



IMTEK
INSTITUT FÜR
MIKROSYSTEMTECHNIK

A European centre of excellence in microsystemic technologies: IMTEK as a best practice for research, technology integration and industrial transfer

Best practice category

New impetus for chip design; Partner collaboration and open ecosystems; Strengthening manufacturing capacities

Stakeholder group

Research and
Academia

Value chain position

R&D

General Information

The Institut für Mikrosystemtechnik (IMTEK) is part of the Faculty of Engineering at the University of Freiburg and is one of the largest and most important academic centers in the field of microsystems technology. Founded in 1995 has hundreds of researchers, and a large student body committed to the development of advanced microsystemic technologies. IMTEK's research spans a broad technological spectrum, including biomedical microsystems, intelligent integrated microsystems, intelligent materials, and photonics. The institute has state-of-the-art laboratory infrastructure, including a **microfabrication cleanroom** and **interdisciplinary research environments** that connect micro, nano, and information technologies, supporting the creation of prototypes, miniaturised systems, and advanced technological solutions. It is also a prime example of successful technology transfer from academia to the market, driven by numerous **spin-offs** that turn fresh research into commercial reality. Furthermore, the Faculty of Engineering is highly international: 36% of students come from over 50 countries, facilitating networking and useful contacts for the future.

Activities and best practices

- IMTEK's approach is characterised by a type of interdisciplinary research with a high social value, thanks to microsystemic solutions for society. IMTEK conducts basic and applied research on microsystems that combine sensors, microelectronics, intelligent materials, and micro-nanotechnology processes to create high-performance miniaturised devices. Microsystems developed at IMTEK find application in key areas for society, such as medical diagnostics, smart mobility, security, communications and environmental technologies, responding to complex needs and contributing to improved quality of life and sustainable innovation. For example, IMTEK developed a bionic arm with advanced sensory feedback, which won the Misha Mahowald Prize in 2021, allowing users to regain a sense of touch and control delicate movements, demonstrating the social impact of their microsystem technologies.
- IMTEK combines research and specialist teaching, providing students with practical, interdisciplinary experiences ranging from microsystems to microelectronics, MEMS and photonics. Students participate in concrete projects such as the System-Design-Project, in which they build robots in interdisciplinary groups using components such as sensors, actuators, and mechanics, and in the Messtechnik-Praktikum, where they acquire skills in electrical measurements and laboratory techniques on microsystems. In addition, master students can take part in the COSIMA competition, devising innovative applications of sensors and microsystems to improve the interaction between man and technology. These experiences, together with the possibility of carrying out laboratory activities in highly specialised environments such as the Cleanroom Service Center, allow students to develop cutting-edge theoretical and practical skills and contribute to real-world research projects.

- IMTEK promotes strong technology transfer through spin-offs that transform research into real-world applications. For example, CorTec develops brain-computer interfaces (BCIs) that allow severely paralysed people to communicate or interact with the environment via neural signals. Another spin-off, Neuroloop, created Baroloop, a drug-free neurostimulator for blood pressure reduction, winner of the 2016 Applied Computing and Microtechnology Forum Award. These initiatives demonstrate IMTEK's commitment to transforming cutting-edge microsystemic research into socially impactful medical technologies.

Challenges addressed with this practice

IMTEK's activities address complex challenges related to health, mobility, safety, and environmental sustainability, transforming microsystemic research into concrete solutions for society. The combination of sensors, microelectronics, intelligent materials, and micro-/nanotechnologies enables the development of high-performance miniaturised devices, improved human-machine interaction, the creation of new medical therapies, and the facilitation of the technological transition to real-world applications through spin-offs. These practices address emerging social needs, reduce barriers to access to innovative technologies, and promote quality of life and sustainability.