TASK OF THE PROJECT / THESIS

for: **Available**

Posed by: **Prof. Dr.-Ing. Jan C. Balzer**

Topic: Detection of material defects using Terahertz SAR imaging

In recent years, terahertz frequency-modulated continuous-wave (FMCW) radar technology has advanced significantly. By integrating FMCW radar with synthetic aperture radar (SAR) imaging, it becomes possible to realize compact and high-resolution imaging systems capable of non-contact inspection.

Such systems have shown great potential for defect detection in materials, for example, identifying voids, delamination or cracks that may occur during fabrication or in-service use. Ensuring product integrity through reliable, non-destructive testing is becoming increasingly important in materials science, manufacturing and quality assurance.

The goal of this work is to build a terahertz SAR imaging system for detecting material defects. The setup includes an FMCW radar and a robotic arm. The student will focus on building the system, performing experiments, and processing imaging data to characterize material properties and defects.

The task includes:

- the creation of a time and work plan,
- Learn to operate the existing FMCW radar and robotic arm system,
- Establish the experimental setup and perform scanning of various samples,
- Process acquired radar data (radargrams) and apply SAR image reconstruction techniques,
- Characterize and compare different materials and defect types,
- Improve scanning strategies for better imaging quality,
- Documentation of the work,
- Presentation of an interim report,
- Final presentation of the work,
- Submission of the documentation and the presentation in PDF format as well as the hand in of the printed documentation to the Prüfungsamt according to the regularisation in the Prüfungsordnung.

Second reviewer: Prof. Dr.-Ing. A. Czylwik

Duisburg, _____ Supervisor: _____

Prof. Dr.-Ing. Jan C. Balzer