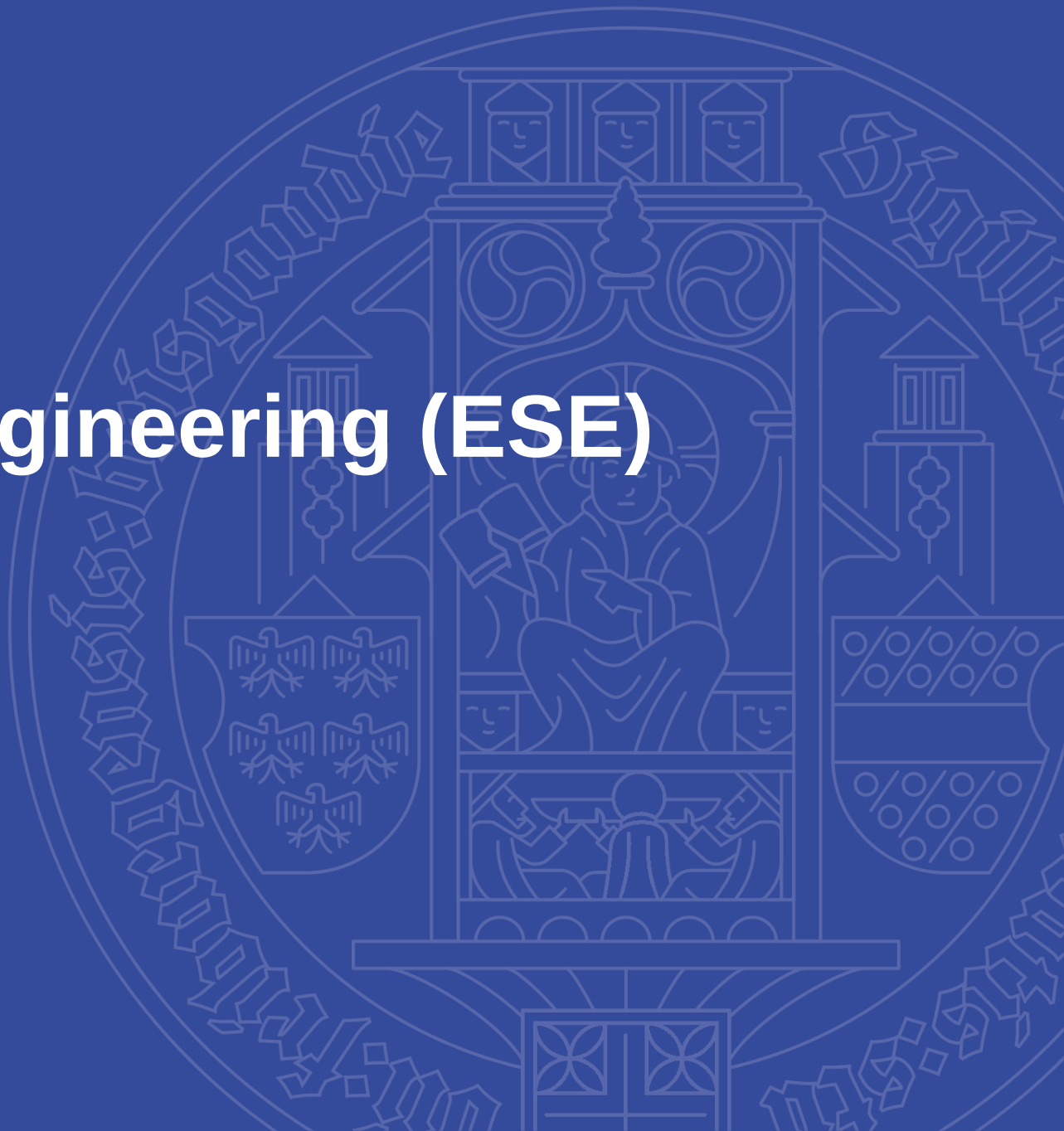
universität freiburg

Master of Science
Embedded Systems Engineering (ESE)



