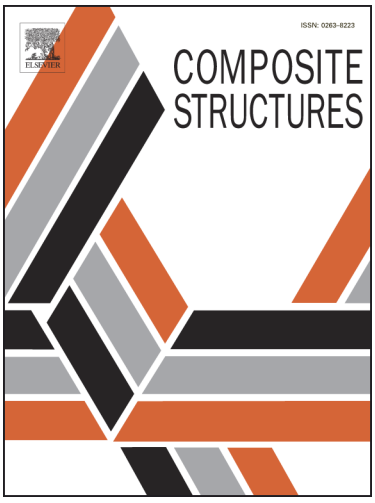

A three dimensional elasticity model for free vibration analysis of functionally graded micro/nano plates: modified strain gradient theory

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A three dimensional elasticity model for free vibration analysis of functionally graded micro/nano plates: modified strain gradient theory

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Abstract

The different applications of micro/nano scale structures increase daily, and using new developed theories accounting size-reduction effect can be useful to study mechanical behaviors of such structures. The size dependent theory of modified strain gradient is capable for considering micro/nano structures. In the current work a new model based on the modified strain gradient and three dimensional elasticity theories is developed for free vibration of functionally graded (FG) micro/nano plates, and an exact analytical solution is carried out for extracting the natural frequencies of it. The present three-dimensional elasticity model contains three length scale parameters. Analytical solution is based on the state space method. In order to achieve the analytical solution, the distribution of material properties through the plate thickness follows an exponential law. Finally, some exact numerical results are tabulated for both homogeneous and FG plates that can be used as an exact three dimensional elasticity benchmark for validate other two dimensional models.

Keywords: Functionally graded, Modified strain gradient theory, Three-dimensional elasticity, Free vibration, State space method.