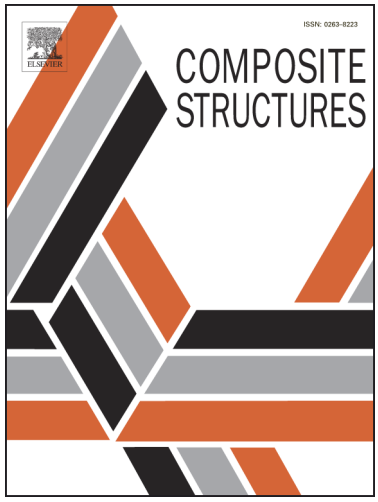

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Exact closed-form free vibration analysis for functionally graded micro/nano plates based on modified couple stress and three-dimensional elasticity theories

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Abstract

In the present manuscript, a model for static and vibration of functionally graded (FG) micro/nano plates is developed based on modified couple stress and three-dimensional elasticity theories. This three-dimensional model contains one length scale parameter to consider the small size effect. The equations of motion and boundary conditions are derived using Hamilton's principle. Analytical closed-form solutions are presented for both in-plane and out-of-plane free vibrations of simply supported plates. To obtain the analytical solutions, elasticity modulus and mass density are assumed to vary exponentially through the plate thickness, while Poisson's ratio and length scale parameter are set to constant values. Finally, some numerical results are presented and the effects of length scale parameter and material gradient index on the natural frequencies for FG micro/nano plates are discussed.

Keywords: Functionally graded plates, Modified couple stress theory, Three-dimensional elasticity, Free vibration, Analytical modeling

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