The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

A Hybrid High Order method for gradient damage models

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Keywords: *Hybrid High Order, Phase field fracture, Micromorphic approach*

The standard conforming finite element method suffers from volumetric locking when nearly- incompressible materials are considered, leading to spurious oscillations of the hydrostatic pressure. In order to circumvent this phenomenon, the recent HHO (Hybrid High Order) [2] method is considered. This method has several advantages over standard finite elements:

- it is robust to volumetric locking phenomena in primal formulation
- polyhedral elements are natively supported
- the displacements and the strains have the same approximation order

The HHO method is hybrid as it introduces cell unknowns and faces unknowns which live on the cell boundaries. In the spirit of discontinouous Galerkin methods, displacement can be discontinuous at the cell boundary. In this work, we derive a HHO formulation for coupled mechanical and gradient damage models [1, 3], and investigate the performance of both a phase field approach and a micromorphic approach.

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