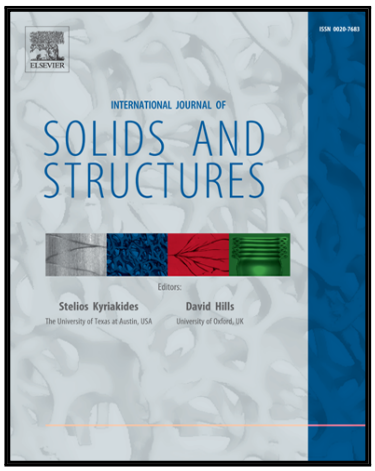

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Analysis of stress concentrations in transversely loaded steel-fiber composites with nano-reinforced interphases

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Abstract

Continuous steel fiber polymer composites are susceptible to high stress concentrations under transverse loading. This is due to the high mismatch in elastic properties of steel fiber and polymeric matrix. In the present work, the effect of a nano-reinforced interphase on the stress concentrations is evaluated. Three types of nano-reinforcements are considered: 1) carbon nanotubes (CNTs) grown on fibers and 2) graphene nano-plates deposited on the fiber surface and 3) graphene nano-plates randomly distributed in the matrix. The study is carried out using finite element (FE) analysis with an intermediate homogenization step to obtain elastic properties of the nano-reinforced interphase. These properties are calculated using an inclusion based approach. Results indicate that the presence of the nano-reinforced interphase increases radial stress concentrations and those in the direction of the load. The suppression is only observed for shear stress concentrations in the case of the CNT interphase around the fibers.

KEYWORDS