universität freiburg

Master of Science
Embedded Systems Engineering (ESE)

Prof. Dr.-Ing. Bastian Rapp
Faculty of Engineering
October 11th, 2023

About me

Prof. Dr.-Ing. habil. Bastian E. Rapp

Full Professor,
Laboratory of ProcessTechnology
Department of Microsystem Technology (IMTEK)
University of Freiburg

- 2005, mechanical engineering
  University of Karlsruhe
- 2008, PhD in Microfluidics and Biosensors
  University of Karlsruhe
- 2017, Habilitation on fluid mechanics and microfluidics
  Karlsruhe Institute of Technology (KIT)
- 2018, Full Professor Process Technology
  IMTEK, University of Freiburg
- 2018, Founding CEO and current CTO of Glassomer GmbH
- several industry/academic awards (selection):
  GMM, *Edison Award*, *Südwestmetallförderpreis,* 2 of my former PhD students won the *Deutsche Studienpreis*
- since WS 2023/2024: Dean of Studies of IMTEK

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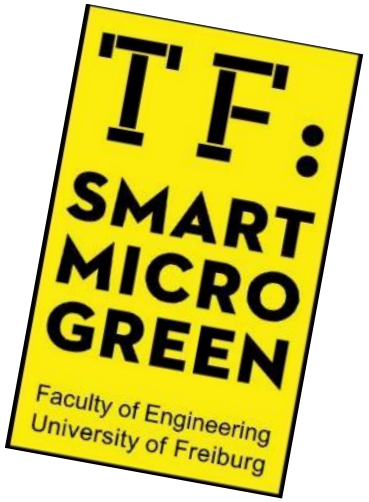
The Faculty of Engineering



- 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 500 employees
  - Nearly 2500 students (Women: ca. 21%, Internationals: ca. 35% (more than 50 nations))

Students | head count

Students | Graduates | Research | Staff

Faculty
Faculty of Engineeri..

Current numbers | WS 2022/23 (fall semester)

WS 2022/23
2,478
Students enrolled
▲ 3.68% to WS 2021/22


female

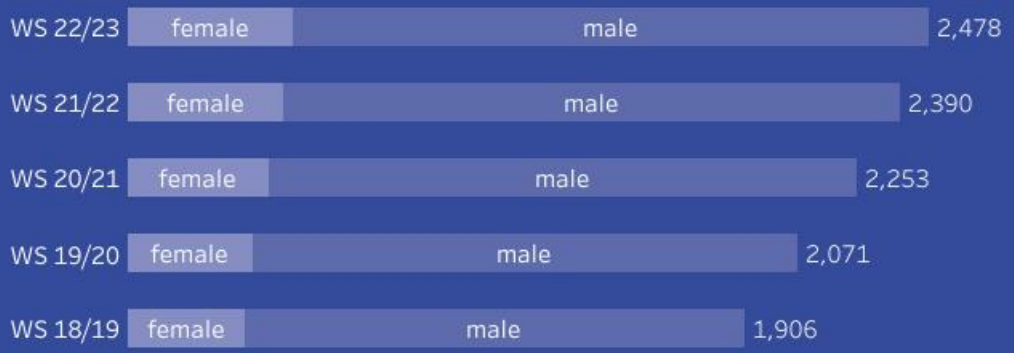
–512 | 21%
79% | **1,966**–
0 Stud. unknown/diverse


