Chair of Computational Modeling and Simulation
TUM Department of Civil, Geo and Environmental Engineering
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Software Lab:

Virtual characterization of short fiber reinforced plastic

Modeling:
Mathematics:
Programming:
Science:

Description

Short fiber reinforced composite materials can be found in various industries, due to their beneficial mechanical properties. Within this project, a calculation tool should be developed in order the characterize the mechanical properties of such materials. For this purpose, a micromechanical representative volume element (RVE) is constructed, consisting short glas fibers integrated into the surrounding polymer matrix. Then finite elements are used to approximate the homogenized properties of the built composite material unit. These are the elastic parameters and the strength of the short fiber reinforced composite. To explore the affecting factors on the structural performance of the material, parametric studies should be completed with varying reinforcing fiber size, shape and orientation.

For the calculation Abaqus solver should be used.
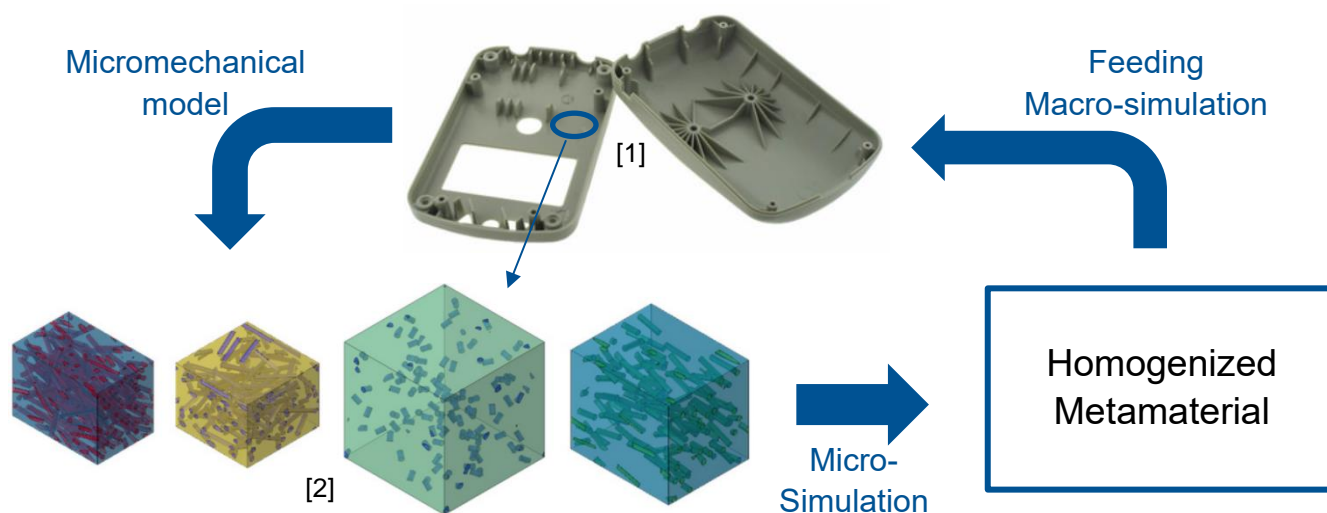
Task

Development of an integrated Abaqus-Python tool that handles the numerical analysis of the composite unit cells:

- Automatic CAD generation of the representative volume element with varying geometric parameters of the fibers
- Meshing of the geometry and assignment of periodic boundary conditions using Python libraries
- Automatized postprocessing of the simulation results, after the execution of the Abaqus analysis
- Design of experiments with variation of geometric parameters of the fibers using Python libraries
- Optimization of the design variables to maximize the mechanical performance of the material (stiffness, strength)
- Integration of sub-modules into one Python interface

Supervisor

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References

[1] epectec.com

[2] Breuer, K.; Stommel, M. Prediction of Short Fiber Composite Properties by an Artificial Neural Network Trained on an RVE Database. Fibers 2021