

Extended finite element method with gradient weighted technique for fracture analysis

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Abstract

In this study, a gradient weighted extended finite element method (GW-XFEM) is presented for the analysis of linear fracture problems, which aims to further improve the performance of standard XFEM. In the GW-XFEM, the domain discretization is the same as standard XFEM. However, the gradient field is constructed by considering influences of element itself and its adjacent elements. Based on Shepard interpolation, the weighted strain field can be obtained, which will be utilized to construct discretized system equations. The solution procedures are straightforward and can be easily implemented based on existing XFEM codes. In addition, no penalty parameters or additional degrees of freedom are involved. The validity of presented method is fully investigated through several numerical examples. From these results, it is shown that the GW-XFEM can achieve much better accuracy, efficiency and higher convergence when dealing with linear fracture analysis.

Keywords: Numerical method, XFEM, Linear fracture, Shepard interpolation.