Meso-scale fracture modelling of concrete using a finite element-scaled boundary finite coupled method

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Abstract

This study develops a method coupling the finite element method (FEM) and the scaled boundary finite element method (SBFEM) for meso-scale fracture modelling of concrete. In the model, the material heterogeneity is characterised by randomly generated aggregates and cement, and the cement is assigned as FEM element while the aggregates are treated as SBFEM subdomains. Nonlinear cohesive interface elements with normal/shear traction-separation constitutive laws are embedded within cement and on aggregate-cement interfaces to simulate potential cracks. The resultant nonlinear equation system is then solved by local arc-length controlled solvers. The tensile failure behaviour of an L-specimen is simulated. The result shows good qualitative and quantitative agreement with experimental observations and simulations from literatures.

Keywords: Finite element method, Scaled boundary finite element method, Meso-scale modelling of concrete, Cohesive crack model, L-specimen