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Mohammad Arefi, Elyas Mohammad-Rezaei Bidgoli, Rossana Dimitri, Francesco Tornabene

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Free vibrations of functionally graded polymer composite nanoplates reinforced with graphene nanoplatelets

Mohammad Arefi [1], Elyas Mohammad-Rezaei Bidgoli [1],

Rossana Dimitri [2], Francesco Tornabene [3]*

[1]*Faculty of Mechanical Engineering, Department of Solid Mechanics, University of Kashan, Kashan, Iran*
[2]*Department of Innovation Engineering, Università del Salento, Lecce, Italy*
[3]*DICAM Department, School of Engineering and Architecture, University of Bologna, Bologna, Italy*

Abstract. A two-variable sinusoidal shear deformation theory (SSDT) and a nonlocal elasticity theory are applied in this paper to analyze the free vibration behavior of functionally graded (FG) polymer composite nanoplates reinforced with graphene nanoplatelets (GNPs), resting on a Pasternak foundation. Based on the proposed theory, the transverse deflection is assumed as summation of bending and shear transverse deformations. Four different FG reinforcement patterns are here employed, namely a uniform distribution UD, and non-uniform distributions FG-O, FG-X and FG-A. The effective elastic modulus, the Poisson's ratio and the density of composite nanoplates are computed using the Halpin-Tsai model and the rule of mixture, respectively. The numerical results are validated through a comparative assessment of the results with respect to predictions from literature, including nanoplates and FG polymer composite plates. A wide parametric investigation shows the influence of some significant parameters, such as nonlocal parameters, total number of layers, weight fraction, as well as parameters related to the Pasternak foundation and geometry, on the free vibration response of FG polymer composite nanoplates reinforced with GNPs.

Keywords: Composite nanoplate, Reinforcement, Graphene nanoplatelet, Two-variable sinusoidal shear deformation theory, Pasternak foundation.

[3] * corresponding author, *email address:* francesco.tornabene@unibo.it (Francesco Tornabene)