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Scaling effect on the fracture toughness of bone materials using MMTS criterion

Javad Akbardoost^{a*}, Reza Amirafshari^a, Omid Mohsenzade^a, Filippo Berto^b

^aDepartment of Mechanical Engineering, Faculty of Engineering, Kharazmi University, Mofatteh Avenue, P.O. Box 15719-14911, Tehran, Iran.

^bdepartment of mechanical engineering, Norwegian university science and technology, Richard birkelands vei 2b, 7491 Trondheim, Norway.

*Corresponding author: J. Akbardoost, Tel./Fax: +98 26-4569555. Akbardoost@khu.ac.ir

Abstract

The aim of this study is to present a stress based approach for investigating the effect of specimen size on the fracture toughness of bone materials. The proposed approach is a modified form of the classical fracture criterion called maximum tangential stress (MTS). The mechanical properties of bone are different in longitudinal and transverse directions and hence the tangential stress component in the proposed approach should be determined in the orthotropic media. Since only the singular terms of series expansions were obtained in the previous studies, the tangential stress is measured from finite element analysis. In this study, the critical distance is also assumed to be size dependent and a semi-empirical formulation is used for describing the size dependency of the critical distance. By comparing the results predicted by the proposed approach and those reported in the previous studies, it is shown that the proposed approach can predict the fracture resistance of cracked bone by taking into account the effect of specimen size.

Keywords: Size effect, fracture toughness, bone, critical distance, orthotropic media.

Abbreviations

K_{Ic} Fracture toughness

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