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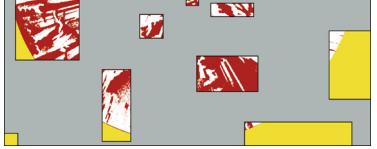

Material configurational forces applied to mixed mode crack propagation

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ABSTRACT.

The concept of material configurational forces is applied to predict the mixed mode crack propagation. A new fracture criterion based on the resultant of configurational forces (termed as C-force criterion) is proposed. The basic assumption is that the onset of crack growth occurs when the resultant of configurational forces reaches a critical value and the crack growth takes place in the direction of resultant configurational forces. An implementation of the configurational forces into the finite element is presented. The newly proposed C-force criterion is further validated through a series of examples. It is concluded that the predictions of mixed-mode crack propagation by C-force criterion are in good agreement with experimental data in the open literatures. In addition, an experimental procedure on evaluation the configurational forces is proposed by using the digital image correlation. It is demonstrated that the C-force criterion provides a more convenient and accurate procedure to predict the mixed mode crack propagation.

Keywords: material configurational forces, crack, criterion, digital image correlation

1. Introduction

Fracture behaviors of materials have been widely investigated concerning structural integrity, reliability, and functionality. The evaluation of both onset of crack growth and the crack growth direction involved in fracturing of materials necessitates an effective fracture criterion to indicate the instance when the onset of crack growth occurs and where the crack propagates. The well-known criteria within the framework of fracture mechanics of crack instability include the energy release rate G [11], the