Scalar damage in 2D solids: a VEM formulation

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Abstract

This work is devoted to the study of a first order virtual element approach for modeling the strain-softening response of quasi-brittle materials, such as concrete, rocks or ceramic materials [1]. In the context of a 2D formulation, virtual elements of arbitrary shapes, including concave geometries and hanging nodes, are implemented.
We aim to test the effectiveness of the VEM in dealing with highly localized strains due to material instabilities, typically exhibited by such types of materials undergoing severe loading conditions. The method is based on minimization of an incremental energy expression, [2],[3], with a novel construction of the stabilization energy properly modified to deal with the isotropic elasto-damage model. Two regularization techniques, either based on local or non-local approaches, are used to overcome the well-known spurious mesh sensitivity problems, that occurs in numerical computations when, in the presence of softening behavior, the governing differential equations may loose ellipticity thus, resorting to ill-posed boundary value problems. Numerical examples include a non-uniform tensile test, a three-point bending test on a concrete beam, and, finally, a splitting test of a granite cylindrical specimen.

Keywords: **VEM, Stabilization, Isotropic damage, Regularization techniques**

References

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