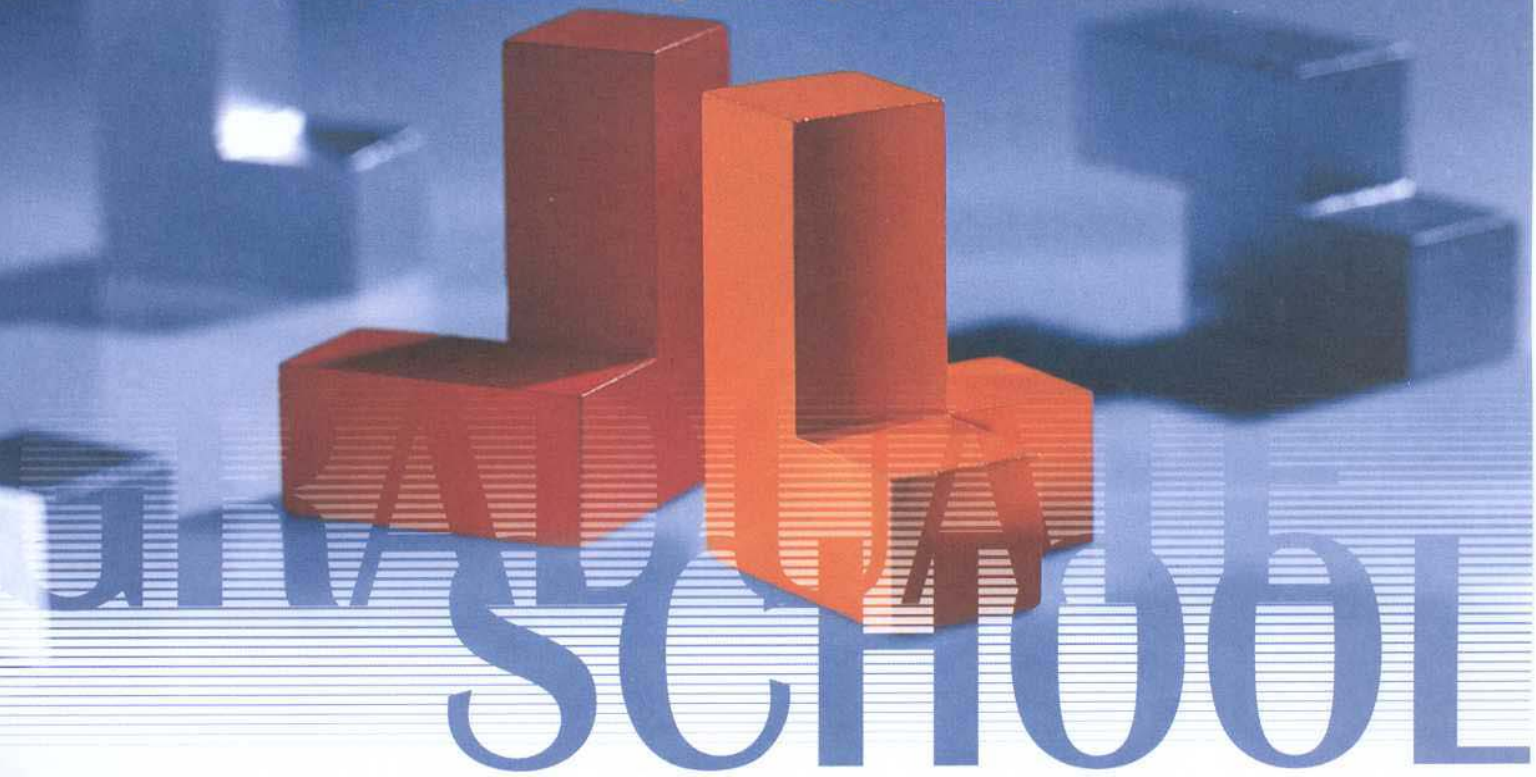
UNIVERSITÄT DORTMUND

Graduate School
of Production Engineering and Logistics



SCHOOL

GUEST LECTURE

Prof. H.L. SCHREYER
University of New Mexico

Wednesday, 02.03.2005, 15.00 – 17.00
MB I, Campus Nord, E 23

A Decohesive Model of Material Failure That Includes Uniaxial Splitting

The failure of ductile materials is often shear dominated (Mode II) so the models of Tresca and Mises are generally considered to be appropriate. On the other hand, brittle materials under tensile loading fail in Mode I and the maximum principal stress criterion is widely used. However, under uniaxial compression of brittle materials, axial splitting is observed. Neither category of models can predict axial splitting and illustrates a basic deficiency in our ability to predict both the stress at which failure initiates and the mode of failure.

A decohesive constitutive equation for crack evolution is proposed to fill this need. The model displays a smooth transition in stress space from pure Mode II to mixed mode and, eventually, to a regime in stress space that is strictly Mode I which includes both uniaxial tension and uniaxial compression. Material parameters can be chosen to reflect either pure Mode I or pure Mode II failure for all failure states if warranted by experimental data.

The constitutive equation provides the stress at which failure initiates, the orientation of the normal to the crack surface, the mode of failure, and the governing equations for the evolution of crack development. A partially developed crack is represented through low values of evolution variables. Multiple intersecting cracks have been treated numerically. A side benefit of the formulation is that existing interfaces that are weak, such as interfaces and jointed rock, can be handled merely by presetting one of the evolution parameters to reflect a reduced strength.