male

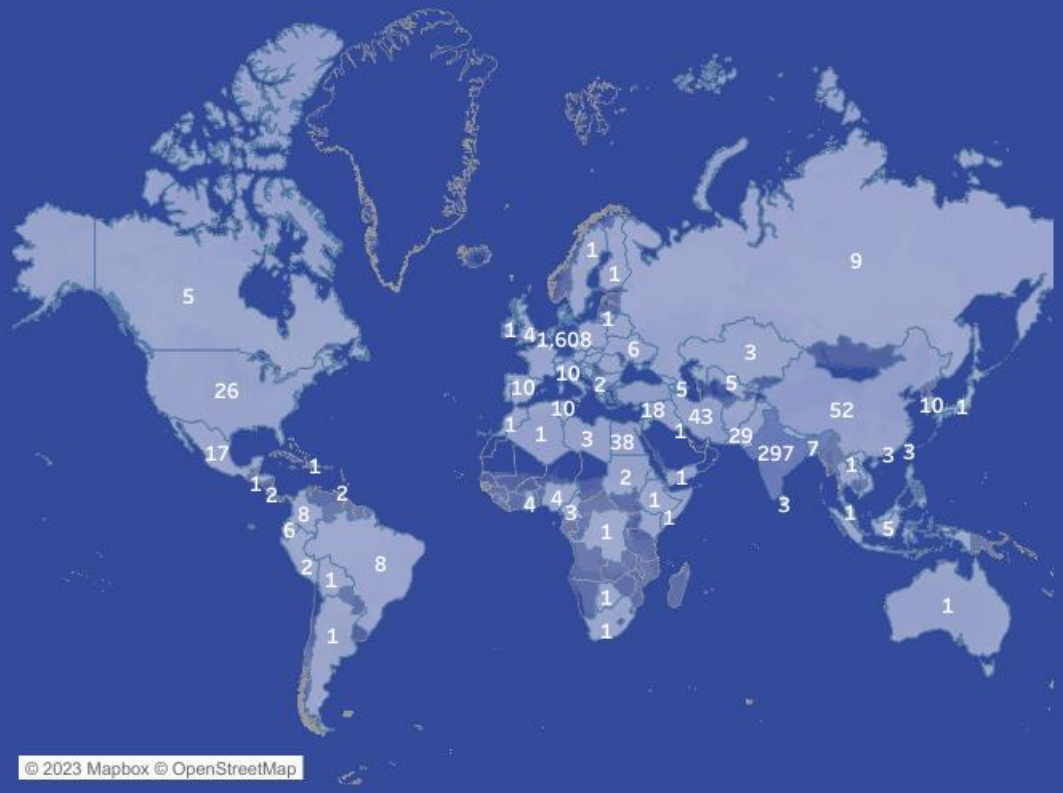
35%
International Students

WS 2022/23
536
First-year students
▲ 2.49% to WS 2021/22

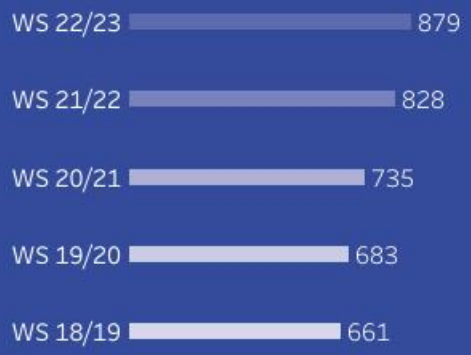
Development of student numbers



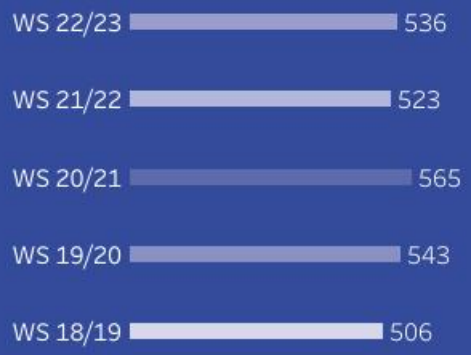
Students by citizenship



International students



First-year students



