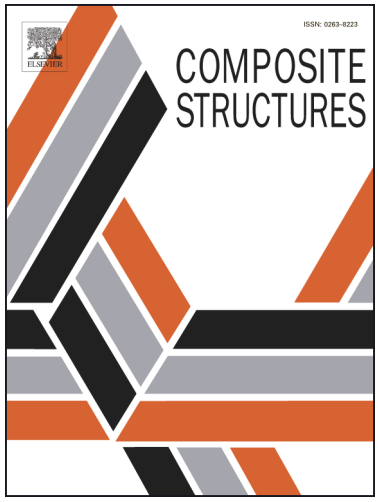

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Effects of neutral surface deviation on nonlinear resonance of embedded temperature-dependent functionally graded nanobeams

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Abstract

In this paper, forced vibration of functionally graded (FG) nanobeams resting on the nonlinear elastic foundations are investigated based on the nonlocal strain gradient theory. The material parameters of FG nanobeams are assumed to be temperature-dependent and change continuously along the thickness direction according to the power-law function (PFGM) or sigmoid function (SFGM). Based on the Euler–Bernoulli beam theory and von-Kármán geometric nonlinearity, the governing equations of motion are derived by considering the deviation between the geometrical and physical neutral surfaces. Closed-form approximate solution for nonlinear forced vibration of a FG nanobeam is derived by using multiple time scale method. The results show that decrease of non-homogeneity index and material length scale parameter, or increase of temperature variation and nonlocal parameter will increase the resonance frequencies of FG nanobeams. The effect of the in-coincidence of physical and geometrical neutral surfaces on the nonlinear resonance of the nanobeams could not be ignored, especially for SFGM nanobeams with larger non-homogeneity index and stronger size effects, embedded in a softer medium