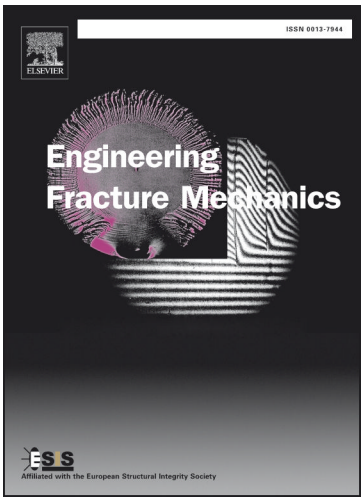

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PII: S0013-7944(17)30821-4
DOI: https://doi.org/10.1016/j.engfracmech.2017.10.019
Reference: EFM 5722

To appear in: *Engineering Fracture Mechanics*

Received Date: 7 August 2017
Revised Date: 19 October 2017
Accepted Date: 20 October 2017

Please cite this article as: Gao, Z., Zhang, L., Yu, W., A nonlocal continuum damage model for brittle fracture, *Engineering Fracture Mechanics* (2017), doi: https://doi.org/10.1016/j.engfracmech.2017.10.019

A nonlocal continuum damage model for brittle fracture

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Abstract

The objective of this paper is to develop a nonlocal continuum damage model for brittle fracture. A nonlocal damage conjugate force tensor is obtained from the "local" one, using an integral-type regularization technique, and the thermodynamic equations are formulated in a nonlcally generalized standard manner. A nonlocal damage model is developed based on a recently developed "local" model, which can rigorously handle damage anisotropy, distinct tensile and compressive damage behavior, and damage deactivation, so that the nonlocal model not only handles brittle fracture well but also possesses the advantageous features of the "local" model. A fully explicit integration scheme for the present model is developed and then implemented in Abaqus/Explicit via VUMAT. The present model is validated through: 1. simulating cyclic uniaxial tests on a SiC–SiC woven composite; 2. calibrating its associated material parameters via single edge notched bend (SENB) tests on concrete beams. Its versatility is demonstrated through simulating a mixed-mode fracture test on a double edge notched (DEN) specimen. It is found to be capable of producing realistic fracture paths and capturing size effects in real materials. A wide variety of mechanical behavior can be incorporated into the present model in the future.

Keywords:
integral-type, damage anisotropy, explicit integration scheme, fracture path, size effect

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