Prof. Dr.-Ing. Bastian Rapp
Faculty of Engineering
April 10th, 2024

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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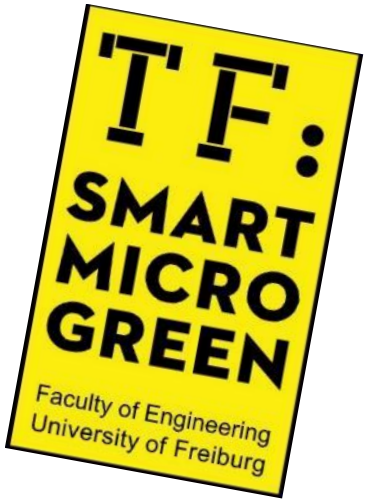
The Faculty of Engineering



- 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
  - More than 2500 students (Women: ca. 22%, Internationals: ca. 36% (more than 50 nations))

Students | head count

Students | Graduates | Research | Staff

Faculty
Faculty of Engineer..

Current numbers | WS 2022/23 (fall semester)

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

female

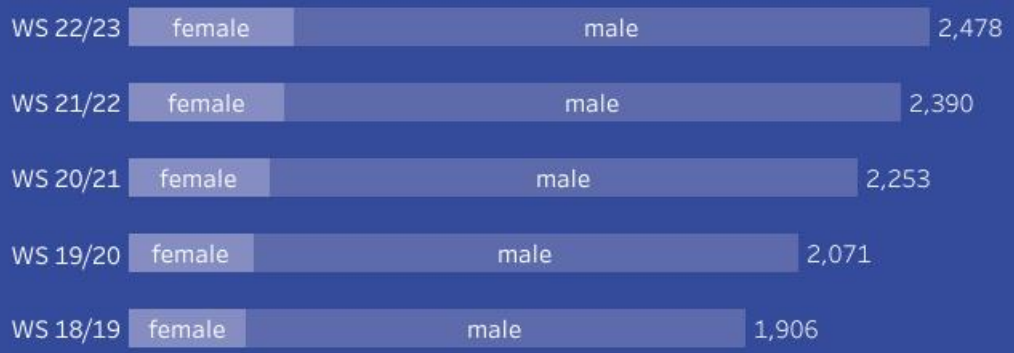
512 | 21%
79% | **1,966**
0 Stud. unknown/diverse

