Art der studentischen Arbeit: ***Type of study work:***	Master thesis
Teilprojekt: ***Sub-Project:***	**B1,B2**
Kategorie: ***Category:***	Simulation

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Start:	As soon as possible

Aufgabenstellung/*Task formulation:*

Implementation of a software interface for coupling MATLAB® and Abaqus/CAE® to obtain continuum and truss-based topology optimized designs.

Topology optimization is a branch of structural optimization that pursues the optimal distribution of material within a predefined design space. Since topology optimization first attracted attention in engineering through Bendsoe's and Kikuchi's pioneering work in 1988, the focus was laid on structures with high stiffness or low compliance, respectively, while reducing structural weight. Although this idea was already implemented in MATLAB® and Python scripts -the latter being used as a subroutine in Abaqus/CAE ®-, each of these programs has limitations that restrict the solution of problems to structured domains. Moreover, most of these routines are implemented in form of toolboxes, which makes them inflexible to changes and extensions, necessary to consider particular material properties, as is the case of stress anisotropy in reinforced concrete. For this reason, a proper script to solve topology optimization problems must be developed in order to obtain reliable results and adequately visualize them, exploding the advantages of both MATLAB® and Abaqus/CAE® software in continuum and truss-based models.

Zielstellung/*Aim of the work:*

The goal of the thesis is to develop a script that couples MATLAB® and Abaqus/CAE® software for the solution of three-dimensional continuum and truss topology optimization problems. A reference approach in 2D is preset by the advisors. Coding should be performed in MATLAB® and if necessary, Python language. The script should be tested by matching the results with existing benchmarks.

Arbeitspakete/Umfang:

Working packages/Scope of the work:

- Literature review on structural optimization with focus on topology optimization.
- Review of existing MATLAB® and Python codes applied to topology optimization problems
- Implement two separate codes for the solution of spatial continuum and truss topology optimization problems, providing an interface between MATLAB® and Abaqus/CAE®, with possibility to analyze non-structured geometries
- Validate the code with benchmark examples and provide optimized designs for common problems in structural engineering
- Textual and graphical documentation as well as presentation of all relevant results