BACHELOR THESIS

in the course „International Studies in Engineering“

For: **To be determined (available in German and English)**

Set by: **Prof. Dr.-Ing. A. Czylwik**

Topic: **Optimisation of the geometrical shape and characterization of coupling structures for dielectric terahertz waveguides**

Terahertz radiation, which is defined as electromagnetic radiation in the frequency range approximately between 100 GHz and 10 THz, has been largely unrecognized for decades, due to its complicated and expensive generation and its limited available power. In recent times, several terahertz devices have been developed which are better suited for handling in non-laboratory environments and the increasing number of applications has made them more attractive due to the decreasing costs of terahertz radiation generation. In addition, there is growing demand for terahertz waveguides.
Due to its low losses, dielectric waveguides have shown to be advantageous for terahertz guiding. In many cases, the radiation needs to be coupled from free space into the waveguide at its input and back into free space at its output. Certain geometrical shapes have proven to have a higher coupling efficiency than others. Also, a low divergence of the beam raidated into free space is required in many applications. In particular, elliptical structures known as coupling structures can be placed at the ends of dielectric waveguides to form collimated terahertz beams.
Therefore, this bachelor thesis aims to investigate which design and geometrical parameters of a coupling structure can achieve a high coupling efficiency, a low beam width, and a low divergence of the decoupled beam.

This bachelor thesis can be divided into the following sub-tasks:

- Creation of a work plan and a time schedule,
- Literature research on quasi-optical components for the collimation of terahertz radiation,
- Simulation of different coupling structures and selection of promising designs,
- Fabrication of the coupling structures,
- Characterization of the coupling structure's radiation patterns,
- Evaluation of the optimal coupling structure for the prescribed application,
- Documentation of the achieved work,
- Finalisation of the work in the form of an oral presentation.

Second reviewer: Prof. Dr.-Ing. Jan C. Balzer

Duisburg, _____ Supervisor: _____

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