male

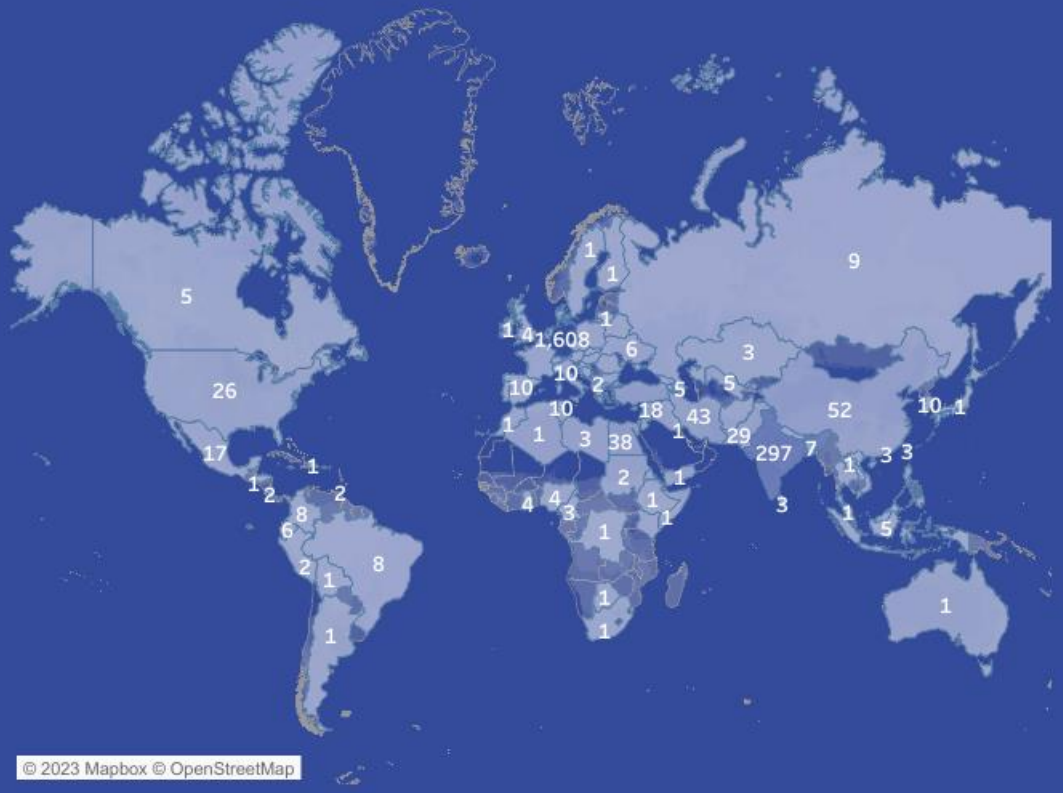
35%
International Students

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

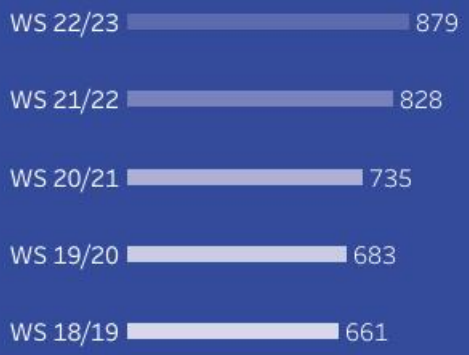
Development of student numbers



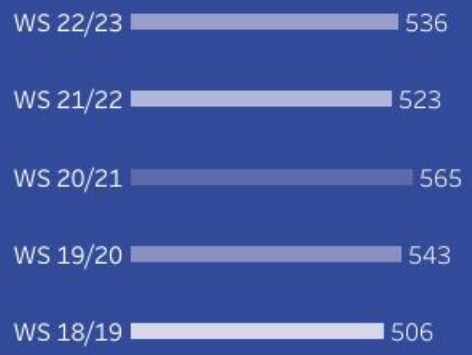
Students by citizenship



International students



First-year students



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

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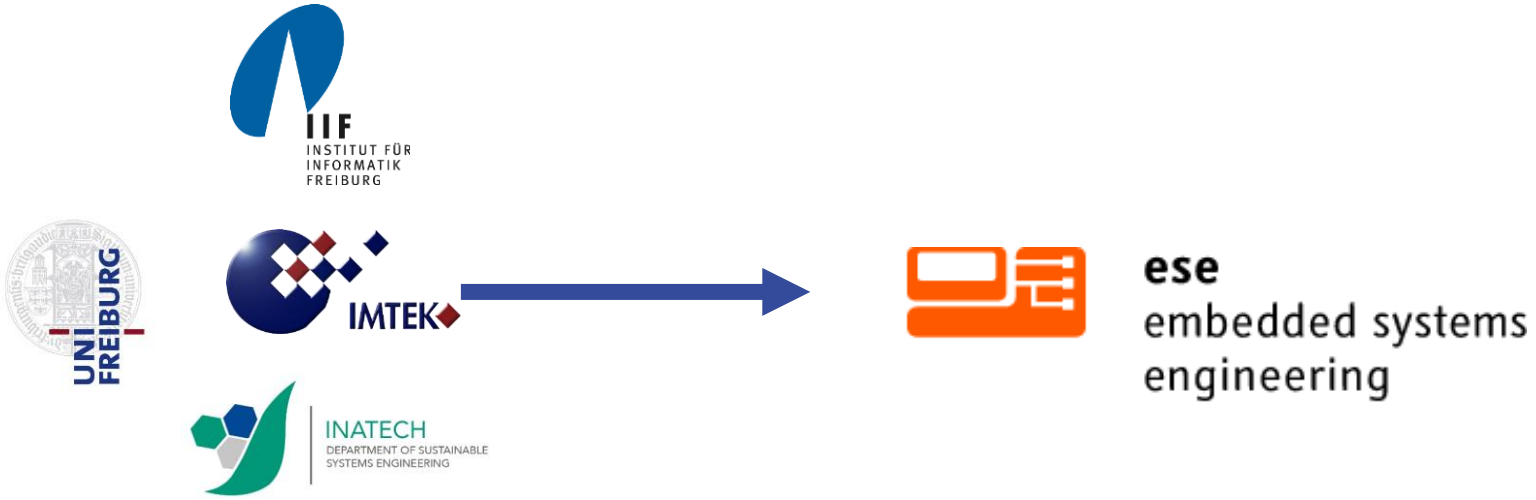
Embedded Systems at the Faculty of Engineering