Data: **September 24, 2023** | D1.2 Controlling and Information Management

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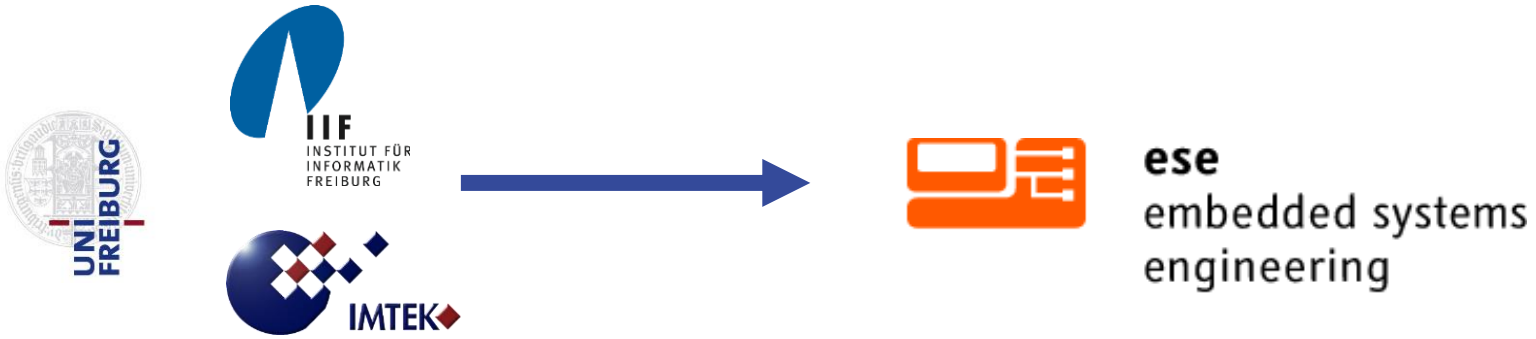
Embedded Systems at the Faculty of Engineering

- 21 Laboratories at IMTEK, 18 Chairs/research groups at IIF
- 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

