An embedded crack in a constant strain triangle utilizing extended finite element concepts - DTU Orbit (05/12/2018)

An embedded crack in a constant strain triangle utilizing extended finite element concepts
This paper revisits the formulation of the CST element with an embedded discrete crack taking advantage of the direct formulations developed within the framework of the extended finite element method, XFEM. The result is a simple element for modeling cohesive fracture processes in quasi-brittle materials. The element is easily fitted a standard FEM code, and as such it is an alternative to more cumbersome XFEM elements which require special d.o.f.’s and extra administration. The crack description is embedded, in the sense that extra d.o.f.’s controlling the crack opening are eliminated at the element level. The cracked element is stress-compatible in the sense that stresses are continuous across the crack. A special shape function is introduced to allow for the discontinuous displacements without eradicating the stress compatibility. The simplicity of the element comes at the cost of inter-element discontinuity of displacements. The formulation is based on a variational principle of virtual work involving only the interpolation of displacements. The good performance of the element is demonstrated through the comparison with three benchmark tests in which a single crack is propagated: The center cracked sheet in uni-axial tension, the three-point bending test and the four-point shear beam test.

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