Multiscale modelling of failure for fiber reinforced composites

TECHNISCHE UNIVERSITÄT DARMSTADT

Bachelor- / Master-Thesis (Mechanik / CE / Maschinenbau / Bauingenieurwesen)

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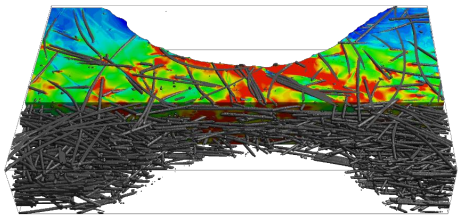
Topic



Fiber reinforced composites (FRP) are often used in crash-relevant components due to their stiffness and strength properties. However, modelling their material behavior is a challenging task, as their mechanical properties are spatially very inhomogeneous and depend on the stress state.
In most simulation software tools, the material behavior is implemented through so called “material cards”. The calibration of accurate material cards for FRP requires a large number of material tests.

Work programme

In this thesis, we propose an alternative multiscale approach. The calibration data for the macroscopic material card is generated by virtual experiments based on microscale simulations. The setup of the simulation model on the microscale requires only CT analysis for the geometrical description, and a few simple experiments on the constituents. The software tool FeelMath (developed at Fraunhofer ITWM) will be used on the microscale. On the component scale, failure is often modelled using the GISSMO model. It requires the prescription of a triaxiality-dependent failure strain which is difficult to obtain experimentally. In this thesis, we want to extend the multiscale method to the modelling of failure. The parameters needed for calibrating the failure model on the component scale should be obtained virtually using microscale simulations.

Required skills

- continuum mechanics
- mathematical methods
- computational mechanics

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