Master Thesis Task in the NanoEngineering Program

Topic: Design of Deembedding Structures and a Frequency Doubler Circuit for Application in the Next-Generation Communication Standard (6G)

Task:

The increasing connectivity and automation across all industrial sectors continuously impose new demands on communication system capacities. Applications require systems capable of ever-higher data rates, reaching up to terabits per second. To meet future requirements, next-generation wireless standards such as 6G will leverage the vast bandwidth available in the terahertz (THz) frequency spectrum. Various semiconductor technologies enable operation at such high frequencies. One such technology is based on the silicon-germanium (SiGe) material system, which is industrially available and has undergone significant improvements over the past years. Another promising semiconductor technology is based on the indium phosphide (InP) material system, which also supports operation in the THz range, although further optimization potential remains.

Within this work, structures for the extraction of intrinsic device properties—so-called deembedding structures—will be designed. The design process will be carried out using electromagnetic simulation software. Based on the insights gained from the deembedding analysis, a transistor-based frequency doubler circuit will be developed and optimized for operation in the THz range, targeting applications in next-generation communication systems such as 6G.