Supervisor: Dr. -Ing. Alaa J. Jumaah

Title: Miniaturized Terahertz System for Environmental Sensing in Laboratory Settings

General description

The terahertz (THz) region of the electromagnetic spectrum, which lies between the microwave and infrared regions, has unique properties that make it highly suitable for various sensing applications. A miniaturized terahertz system can offer significant advantages in environmental monitoring, including high sensitivity, non-invasive analysis, and the ability to penetrate various materials. This challenge focuses on designing and developing a compact terahertz system tailored for laboratory environmental sensors. Therefore, you are invited to design and develop a miniaturized terahertz (THz) spectrometer system for environmental sensing applications in laboratory settings. The goal is to create a compact, portable, and sensitive THz system that can be used for real-time analysis to bridge the gap between cutting-edge THz technology and practical environmental sensing applications. You are encouraged to explore the principles of terahertz technology, design miniaturized components, and integrate these into a functional sensor system to monitor environmental parameters such as temperature, humidity, and chemical composition in a controlled laboratory environment.

Students task description

Review the literature on terahertz technology, its applications in sensing, and the principles behind its generation and detection.

Design a miniaturized terahertz spectrometer system, including the design of terahertz sources, detectors, and optical components.

Implement strategies to enhance the system's sensitivity and overcome challenges such as water absorption of THz waves.

Recommended background

Students should have a good understanding of electromagnetic theory, particularly the terahertz spectrum, as well as optics and photonics, including wave propagation and optical system design. Moreover, terahertz technology and its diverse applications, as well as understanding spectroscopy and spectrometer design, are essential.

References:

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