

AUFGABE DER ABSCHLUSSARBEIT

im EIT/ISE-Studiengang

für: **Student*in**
gestellt von: **Prof. Dr.-Ing. Andreas Czulwik**

Thema: Development of a ray tracing model in the terahertz frequency range
for estimating reflected waves from arbitrary samples and objects

A ray tracing model is to be developed which allows to simulate waves incident to a receiver of a THz measurement system that occur during reflection measurements on arbitrary samples and objects. For this purpose, rays are to be generated from a source that hit an arbitrarily positioned object, are reflected there and eventually fall into a sink.

The script should preferably be written in python and include the option of implementing objects using 3D data (.stl, .obj, etc.). It should also allow for the assignment of material parameters such as refractive index and absorption coefficients to the objects.

The ray tracing model should be capable of determining the radar cross-section or an equivalent parameter to characterize an object, which will be compared to real measurements. Additionally, a graphical representation of the simulated system should be provided, enabling users to visualize the interactions between rays and objects clearly.

Additionally, the model could incorporate advanced features such as multiple reflection paths, scattering effects, and the ability to simulate different illumination conditions. It should also allow for the adjustment of simulation parameters to analyze how changes in object properties affect the measurement results. This comprehensive functionality will enhance the model's applicability in real-world THz measurement scenarios and facilitate deeper insights into material characteristics.

The task entails the following steps:

- creating a time and work plan,
- getting familiar with the fundamentals of raytracing and radar cross-section,
- development of a suitable concept for the model,
- development of a simulation script,
- comparison of simulation and measurement data,
- final presentation of the work, and
- submitting a digital copy of documentation and presentation in PDF format.

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

Duisburg, _____

Betreuer: _____

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