- 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), Microsystems Engineering (MSE) and Sustainable Systems Engineering (SSE), as well as external experts

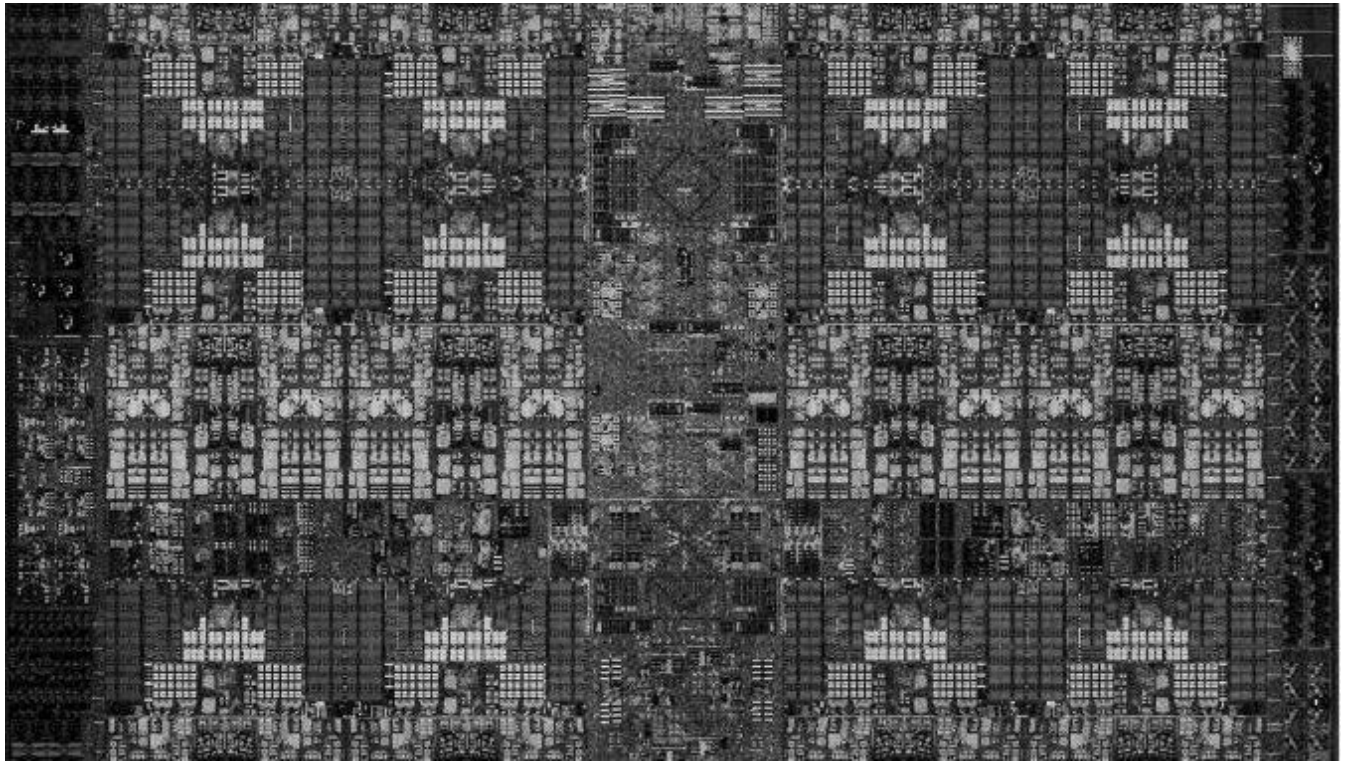


What is special at the Faculty of Engineering?

