11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

INVESTIGATING PATH DEPENDENCY IN MIXED-MODE FRACTURE BY USING COHESIVE ZONE MODELS

Erkan Oterkus[1]*, Cagan Diyaroglu[1], Dennj De Meo[1] and Carlos G. Dávila[2]

[1] Department of Naval Architecture and Marine Engineering
University of Strathclyde
100 Montrose Street, G4 0LZ Glasgow, United Kingdom
erkan.oterkus@strath.ac.uk
[2] NASA Langley Research Center
Hampton, VA, United States of America
carlos.g.davila@nasa.gov

Key Words: *Mixed-mode Fracture, Cohesive Zone Model, Path Dependency.*

Recent experimental investigations indicate that the process of mixed-mode fracture at a point initiates in a shear-dominated mode and then Mode I component gradually increases. This gradual change in the phase angle between shear and opening displacements that seems to occur in all mixed-mode fracture processes raises concerns about the ability of different cohesive models to predict the correct path histories which may yield incorrect energy dissipations during fracture.

In this study, one of the most widely used cohesive zone model (Turon, Camanho, Dávila model – TCD [1]) is investigated and its performance for mixed-mode fracture loading condition is analyzed. A new derivation of the TCD cohesive model from a potential function defined in a nondimensional space is presented. The necessary conditions for correct energy dissipation in the TCD model are given and the consequences of these conditions on the applicability of TCD model are highlighted. The derivation confirms that the TCD model is thermodynamically consistent and that it has the physically desirable attribute of being path-dependent. The mode-mixity predictions of TCD model for various test configurations are compared against experimental observations and the effect of path dependency is demonstrated.

Finally, some basic concepts related with mixed-mode fracture are reviewed critically, including the local and global mode-mixity definitions and the convergence of cohesive zone model formulation to Linear Elastic Fracture Mechanics (LEFM) formulation in the limiting case of the process zone size tending to zero.

REFERENCES

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