FINITE FRACTURE MECHANICS CRITERION AT ELASTIC INTERFACES IN THE FEM PACKAGE ABAQUS APPLIED TO COMPOSITES

Luis Távara, María del Mar Muñoz-Reja and Vladislav Mantič

Grupo de Elasticidad y Resistencia de Materiales.
Escuela Técnica Superior de Ingeniería. Universidad de Sevilla
Camino de los Descubrimientos s/n, 41092. Sevilla - Spain
e-mail: ltavara@us.es, web page: http://www.germus.es

ABSTRACT

A procedure based on the Linear Elastic-(perfectly) Brittle Interface Model (LEBIM) combined with a Finite Fracture Mechanics (FFM) approach was successfully developed in a 2D Boundary Element Method (BEM) code [1]. In the present investigation the FFM coupled criterion is used together with the UMAT included in ABAQUS to obtain a new numerical tool with all the advantages of the previous BEM implementation, and including new advantages like (i) a graphical interface for the modelling, (ii) the possibility to use a much higher number of degrees of freedom, and (iii) reduce the calculation time (compared to BEM).

In the FFM framework, the applied load necessary to produce an interface debond is predicted through a coupled criteria based on: (i) the maximum stress produced in the interface and (ii) the energy released due to the debond onset in the adhesive layer. The LEBIM [2, 3] is implemented into the FEM package ABAQUS [4] through the user-defined subroutine UMAT. The FFM coupled criteria is programmed in a Python [5] environment, which is able call ABAQUS commands and solve different linear elastic scenarios, needed to apply the FFM criteria. Preliminary numerical results show a nice correlation of the results obtained with the present tool and those obtained with the BEM code.

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