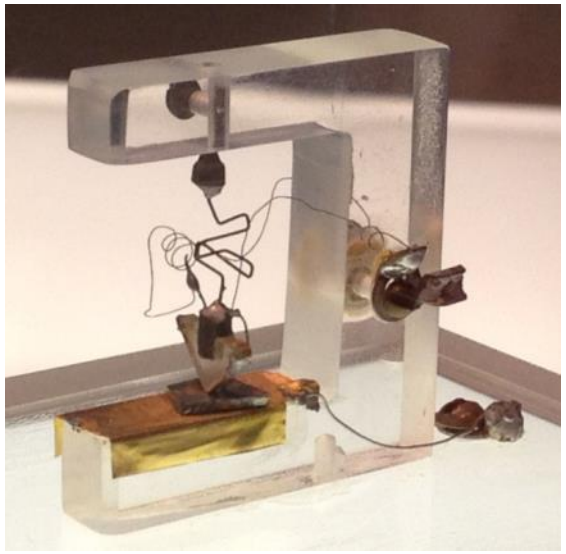
- Unique combination of Computer Science and MSE
- Interdisciplinary study programme
- Great infrastructure:
  cleanrooms, laboratories, computer pools, Wi-Fi, tele-teaching facilities, own engineering library
- Close contact to
  - Faculties of Biology, Chemistry, Medical Science, Physics, Materials 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)

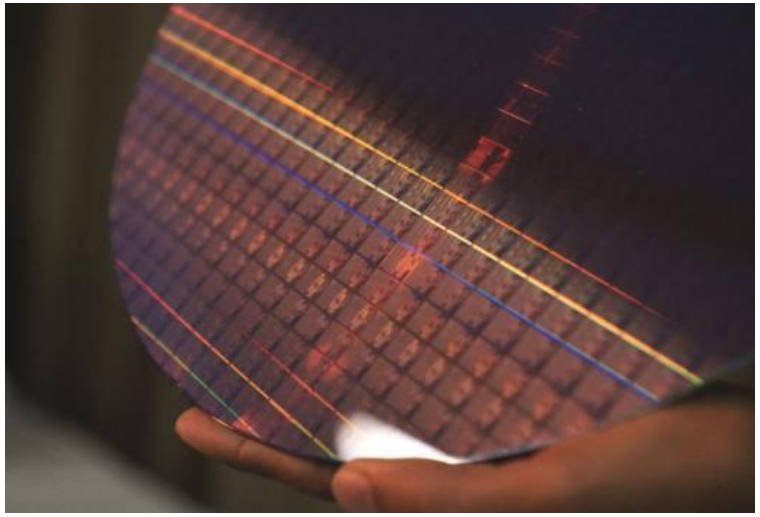


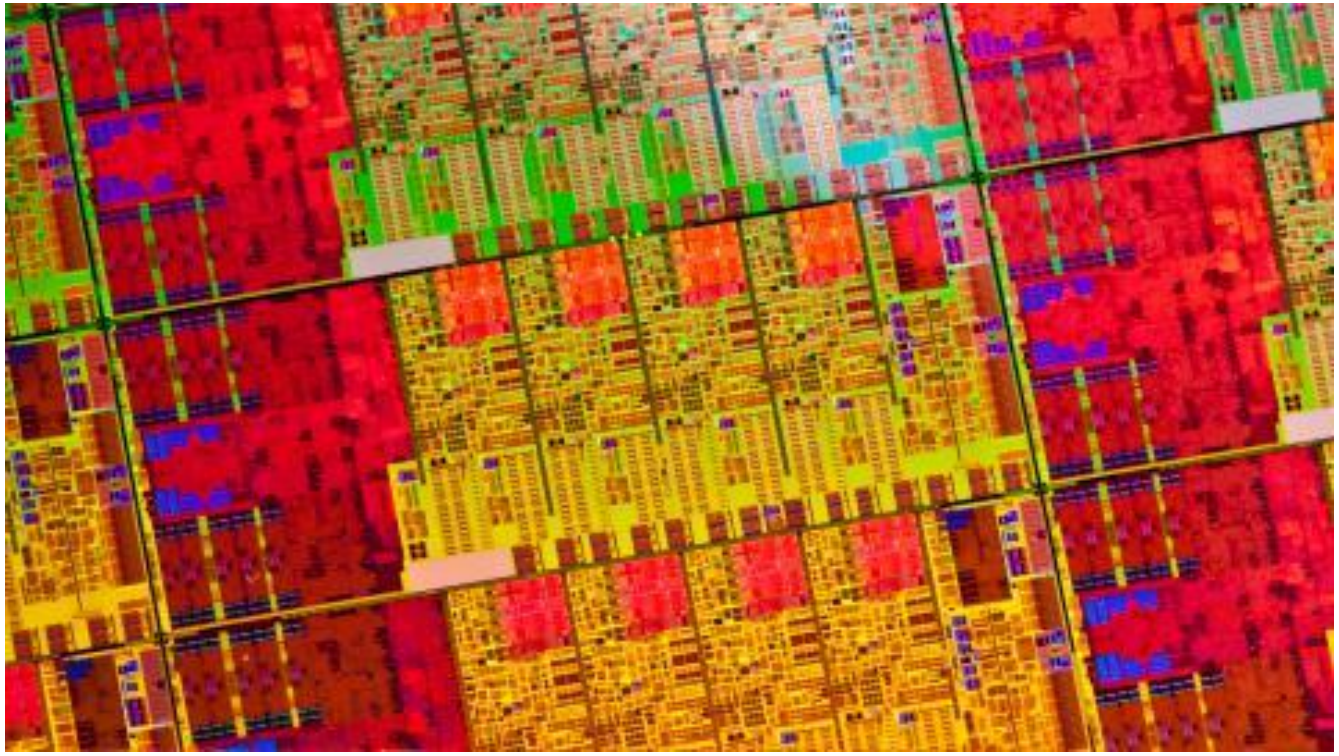
the first transistor ever built exhibited at Bell labs

