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Adaptive Combined Discrete and Finite Element Algorithm for Analyzing Brittle Fracture

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The two-dimensional adaptive combined discrete and finite element algorithm is expanded to analyze the general three-dimensional fracture procedure of brittle materials. In this approach a system is completely discretized into the finite elements at the initial moment without any discrete element generated until part of the finite elements becoming severely deformed; and then each finite element, whose maximum tensile stress exceeds a user-specified criterion, named the conversion stress, is converted into eight spherical discrete elements while the system is fragmented into two subdomains, the finite element (FE) and the discrete element (DE) subdomains. The brittle fracture procedure is captured by using an extrinsic cohesive fracture model only in the DE subdomain. Two simple cases are calculated by using the adaptive algorithm and a good agreement is achieved with the experimental results to validate its effectiveness while the adaptive algorithm has a higher efficiency than the pure DEM.

Keywords: Combined algorithm, Discrete element method, Cohesive model, Brittle fracture