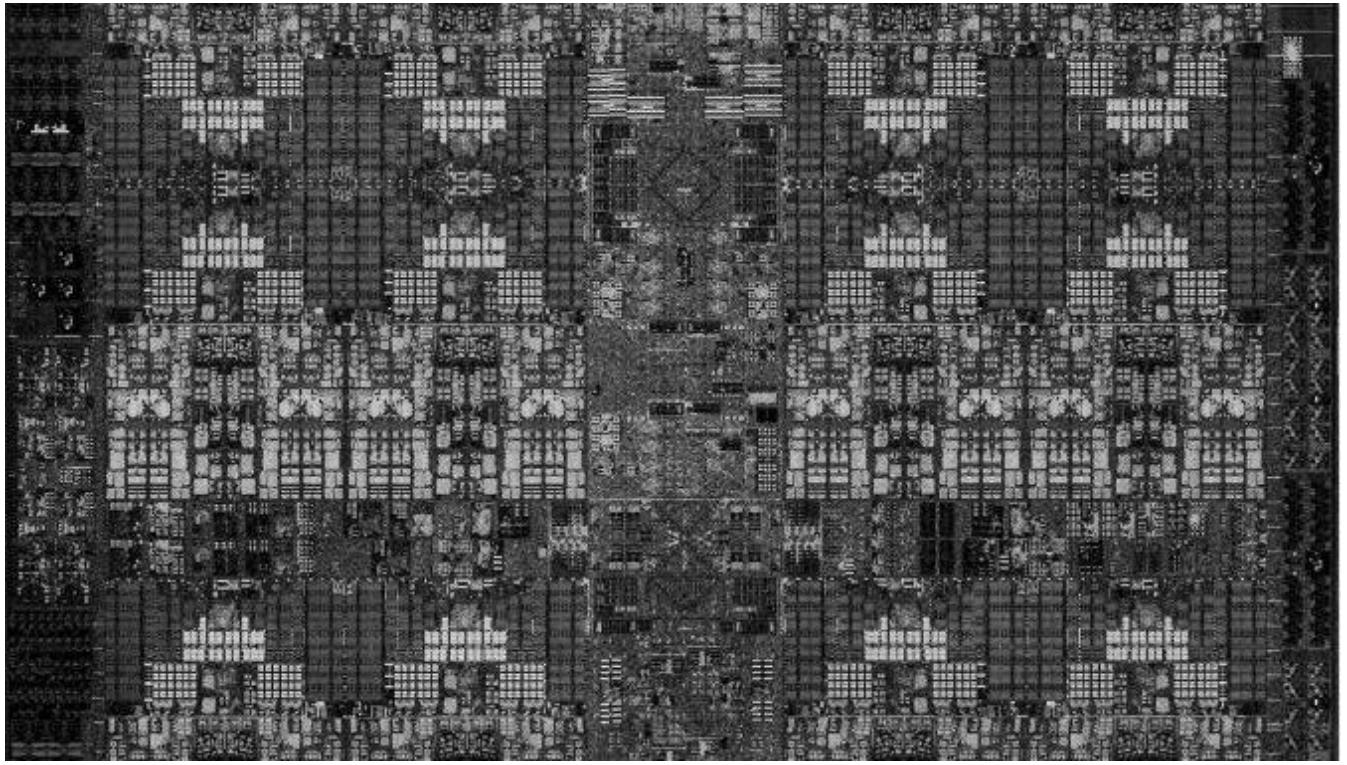


What is special at the Faculty of Engineering?

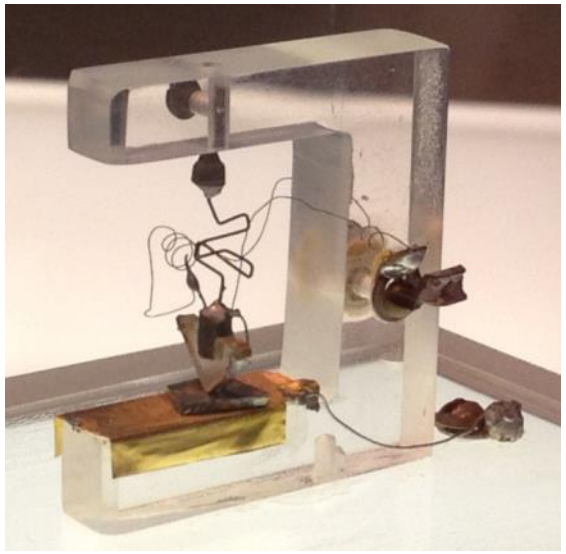
- Unique combination of Computer Science and MSE
- Interdisciplinary study program
- Great infrastructure:
  cleanrooms, laboratories, computer pools, WiFi, tele-teaching facilities, own engineering library
- Close contact to
  - Faculties of Biology, Chemistry, Medical Science, Physics, Materials Science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

From the first transistor to super computers

John Bardeen, William Shockley and Walter Brattain at Bell Labs, 1948



IBM Power9 supercomputer with 150 petaflops (peta=1E15)