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)



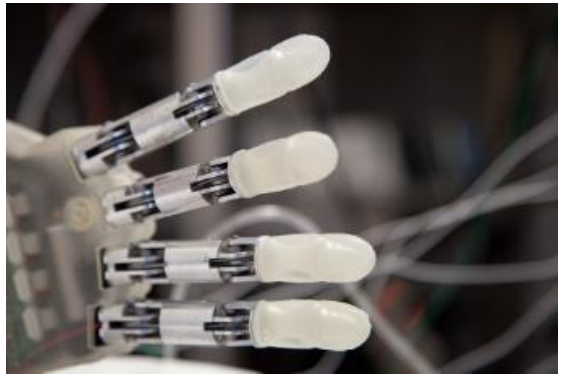


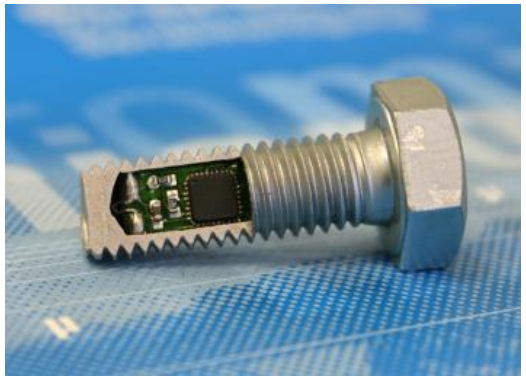
area: 30.000 mm², 100 million transistors / mm²
population: 3.000 billion transistors (10 nm node, 2019)

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 programme structure

Structural principles of all study programmes at the faculty

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

The Master programme ESE is…

- generally an international study programme
  - 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 programme
(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/information-for-new-students-summer-semester
- 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 programme
  - 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 programme 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

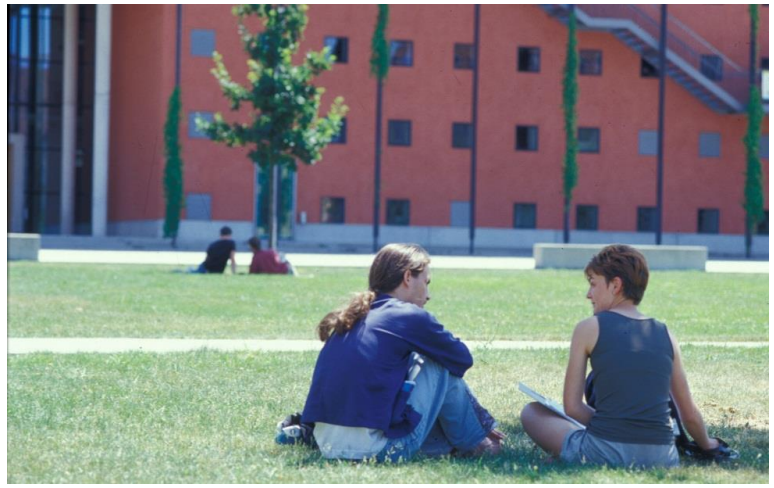
Don‘t forget

- 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 (shared!): 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
    → Programme 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 programme
- 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!