Die Graduiertenschule MUSIC mit dem IRTG 1627 lädt ein zum Vortrag:

"Multiscale Damage Modeling in Heterogeneous Materials"

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Graduiertenschule MUSIC, Appelstr. 11A, Room A 501, 5th floor

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Damage phenomena, macroscopically characterized by decrease in material stiffness or so-called softening, are common in all engineering materials and can significantly decrease structural load-carrying capacity, and eventually lead to a complete loss of mechanical integrity. A lot of engineering materials can be treated as heterogeneous, particularly if they are observed at microscale. Geometrical and material properties of the constituents forming microstructure have a significant impact on material behaviour. Therefore, in order to assess structural integrity and to predict structural lifetime, an analysis evolving microstructure is necessary.

Damage responses of both quasi-brittle and ductile materials will be considered using the multiscale computational procedures. An efficient quasi-brittle damage model implemented into the finite element formulation employing the nonlocal continuum theory is proposed. The damage enhanced constitutive relations are embedded at the structural macrolevel, while the material stiffness matrices are computed at the microscale using the second-order homogenization procedure. Therein, an appropriate representative volume element (RVE), representing a sample of heterogeneous material, is considered. The ductile damage is modelled at the microlevel employing the gradient-enhanced elastoplasticity, and after the homogenisation procedure the state variables are mapped at the macroscale. Here, the first-order computational homogenization scheme is applied. An implicit nonlocal ductile damage model, governing the evolution of damage variable, is comprised. Besides the displacement, the nonlocal equivalent plastic strain measure is discretized over the RVE, and accordingly, the mixed finite element formulation is derived. The macrolevel discretization is performed by means of the regular displacement finite element formulation. All algorithms derived have been implemented into the finite element software ABAQUS. The efficiency and accuracy of the proposed computational strategies will be demonstrated by standard benchmark examples.