Karlsruhe Institute of Technology

Seminar im Rahmen des GRK 2078

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Titel: **Multiscale modelling of the deformation and damage behaviour of fibre-reinforced polymers**

Abstract

This contribution addresses the modelling and simulation of the mechanical behaviour of textile-reinforced polymers at different scales. Starting from the material properties of the individual constituents (micro-scale) and their geometrical arrangement (meso-scale), the effective material behaviour of the composite (macro-scale) is predicted using computational homogenization techniques. In particular, the inelastic deformation behaviour of the composite, which is influenced by the strain-rate dependent material behaviour of the polymeric matrix and various damage effects, is investigated.

In order to obtain the required input data regarding the material behaviour of the microscopic constituents, fibres and matrix are characterized in individual experiments. Furthermore, the fibre-matrix interface is examined. To this end, single fibre fragmentation and pull-out tests have been conducted and evaluated. Suitable material models are derived and a structured approach to parameter identification is outlined.

The different constitutive models are incorporated in numerical models of the micro- or mesoscopic material structure to simulate the local behaviour. Advanced numerical techniques, e.g. XFEM and phase-field approaches, are used to account for failure of the local material structure in a discrete or diffuse manner. Eventually, boundary conditions, that allow for the strain localization in a volume element without leading to spurious localization zones, are utilized to predict the effective mechanical behaviour of the composite.

Different examples for the application of the developed methods which include fibre-reinforced thermoplastics and thermosets as well as hybrid FRP-metal structures are presented.

Alle Interessenten sind herzlich eingeladen.
Prof. Dr.-Ing. Thomas Böhlke