

Master Thesis Task in the NanoEngineering Program

Topic: Analysis and development of a communication link based on resonant tunneling diodes

Task:

The resonant tunneling diode (RTD) is a promising candidate for applications in the terahertz (THz) range. With this device, THz sources can be realized up to approximately 2 THz. These sources operate at room temperature and can generate output powers of up to about 10 mW when used in arrays. In addition to signal generation, resonant tunneling diodes can also be employed as broadband detectors. These detectors are typically operated at the zero-crossing point of their I–V characteristic curve, resulting in very low noise levels. At our facility, RTDs are integrated into printed circuit board modules for both transmitter and receiver applications, making them suitable for a wide range of uses.

This work aims to investigate various modulation techniques for data transmission. The key objective is to analyze the feasibility of applying these modulation schemes to a single free-running resonant tunneling diode. Following this analysis, the most promising modulation methods will be tested within a communication link. To this end, an appropriate experimental setup must be realized. Furthermore, new samples incorporating resonant tunneling diodes combined with filter networks and patch antennas will be evaluated.

The project consists of three main parts: (1) analysis of different modulation techniques, (2) assessment of the RTD's response to these modulation schemes, and (3) the implementation and testing of a first prototype communication link.