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CRACK PROPAGATION IN FINITE ELEMENTS AUGMENTED WITH EMBEDDED INTERPHASES

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In the FE analysis of quasi-brittle materials, one of the main issues is how to correctly capture cracks propagation. In particular, under specific load intensity, strains progressively localize in narrow bands, leading to a global nonlinear softening response until collapse.

A variety of FE models have been proposed, which may be separated in two main groups: discrete crack models and continuous models. Discrete crack models introduce a discontinuity along the inter-element boundaries or inside elements (intra-element discontinuity). Continuous models modify the constitutive relations of the local material to better describe its behaviour in presence of a fracture.

In the framework of intra-element discrete crack models, in this work we propose a strategy based on the Augmented Finite Element Method (A-FEM). A localization band is assumed to form inside an element and is modelled through a zero-thickness interphase model (IPH). Consequently, the original element is divided in two elastic sub-elements with an interposed nonlinear IPH element, governed by an elastic-damaging constitutive relation. The additional degrees of freedom introduced to decompose the cracked element are condensed at the equilibrium level, therefore are not present at the global level, as for the embedded crack models.

Examples are reported to illustrate the main features of the adopted strategy, among which the absence of a global remeshing phase, mesh independency on the results, and versatility of the model in simulating different benchmark cases.

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