Buckling Behavior of 3D Randomly Oriented CNT Reinforced Nanocomposite

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Abstract

In this paper, the influence of carbon nanotube (CNT) in a metal matrix on the buckling behavior of the resulting nanocomposite plate is studied. The Young's moduli of CNT reinforced nanocomposite are predicted first using the representative volume element (RVE) method. CNTs are considered to have the periodic spatial distribution in the RVE and their 3D orientations are randomized using COMSOL Multiphysics® Livelink™ for MATLAB® module. Thereafter, the effect of CNT reinforcement on the buckling behavior of simply-supported nanocomposite plate is predicted using the plate physics of COMSOL Multiphysics. The procedure to calculate the Young's modulus is verified by comparing the results of the single CNT reinforced RVE with the analytical solution obtained by the rule of mixtures. Buckling strength of the nanocomposite plate is also compared with the classical plate theory (CPT) based analytical result. It is concluded that the enhanced stiffness properties of the CNT-reinforced nanocomposite resulted in the increase of buckling strength of the nanocomposite plate.

Reference

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Figures used in the abstract

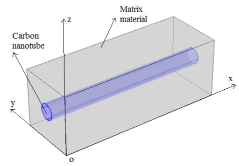

Figure 1: Single CNT RVE for the vf = 0.01.

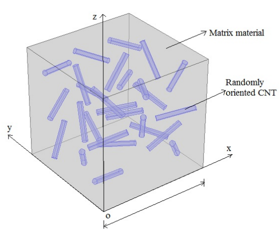

Figure 2: RVE consisting of randomly oriented and periodically distributed CNT for vf = 0.01.

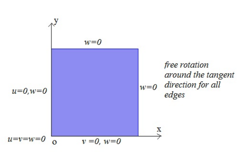

Figure 3: Boundary conditions for the all edges simply supported plate.

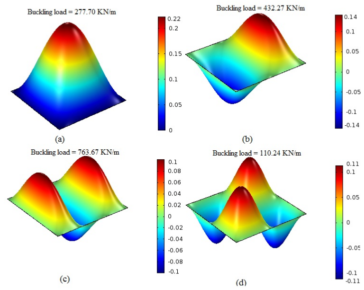

Figure 4: (a-d) First four mode shapes of CNT-Mg nanocomposites plate having 1% CNT reinforcement with a/h =50.