Dynamic Fracture Simulation of Concrete Using an extended Virtual Internal Bond Model

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Abstract

A multi-scale virtual internal bond (VIB) model for isotropic materials has been recently proposed to describe material deformation and fracture under static and dynamic loading situations. Fracture simulation using an isotropic VIB model, is made possible by incorporating a cohesive type law, inspired by atomistic-level interaction among particles into a hyper-elastic framework at the continuum level. Thus, fracture is built directly into the constitutive formulation. The numerical implementation of the material model for brittle materials, into a finite element scheme and the determination of model parameters was described in detail earlier.

In this research, the isotropic model is applied to the dynamic fracture simulation of plain concrete. An extension of the originally proposed model using both tension and shear potentials is presented in order to incorporate the effects of the elastic modulus and Poisson's ratio. The experimental study on the dynamic tensile failure of concrete by Gran *et al*. is used to determine the VIB material parameters for plain concrete. Simulations and results of comparisons with the concrete-VIB model with the experimental results are presented in this paper.

Keywords: Cohesive model, concrete dynamic fracture, crack propagation, finite elements.