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A COMPARISON BETWEEN GFEM AND AN EMBEDDED DISCONTINUITY APPROACH

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ABSTRACT

In this paper, two different approaches available for the numerical modelling of strong discontinuities are analysed: the discrete strong discontinuity approach (DSDA) [1,2], which is based on an embedded discontinuity formulation, and the generalized finite element method (GFEM) [3,4].

The main characteristics of the DSDA are: (i) the use of a consistent variational formulation in which the traction continuity condition is enforced in a weak sense, (ii) additional global degrees of freedom, which are located at the discontinuity, (iii) a non-homogeneous jump field within each parent finite element and (iv) a kinematical enrichment of the parent element in which the jumps are transmitted to the element nodes as a rigid body motion.

The generalized finite element method is a nodal enrichment formulation, in which the additional global degrees of freedom are located at the nodes belonging to the elements crossed by the discontinuity. As a consequence, more additional degrees of freedom are needed than in the DSDA.

Oliver et al. performed a comparative analysis between the computational performance of the non-symmetric embedded formulation and the GFEM [5]. In this work, another comparison is presented, between the DSDA and the GFEM. First, both formulations are reviewed in a common variational framework. Next, the finite element approximation and the discretised equations are obtained. Some element examples are computed both in mode-I and mode-II fracture, in which the discontinuity is assumed parallel and inclined with respect to the finite element edges. Some structural examples are also presented, in which mixed-mode fracture is also taken into account. Some conclusions are drawn on the advantages and disadvantages of using either the DSDA or the GFEM in the scope of the strong discontinuity framework. Finally, the possibility of enhancing the kinematics of the *standard* DSDA is also addressed.

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