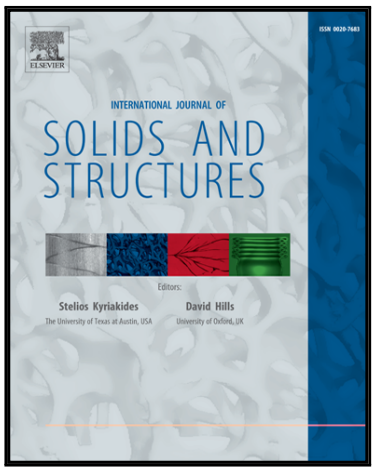

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Theodore V. Gortsas , Stephanos V. Tsinopoulos ,
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Strain gradient elasticity and size effects in the bending of fiber composite plates

Theodore V. Gortsas[1], Stephanos V. Tsinopoulos[2], Dimitrios Rodopoulos[1] and Demosthenes Polyzos[1(*)]

[1]Department of Mechanical Engineering & Aeronautics

University of Patras

Patras, GR-26500, Greece

[2]Department of Mechanical Engineering

Technological Educational Institute of Western Greece

Patras, GR-26334, Greece

(*) Author to whom correspondence should be addressed. Electronic mail: polyzos@mech.upatras.gr (D. Polyzos)

Abstract

The present work aims to examine whether strain gradient elastic theory is able to capture both positive and negative size effects appearing in the bending of unidirectional fiber composite plates. To this goal, the deflections of fiber composite plates subjected to a bending loading under plane strain conditions are numerically evaluated and compared to the corresponding ones provided by the bending of the same plates homogenized as gradient elastic materials. All the plates have the same dimensions and fiber volume fraction, while the radius of the embedded fibers gradually changes. Plates with up to 2352 periodically and randomly distributed cylindrical elastic fibers, embedded in a matrix medium, has been considered. The fibers are either harder or softer than matrix medium while the case of cylindrical cavities is also considered. Each of the considered problems is solved numerically through a Boundary Element method (BEM) supported by Adaptive Cross Approximation (ACA) techniques so that to be able to solve large-scale problems involved in the present study. The obtained results are demonstrated and commented.