

PROCEEDINGS

A Local to Global (L2G) Finite Element Method for Efficient and Robust Analysis of Arbitrary Cracking in 2D Solids

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ABSTRACT

P This paper presents and validates a new local to global (L2G) FEM approach that can analyze multiple, interactive fracture processes in 2D solids with improved numerical efficiency and robustness. The method features: 1) forming local problems for individual and interactive cracks; and 2) parallel solving local problems and returning local solutions as part of the trial solution for global iteration. It has been demonstrated analytically (through a simple 1D problem) and numerically (through several benchmarking examples) that, the proposed method can substantially improve the robustness of the global solution process and significantly reduce the costly global iteration for convergence. The demonstrated improvement in numerical efficiency is up to 20 ~ 40% for mildly unstable problems. For problems with severely unstable crack initiation and propagation, the improvement can be more significant. This new method is readily applicable to other popular methods such as the extended FEM (X-FEM), Augmented FEM (A-FEM) and Phantom-node method (PNM).

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