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## Seminar über Fragen der Mechanik

zu folgendem Vortrag wird herzlich eingeladen

Dienstag, **14.12.2010, 16:00 Uhr**, Egerlandstr. 5, Raum 0.044

### Microscale modelling and homogenization of fiber structured materials

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Various phenomena occurring on the macrostructure result from physical and mechanical behaviour on the microlevel [1]. For the mechanical modeling and simulation of the heterogeneous composition of fiber structured material, in addition to the material properties the contact between the fibers has to be taken into account.

The material behaviour is strongly influenced by the material properties of the fiber, but also by the geometrical structure. Periodically arranged fibers like woven, knitted or plaited fabrics and randomly oriented ones like fleece can be distinguished in their arrangement.

In consideration of different lengthscales the problem involves, it is necessary to introduce a multiscale approach based on the concept of a representative volume element (RVE).

The macro-micro scale transition requires a method to impose the deformation gradient on the RVE by suited boundary conditions. The reversing scale transition, based on the *Hill-Mandel* condition, requires the equality of the macroscopic average of the variation of work on the RVE and the local variation of the work on the macroscale [2]. For the micro-macro transition the averaged stresses have to be extracted by a homogenization scheme. From these results an effective material law can be derived.

Beside the theoretical aspects, we present the stress-strain relation for RVE-models and different boundary conditions.

- [1] V. Kouznetsova „Computational homogenization for the multi-scale analysis of multi-phase materials“, PhD-Thesis, University of Technology Eindhoven, 2002
- [2] C. Miehe „Computational micro-to-macro transitions for discretized micro-structures of heterogeneous materials at finite strains based on the minimization of averaged incremental energy“, *Comp. Meth. Appl. Mech. Engr.* **5-6**, 559, 2003