A TWO-SCALE MODEL OF STIFFNESS FOR 1D TENSILE CRACK OPENING, CLOSURE AND HEALING

Chloé ARSON
School of Civil and Environmental Engineering, Georgia Institute of Technology
790 Atlantic Drive, Atlanta GA 30332-0355, USA, e-mail: chloearson@ce.gatech.edu
Center for Tectonophysics, Texas A&M University

ABSTRACT

A thermodynamic framework is proposed to model crack opening, closure and healing for one single crack embedded in a solid matrix. The model combines principles of Continuum Damage Mechanics (CDM), Linear Fracture Mechanics (LEFM) and Diffusive Mass Transfer (DMT). The formulation requires a full coupling of properties defined at the crack scale and at the scale of the Representative Elementary Volume (REV). The framework can readily be adapted to diffuse damage induced by a set of identical parallel micro-cracks. The model is expected to be of interest in many problems of cracking and healing encountered in civil engineering structures built in cement-based materials.

Keywords
Stiffness, crack opening, damage, crack closure, unilateral effects, crack healing, mechanical recovery, Representative Elementary Volume, multi-scale