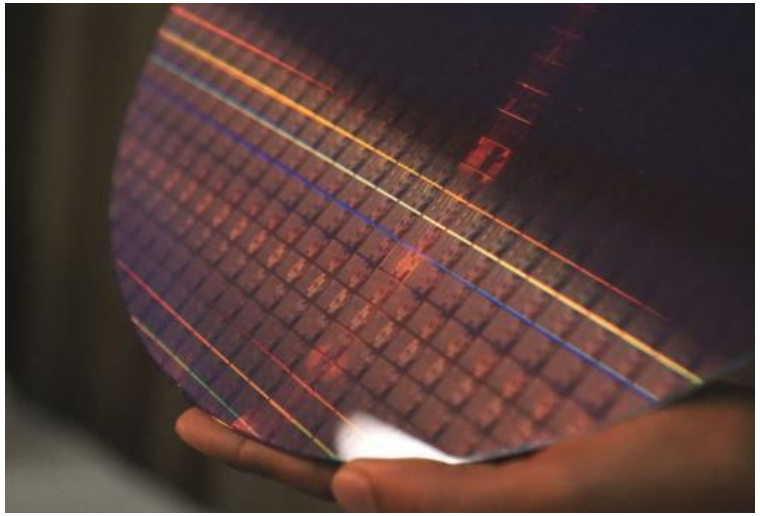


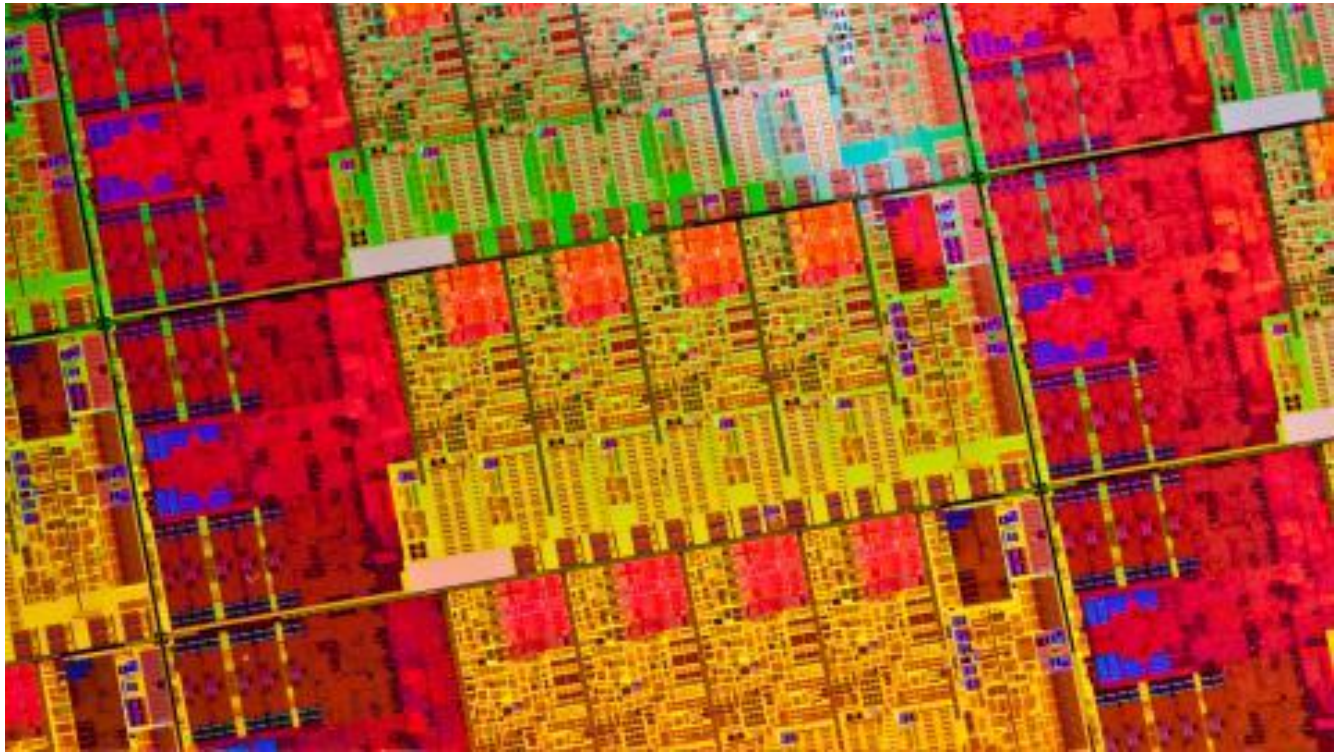
the first transistor ever built exhibited at Bell labs

Wikimedia Commons, 19/10/2018; www.nextplatform.com/2017/09/19/power9-rollout-begins-summit-sierra, 19/10/2018

The power of microelectronics

area: 148.000.000 km²
population: 7.8 billion people (2020)



