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An Energy Conserving Scheme for Time Dependent Problems Using the Extended Finite Element Method

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Lots of techniques have been developed to take into account discontinuities such as cracks, holes or material interfaces. The eXtended Finite Element Method (X-FEM) for example has first been presented for crack modeling but is also used for arbitrary discontinuities. This paper proposes, with a proof of stability for the numerical scheme in the linear case, a generalization of X-FEM for time dependent problems with an application to dynamic crack propagation. An enrichment strategy is developed to satisfy conditions obtained from a theoretical study. This strategy is energy preserving and satisfies the same stability conditions as Newmark type schemes. Numerical results reveal the advantage of X-FEM which avoids numerical problems due to remeshing and projections. This framework is still valid for other time dependent problems and this general enrichment strategy should be applicated to arbitrary moving discontinuities.

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