Accepted Manuscript

Local strain energy density to predict size-dependent brittle fracture of cracked specimens under mixed mode loading

F. Berto, M.R. Ayatollahi, T. Borsato, P. Ferro

PII: S0167-8442(16)30081-7
DOI: http://dx.doi.org/10.1016/j.tafmec.2016.07.004
Reference: TAFMEC 1724

To appear in: *Theoretical and Applied Fracture Mechanics*

Received Date: 10 April 2016
Revised Date: 17 June 2016
Accepted Date: 13 July 2016

Please cite this article as: F. Berto, M.R. Ayatollahi, T. Borsato, P. Ferro, Local strain energy density to predict size-dependent brittle fracture of cracked specimens under mixed mode loading, *Theoretical and Applied Fracture Mechanics* (2016), doi: http://dx.doi.org/10.1016/j.tafmec.2016.07.004

Local strain energy density to predict size-dependent brittle fracture of cracked specimens under mixed mode loading

F. Berto[a], M.R. Ayatollahi[b,*], T. Borsato[a], P. Ferro[a]

[a]Department of Management and Engineering, University of Padova, Stradella S. Nicola 3, 36100 Vicenza, Italy
[b]Fatigue and Fracture Research Laboratory, Center of Excellence in Experimental Solid Mechanics and Dynamics, School of Mechanical Engineering, Iran University of Science and Technology, Narmak 16846, Tehran, Iran

*Corresponding author: email: m.ayat@iust.ac.ir, phone: +98-21-77240201, fax: +98-21-77240488

Abstract

In this paper the SED-approach is applied to a set of experimental data reported in the literature. Data are referred to mixed mode fracture resistance of Guiting Limestone, a sedimentary soft rock. Two types of specimens have been investigated: cracked Brazilian disk (BD) specimens under diametral compression and edge cracked semicircular bend (SCB) specimens under three-point bend loading. To evaluate size dependent behavior, specimens characterized by four different radii were tested under different mode mixities.

To assess the static strength of cracked components the strain energy density (SED) criterion has been used. It is shown that this criterion can predict the size-dependent fracture behavior of Guiting Limestone. Critical experimental loads have been compared with the theoretical ones, estimated keeping constant the critical value of strain energy density (SED). The dimension of the control volume was found to be a function of specimen size and geometry.

Keywords: Rock fracture mechanics; size effects; strain energy density; mixed mode loading

1. Introduction

Rock structures such as tunnels, mines and embankments often contain cracks and discontinuities that can increase the risk of failure. In this type of material, due to the random orientation of defects, crack growth usually takes place under combined mixed mode I/II loading conditions. Cracked semi-circular bend (SCB) specimens subjected to flexural bending and center cracked Brazilian disk (BD) specimens subjected to diametral compression are often used to evaluate the fracture resistance of brittle materials.[1–9]. These type of specimens have