# AUFGABE DER MASTERARBEIT

**im Studiengang „International Studies in Engineering"**

für:

gestellt von: **Prof. Dr.-Ing. Andreas Czylwik**

Thema: Design of a Millimeter-Wave Harmonic Radar Tag with a Planar Antenna and Dual-Frequency Matching Network

Conventional radar systems transmit electromagnetic signals toward a target and receive the corresponding reflections at the same frequency. These systems generally perform well in unobstructed environments. However, in applications such as entomological tracking, the target may be surrounded or obscured by strong reflectors, including the ground, buildings, and vegetation. The resulting clutter can significantly affect the tracking of the target. In this case, harmonic radar is applied to localize the target. A harmonic radar system consists primarily of a transceiver and a harmonic tag consists of a nonlinear component like a barrier Schottky diode (BSD) connected to an antenna. The transceiver illuminates the tag at a fundamental frequency, while the tag receives the incident signal and retransmits all harmonics of the fundamental frequency, which provides the opportunity to distinguish and differentiate the tagged target among environmental clutter. The dimensions and configuration of the antenna depend strongly on the intended application. Possible implementations include wire antennas and compact planar structures, with the final design determined by factors such as operating frequency, tag weight, and target size.

In this project, the harmonic tag will operate at a fundamental frequency of 50 GHz and reradiate at the second harmonic of 100 GHz. The objective is to design a planar omnidirectional antenna using CST Studio Suite and develop a dual-frequency matching network between the antenna and the barrier Schottky diode. The matching network should provide suitable impedance transformation at both 50 GHz and 100 GHz to enhance power transfer to the diode at the fundamental frequency and facilitate efficient reradiation at the second harmonic.

The task entails the following:

- Creating a time and work plan,
- getting acquainted with the principles of harmonic radar, EM simulator, circuit design in ADS,
- applying different antenna structure and matching network aiming to optimize matching between antenna and BSD,
- documentation and final presentation of the work,
- submitting a digital copy of documentation and presentation in PDF format.

Zweitgutachter: Prof. Dr.-Ing. Jan C. Balzer

Duisburg, den _____ Betreuer: _____

Prof. Dr.-Ing. A. Czylwik