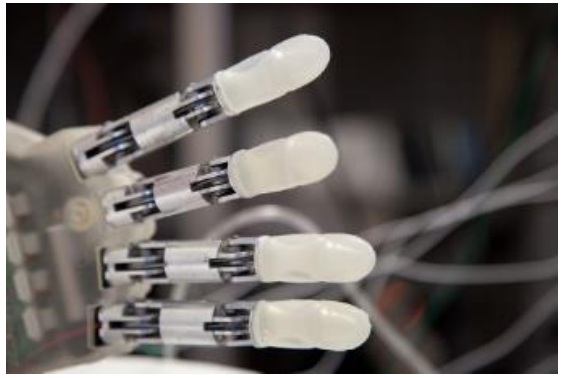


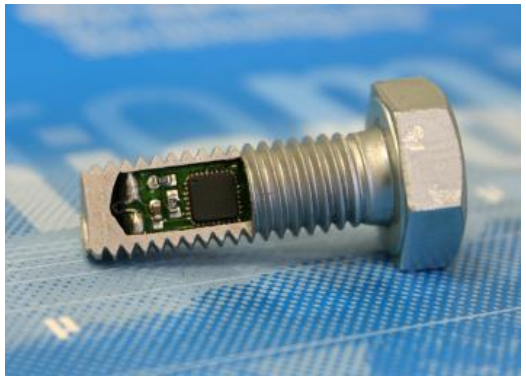
area: 30.000 mm², 100 million transistors / mm²
population: 3.000 billion transistors (10 nm node, 2019)

www.maxpixel.net/Planet-Blue-Planet-World-Space-Earth-Globe-11015, 22/20/2018; wccftech.com/intel-cannonlake-cpu-300-motherboards-2017, 22/10/2018; www.extremetech.com/computing/246902-intel-claims-three-year-advantage-10nm-process-wants-change-define-process-nodes, 22/10/2018

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/semester
- 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
   - Elective Courses in Computer Science
2. Area Microsystems Engineering
   - Advanced Microsystems Engineering
   - Microsystems Engineering Concentration Areas
3. Optional area Customized Course Selection

Total 1-3: **90 ECTS credits**

Master module: **30 ECTS credits**

Altogether: **120 ECTS credits**

More details on course structure, exam regulations etc.

- … will be provided by the study advisor, Mrs. Nopper, directly after I‘m done here.
- Will afterwards 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:
  - Understanding the regulations for the curriculum and designing 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: <u>A University is NOT a school!</u>**
  - 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
- regularly relax and get out

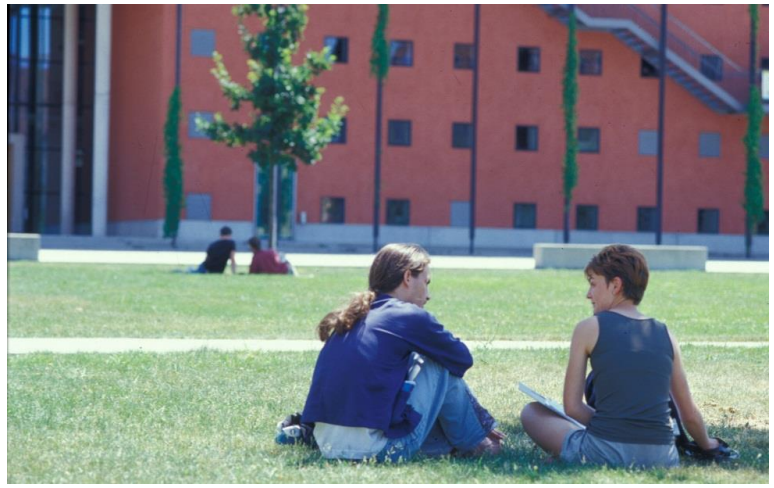
Don‘t forget

- Family
- Friends
- Sports
- Culture
- Nature…

Quelle: TF / M. Diehl / Mellar

Moreover…

- Buy some textbooks
- Contact your mentor
- Form study groups
- Do a project / internship
- Poke around in the laboratories (Hiwi-jobs)
- Find a MSc thesis & a supervisor early on
- Re-enroll and register for things
- 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, Ilka Muckle
  - 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 your 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!