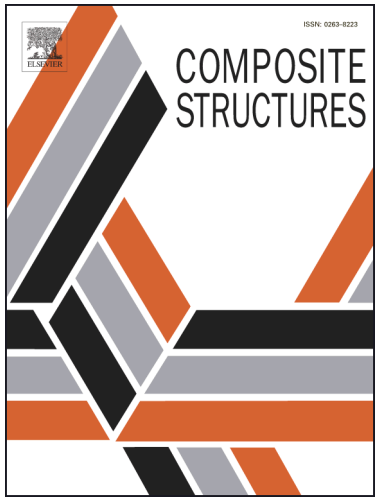

A numerical micro-mechanical study of the influence of fiber-matrix interphase failure on carbon/epoxy material properties

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A numerical micro-mechanical study of the influence of fiber-matrix interphase failure on carbon/epoxy material properties

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Abstract

A finite element micromechanical study of unidirectional carbon-epoxy system is performed in order to investigate the role of fiber-matrix debonding in the degradation of mechanical properties and in the onset of failure for this class of composite materials.

The presence of interphase flaws, that can be induced during the manufacturing processes, into micro-scale FE models is obtained by means of an original damage injection technique developed by the authors. The fibers are considered as transversally isotropic solids and the matrix is modeled as an isotropic, elasto-plastic, material with damage.

The effect of fiber-matrix debonding is analyzed by means of a quasi 3-D unitary cell with a single fiber, with periodic boundary conditions, for different loading cases. Subsequently, multi-fiber representative volume elements are investigated with the same boundary and loading conditions. Finally, the effect of a 3-D debonding propagation is studied via single fiber model with an increased fiber-wise depth.