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A Phase-Field Reliability Method for Modelling Quasi-Brittle Fracture

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Crack nucleation and growth in quasi-brittle materials like rocks, ceramics, or certain human tissues are influenced by the heterogeneity and the uncertainty of the material properties.

Among the different approaches to model fracture, phase-field models have recently gained popularity as they can predict complex crack behavior in both two and three dimensions [1]. It seems particularly promising to implement phase-field models in an isogeometric analysis framework due to the higher-order continuity.

Computer simulations cannot reproduce the crack phenomenon unless the material imperfections are incorporated in the mathematical model. Therefore the elastic, strength, and fracture parameters are modelled as stochastic properties and the midpoint method is adopted to represent stochastic fields.

In this work an efficient reliability finite element method which exploits the phase-field approach for brittle fracture has been developed. It performs better than investigations that are based on Monte Carlo methods, which are particular demanding in computational power [2].

Reliability finite element methods allow to keep the computational burden reasonable while giving a high accuracy of prediction. A benchmark of fracture in quasi-brittle materials is presented and the strenght/limitations of the methodology are identified.

REFERENCES

[1] de Borst R., Computational Methods for Fracture in Porous Media. 1st Edition, Isogeometric and Extended Finite Element Methods, Elsevier 2017, ISBN 9780081009178

[2] Carmeliet, J., and de Borst, R. (1995). Stochastic approaches for damage evolution in standard and non-standard continua. International Journal of Solids and Structures 32, 11491160. doi:10.1016/0020-7683(94)00182-V.