Master of Science
Embedded Systems Engineering

Prof. Dr.-Ing. Jürgen Wilde
Faculty of Engineering
October 12th 2022
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 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 Woollenstein
- 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
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
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 → 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
<table>
<thead>
<tr>
<th>Modules / Area</th>
<th>Semester</th>
<th>ECTS credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Essential Lectures in Computer Science</strong></td>
<td>1 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td>Select between 3 and 6 from 9 modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Elective Courses in Computer Science</strong></td>
<td>2 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td>Choose from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Specialization Courses in CS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seminars (up to 2: 3 ECTS each)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Study Project (1 with 18 ECTS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Advanced Microsystems Engineering</strong></td>
<td>1 to 3</td>
<td>18 to 36</td>
</tr>
<tr>
<td>Select between 3 and 6 from 9 modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Microsystems Engineering Concentrations</strong></td>
<td>2 to 3</td>
<td>18 to 36</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><strong>Optional: Customized Course Selection</strong></td>
<td>2 and 3</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>
To achieve 30 ECTS, you can select 5 courses from the list, like:

<table>
<thead>
<tr>
<th>Microsystems courses</th>
<th>Computer Science courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modelling and System Identification</td>
<td>Cyber-Physical Systems – Discrete Models</td>
</tr>
<tr>
<td>Micro-electronics</td>
<td>Introduction to Embedded Systems</td>
</tr>
<tr>
<td>Micromechanics</td>
<td>Computer Architecture</td>
</tr>
<tr>
<td>Micro-optics</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>Sensors</td>
<td>(mandatory, if conditional course)</td>
</tr>
<tr>
<td>MST Technologies and Processes</td>
<td>(mandatory, if conditional course)</td>
</tr>
</tbody>
</table>
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…
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
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](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)
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 on 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!