BSc./MSc. research project

[Computational damage mechanics]

EMMA
Efficient Methods for Mechanical Analysis
www.mechbau.uni-stuttgart.de/EMMA

Computational damage mechanics with gradient enrichment

Although ultimately of interest, the simulation of the damage and fracture of solids is challenging in many ways. First, the degradation of the material leads to (mathematically put) loss of ellipticity of the boundary value problem. In practice this means that simulations will not converge without applying (sometimes improper) numerical tweaks. Further, the results can depend (strongly) on the chosen discretization level and convergence with increasing mesh resolution is often non-monotonic (if any).

In order to render the simulation of materials undergoing damage more reasonable, gradient enriched continua have been used in the literature. In this BSc./MSc. project we would like to investigate the numerical implementation of gradient enriched materials. A simple isotropic degradation is first looked at. The fracture of simplified specimen geometries is aimed for in a first stage. Later this model could be used in order to predict the fracture onset and the crack propagation in microstructured materials.

(a) failure pattern of plain concrete beam

(b) failure pattern of FB-W1 concrete specimen

(c) failure pattern of FB-W2concrete specimen
J. Zhang; Z. Chen; X. Guo; W. Ma
I J Mat Sci App 5(1):31-35, 2016

experimental observations: fracture of concrete

Requirements

- programming skills (C/C++ and/or MATLAB)
- basic knowledge in numerical simulations
- interest in algorithmic developments

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