Section for Embedded Systems Engineering at DTU Compute

The Embedded Systems Engineering (ESE) section conducts research across the entire computing continuum, from the smallest embedded devices, such as smart sensors and electronics in modern vehicles, to the largest High-Performance Computing (HPC) systems.

We work on the microelectronics components, the operating systems, the programming models used to develop software, and the final applications.

Through this work, we shape a resilient and adaptive digital future, using our expertise in research and innovation to address societal challenges and fuel progress.

Our focus on dependability, performance, energy, and adaptability has provided a strong foundation of research, which we are now extending to address emerging areas such as digital technologies for sustainability, green computing, and quantum computing.

Research areas

AI in Resource-Constrained Embedded Devices

We address the complex problem of implementing AI algorithms on devices with limited resources. This approach allows for smart capabilities in smaller, power-efficient components, for example in wearable technology and smart sensors for building automation. We also work on novel, green computing architectures for AI that are characterized by their energy efficiency.

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Dependable Edge Computing

The increasing number of connected devices requires reliable and efficient processing at the “edge” of networks. Dependable Edge Computing consists of developing systems that process data near its source, for example, in autonomous vehicles or smart factories, ensuring swift and secure decision-making. This technology is critical for industrial applications where real-time data analysis is needed to optimize operations.

Programming Models and Tools for HPC

We develop processor architectures, programming models, compilers, and tools for High-Performance Computing. In addition, we are interested in Quantum Computing and its integration with HPC systems.

Microfluidic Platforms

We develop “biochips” for health technology applications. These programmable platforms, which handle liquid droplets, are emerging in automated biochemical laboratories, digital health, and point-of-care diagnostics. These Lab-in-a-Cloud can be handled remotely via the internet.

Embedded Wireless Networking

Wireless networking within embedded systems is a key feature of the Internet of Things (IoT). This technology enables seamless communication among different devices, which is critical in modern smart homes, agricultural technologies, and healthcare devices. We also address digital technologies for sustainability, focusing on applications such as smart agriculture and underwater IoT in maritime areas.

Time-Predictable Computer Architectures and Networks

In systems where timing is critical, time-predictable architectures ensure that computing operations are performed within a guaranteed period. This timeliness is important in areas such as aerospace and automotive systems, where a delay of milliseconds may have significant consequences.

Chip Design

We develop neuromorphic computing architectures inspired by the biological brain. We design RISC-V architectures with a focus on their application and integration into new processor designs. We create specialised AI accelerators, components engineered for high-performance, energy-efficient artificial intelligence processing. We employ open-source EDA tools to ensure transparent workflows for synthesising complex digital systems.

Join Us in Shaping the Future

As we advance into new research directions, the ESE section is actively seeking partners to address the next generation of scientific and societal challenges. We are particularly interested in collaborators for our emerging research priorities:

Chip Design: We seek industrial partners to collaborate on chip design to jointly address the challenges in synthesizing next-generation processing and accelerator platforms.

Digital Technologies for Sustainability and Green Computing: We are developing computing and communication solutions to address critical environmental challenges. Our work on novel, net-zero architectures for datacenters and AI is a key part of this effort, and we are interested in collaborators with demanding infrastructures and AI applications.

Quantum Computing: We explore the integration of QC with HPC systems. We seek partners from academia and industry to develop the software stack and find novel applications for these powerful combined platforms. We are especially looking for collaborators in life sciences.