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# Crack Nucleation and Propagation in Variational Models of Fracture

Lecture of

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**16. Januar 2020, 16.45 Uhr**

Okerhochhaus, Pockelsstraße 3,  
Seminarraum EG

Damage and fracture in brittle materials are associated to a loss of stiffness and an energy dissipation. These phenomena can be modelled as a minimisation problem on the sum of the elastic and the dissipated energies. This view led a fecund variational theory of fracture and to efficient numerical approximation methods based on variational regularisations. The regularised models share many similarities with phase-field models used in phase-transformation theories. Being characterised by a smeared representation of the crack set, they can be viewed as damage models introducing a gradient term on the damage variable and an internal length. In this talk, I will review the basis of the variational approach to fracture and show how variational gradient damage models can predict nucleation and propagation of crack in brittle solids with a minimal set of material parameters: the fracture toughness and the material strength. Applications to fracture of brittle ceramic and thin films under thermal loadings will be presented.