Friedrich-Alexander-Universität Erlangen-Nürnberg

LTM

Lehrstuhl für
Technische Mechanik
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Einladung

Im Rahmen des Seminars zu Fragen der Technischen Mechanik findet am Mittwoch, dem 23.04.2008, um 12:00 Uhr im Seminarraum des LTM folgender Vortrag statt:

Herr Ph.D. Christian Linder
Department of Civil and Environmental Engineering
University of California, Berkeley

"Modeling of Dynamic Fracture
using Finite Elements with Embedded Strong Discontinuities"

Abstract:
This work is concerned with the development and application of finite elements with embedded strong discontinuities to model dynamic fracture. A strong discontinuity is understood as a discontinuity in the displacement field, representing failure of the material on a macroscopic scale. Embedding such singularities locally into the finite element formulation through a cohesive law is an active area of research in the context of the modeling of cracks in brittle materials or shear bands in ductile materials. Recently an improved kinematic description of the strong discontinuities, in the sense that stress locking can be avoided for non-constant separation modes, has been proposed within the infinitesimal and the finite deformation theory for the quasi-static case. This improvement allows to capture better the localized dissipative mechanisms associated with the response of the singular fields characteristic for the failing material through a proper enhancement of the strain field of the finite element. The modeling of dynamic fracture drastically increases the complexity of the numerical method when compared to the quasi-static case so that extensions of finite elements with embedded strong discontinuities to take into account dynamic effects are rare. In this work a first attempt to model dynamic fracture is undertaken for the newly developed finite elements in the form of the numerical simulation of crack branching in brittle materials and failure mode transition in ductile materials. The application of a velocity based crack branching criterion together with the choice of several representations of the finite element at which the actual crack branching occurs, results in physical realistic crack branching patterns with crack tip velocities in the range observed in experiments. The failure mode transition is achieved based on the high speed impact of a projectile, where depending on the impact velocity, a shear band propagates throughout the specimen or arrests with a crack starting at its tip. The proposed finite elements are able to capture the mode switching with a good agreement of the shear band paths when compared to experimental results.

Erlangen, 15.04.2008
Prof. Dr.-Ing. P. Steinmann