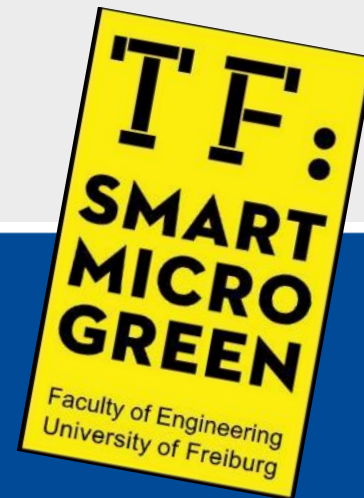# Master of Science Embedded Systems Engineering

Prof. Dr.-Ing. Jürgen Wilde

Faculty of Engineering

April 12th 2023

Albert-Ludwigs-Universität Freiburg

TF: SMART MICRO GREEN

Faculty of Engineering
University of 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)
  - About 500 employees
  - Nearly 2500 students
    - Women: ca. 20%
    - Internationals: ca. 36% (ca. 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
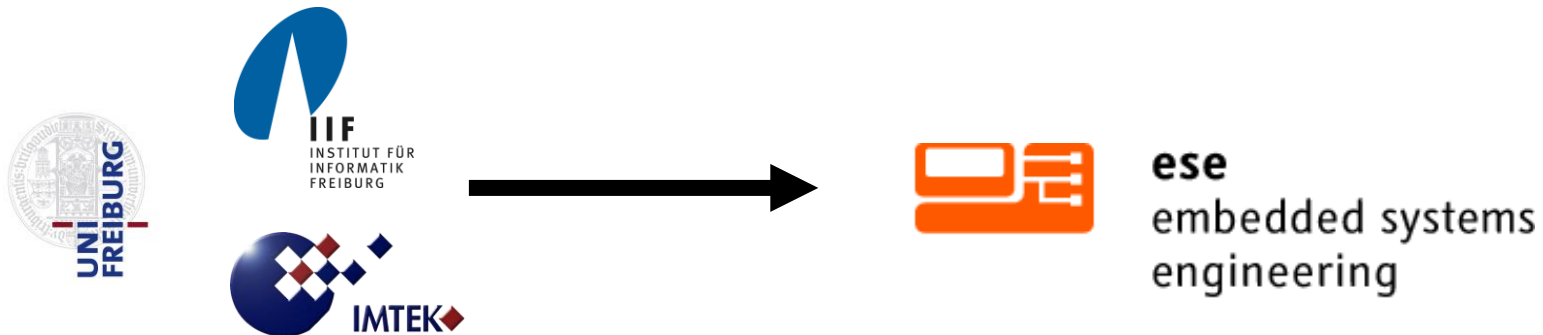
21 Laboratories at IMTEK

- **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
- **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**
  tba
- **Simulation**
  Prof. Dr. Lars Pastewka
- **Smart Systems Integration**
  Prof. Dr. Alfons Dehé
- **Systems Theory**
  Prof. Dr. Moritz Diehl

+ 2 *Adjunct Professors*

18 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**
  tba
- **Intelligent Embedded Systems**
  Prof. Dr. Oliver Amft
- **Software Engineering**
  Prof. Dr. Andreas Podelski
- **Programming Languages**
  Prof. Dr. Peter Thiemann
- **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

+ 3 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
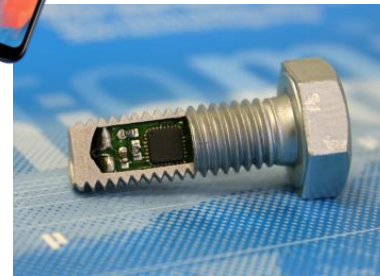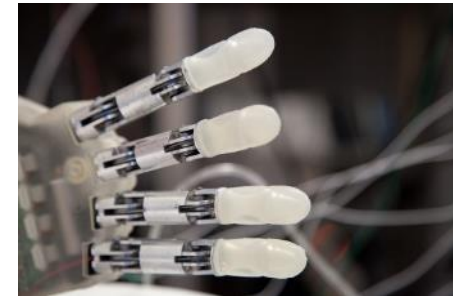
General program structure

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
  ($\rightarrow$ when you do them is up to you)

Structure of the study program
(Overview)

1. **Area Computer Science**

   - Essential Lectures in Computer Science

   - 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**

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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
Signal Processing (6 credits)	Foundations of Artificial Intelligence (6 credits)
Assembly and packaging technology (6 credits)	Image Processing and Computer Graphics (6 credits)
	Software Engineering (6 credits)
Some course(s) from Microsystems Engineering Concentrations Area	*Some course(s) from Elective Courses in Computer Science*
If applicable: Your conditional course(s)	

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
- Do a project
- 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
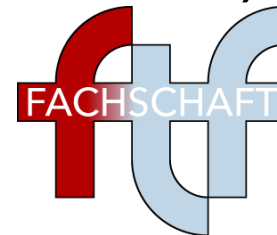
And after graduation?

- **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!