

Fraunhofer IIS - Microelectronic and information technology system solutions and services



The Fraunhofer Institute for Integrated Circuits IIS in Erlangen is a globally leading applied research institution for microelectronic and information technology system solutions and services. Today, it is the largest institute within the Fraunhofer Society. The institute gained international recognition in part through its significant role in the development of the audio coding formats mp3 and MPEG AAC. In close collaboration with clients, the researchers conduct world-class research in the fields of audio and media technologies, imaging systems, energy management, IC design and design automation, communication systems, localization, medical technology, sensor systems, security technology, supply chains, and non-destructive testing.

Master's Thesis (m/f/d) - Quantum Error Correction / Fault-Tolerant Quantum Computing

City: Nürnberg; Starting date (earliest): At the earliest possible; Remuneration: *

Working field

The »Quantum Compilation« group at Fraunhofer IIS, part of the »Machine Intelligence« department at our Nuremberg site, is looking for motivated students! Our team members have diverse academic backgrounds from computer science, engineering and physics. Since 2019 our group has delved into cutting-edge topics within the realm of quantum computing, including quantum machine learning, machine learning for quantum compilation, error correction, and quantum-circuit cutting. The master's thesis will be conducted as a joint project with the »Chair for Quantum Theory« at Friedrich-Alexander University Erlangen-Nürnberg, under the supervision of Prof. Dr. Michael J. Hartmann.

Quantum Error Correction (QEC) is a fast-evolving field aimed at achieving large-scale Fault-Tolerant Quantum Computing (FTQC). It focuses on encoding fragile quantum states to detect and correct errors before they affect the information. Current methods have high overhead, making them impractical in the near term. Thus, developing alternative and more efficient approaches is essential.

You will conduct cutting-edge research on quantum error correction and fault-tolerant quantum computing, guided by an experienced researcher in the field

You will develop and implement techniques to reduce the overhead of quantum error correction.

Utilize tools from machine learning and reinforcement learning.

You will perform experiments to test the developed approaches - first in simulation, later eventually on actual state-of-the-art quantum hardware

You will write down your findings to constitute your master's thesis, if the results permit

potentially followed up by a publication

Requirements

- You are currently studying physics, computer science, mathematics or a related field
- You have experience with quantum computing, in particular quantum error correction
- You have basic understanding in Python programming, including quantum computing libraries like Qiskit
- You are interested in machine learning, mathematical optimization, or similar tools
- You are comfortable communicating in English.
- You are able to attend in-person meetings at out site in Nuremberg when necessary, with the option for remote work as well.

What we offer

- Flexible working hours
- Open and friendly team work
- Varied tasks with room for creativity
- Exciting seminars and events
- Networking with scientists
- Active contribution in applied research
- Interesting and innovative projects
- Mentoring program »josephine®« for talented female students

We are pleased to offer you the opportunity to write a Master's thesis in collaboration with us on the abovementioned topic. The awarding and execution of the thesis will follow the rules of the university where you are enrolled. After your studies, you have the option of working with us full or part-time.

We value and promote the diversity of our employees' skills and therefore welcome all applications - regardless of age, gender, nationality, ethnic and social origin, religion, ideology, disability, sexual orientation and identity.

Application

Interested?

Apply online (<https://short.sg/j/51118093>) now (PDF: cover letter, CV, transcripts). We look forward to getting to know you

More information at <https://stellenticket.de/195244/HTWB/>

Offer visible until 10/07/25

