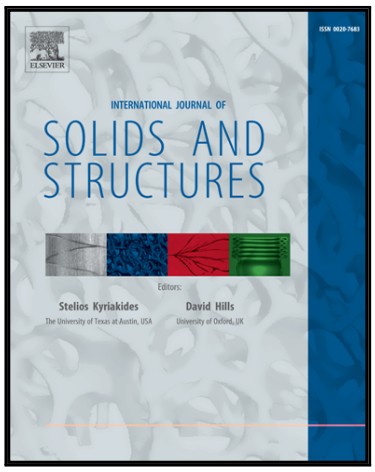

Maximum Mean Principal Stress Criterion for Three-Dimensional Brittle Fracture

J. Wang , L. Ren , L.Z. Xie , H.P. Xie , T. Ai

PII: S0020-7683(16)30300-6
DOI: 10.1016/j.ijsolstr.2016.10.009
Reference: SAS 9331

To appear in: *International Journal of Solids and Structures*

Received date: 11 May 2016
Revised date: 9 October 2016
Accepted date: 16 October 2016

Please cite this article as: J. Wang , L. Ren , L.Z. Xie , H.P. Xie , T. Ai , Maximum Mean Principal Stress Criterion for Three-Dimensional Brittle Fracture, *International Journal of Solids and Structures* (2016), doi: 10.1016/j.ijsolstr.2016.10.009

Maximum Mean Principal Stress Criterion for Three-Dimensional Brittle Fracture

J. Wang[a,b], L. Ren[a,b*], L.Z. Xie[a], H.P. Xie[a] and T. Ai[a,b]

[a] MOE Key Laboratory of Energy Engineering Safety and Disaster Mechanics, Sichuan University, Chengdu, 610065, China

[b] School of Architecture and Environment, Sichuan University, Chengdu 610065, China

Abstract Cracks encountered in engineering structures are typically three dimensional, and the fracture mechanism remains unclear because of the superimposed stresses induced by mixed-mode I/II/III loading. This paper introduces a general 3D mixed-mode fracture criterion based on the maximum mean principal stress (MMPS) by introducing the concept of a characteristic fracture length that is related to the material tensile strength. This criterion has clear physical significance, a systematic mathematical expression and a wide scope of applications to estimate both the in- and out-of-plane fracture angles and fracture strength. The proposed criterion is validated for all mixed-mode conditions (I/II, I/III and II/III) and is compared with several widely used criteria based on experimental results reported in previous studies. Good agreement is achieved in terms of the fracture angles and, in particular, the fracture strength between the results predicted by the new criterion and the experimental results of various brittle materials.

Keywords: 3D Fracture criterion; Mixed-mode loading; Mean stress; Characteristic fracture length.

*Corresponding author. Tel.: +86 15928042556.

E-mail address: renli-scu@hotmail.com.