - Using HISinOne to book your courses
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!
- 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…
Moreover…

- Buy textbooks
- Contact your mentor
- Form study groups
- Poke around in the laboratories
- Find a MSc thesis & an advisor early on
- Stay registered
- Get enough sleep
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 Goldschmidtboing
- 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](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](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](http://fachschaft.informatik.uni-freiburg.de)

21.04.2022 Master ESE - Welcome - Prof. Wilde
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 to 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 assistant
  - Support your professor in educational tasks
  - Duration: 3-5 years
We wish you good luck & much success with your studies!