Finite Element solution of the fiber/matrix interface crack problem: convergence properties and mode mixity of the Virtual Crack Closure Technique

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Abstract

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1. Introduction

Bi-material interfaces represent the basic load transfer mechanism at the heart of Fiber Reinforced Polymer Composite (FRPC) materials. They are present at the macroscale, in the form of adhesive joints, at the mesoscale, as interfaces between layers with different orientations, at the microscale, i.e. the fiber-matrix interface. Bi-material interfaces have for long attracted the attention of researchers in Fracture Mechanics, due to their hidden complexity. The problem was first addressed in the 1950's by Williams [1], who derived through an asymptotic analysis the stress distribution around a crack between two infinite half-planes of dissimilar materials and found the existence of a strong oscillatory behavior in the crack tip's singularity of the form $r^{-\frac{1}{2}} \sin(A \log r)$.

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References

[1] M. L. Williams, The stresses around a fault or crack in dissimilar media, Bulletin of the Seismological Society of America 49 (2) (1959) 199.