An embedded crack in a constant strain triangle utilizing extended finite element concepts - DTU Orbit (17/04/2019)

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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.

General information
Publication status: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Olesen, J., Poulsen, P.
Pages: 1-9
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Computers & Structures
Volume: 117
ISSN (Print): 0045-7949
Ratings:
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.01 SJR 1.69 SNIP 2.399
Web of Science (2013): Impact factor 2.178
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Original language: English
Keywords: Fracture mechanics, Discrete crack modeling, Cohesive crack, Embedded crack
Electronic versions:
dcst_cas.pdf
DOIs:
10.1016/j.compstruc.2012.11.006
Source: dtu
Source-ID: n:oai:DTIC-ART:compendex/377911912::25498
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review