A Hybridizable Discontinuous Galerkin phase-field model for brittle fracture with adaptive refinement

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ABSTRACT

Phase-field models for brittle fracture require high spatial resolution near cracks to approximate properly solutions with small length-scale parameters [1, 3]. The use of extremely fine meshes and the need of remeshing as cracks propagate imply a high computational cost, which motivates the use of a dynamic refinement approach.

In this work, we propose a Hybridizable Discontinuous Galerkin (HDG, [2]) formulation for the quasi-static hybrid phase-field model for brittle fracture in [1]. This formulation enables the straightforward definition of an adaptive refinement strategy locally near cracks with no need of remeshing. The adaptivity process is naturally handled by the method and can be easily implemented from the HDG code due to the use of element-by-element discontinuous basis functions to approximate the solution.

Figure 1 shows an HDG discretization for adjacent elements with different approximation bases in the case of *p*-adaptivity. In Figure 2, we see the damage field obtained for a certain load step in the L-shaped panel test, when using a coarse uniform mesh. White lines frame the elements of the mesh which are refined, in this case by means of *h*-adaptivity.

Different numerical examples regarding both *p* and *h*-adaptivity will be presented.

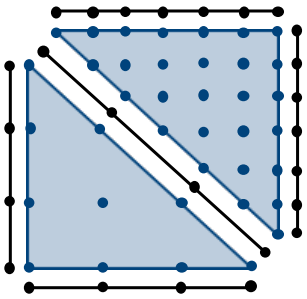

Figure 1: Example of an HDG discretization with *p*-adaptivity.

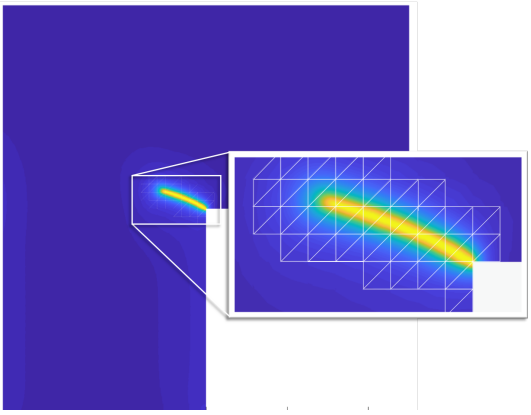

Figure 2: L-shaped panel test with *h*-adaptivity.

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