Mathematics > Numerical Analysis

Integrating strong and weak discontinuities without integration subcells and example applications in an XFEM/GFEM framework

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Partition of unity methods, such as the extended finite element method (XFEM) allow discontinuities to be simulated independently of the mesh [1]. This eliminates the need for the mesh to be aligned with the discontinuity or cumbersome re-meshing, as the discontinuity evolves. However, to compute the stiffness matrix of the elements intersected by the discontinuity, a subdivision of the elements into quadrature subcells aligned with the discontinuity is commonly adopted. In this paper, we use a simple integration technique, proposed for polygonal domains [2] to suppress the need for element subdivision. Numerical results presented for a few benchmark problems in the context of linear elastic fracture mechanics and a multi-material problem, show that the proposed method yields accurate results. Owing to its simplicity, the proposed integration technique can be easily integrated in any existing code.

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