عنوان مقاله:

Nonlinear Vibration Analysis of FG Nano-Beams in Thermal Environment and Resting on Nonlinear Foundation based on Nonlocal and Strain-Inertia Gradient Theory

محل انتشار:

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نویسنده:

Ebrahim Mahmoudpour - *Department of Mechanical Engineering, Islamic Azad University,Borujerd,Iran*

خلاصه مقاله:

In present research, nonlinear vibration of functionally graded nano-beams subjected to uniform temperature rise and resting on nonlinear foundation is comprehensively studied. The elastic center can be defined to remove stretching and bending couplings caused by the FG material variation. The small-size effect, playing essential role in the dynamical behavior of nano-beams, is considered here applying strain-inertia gradient and non-local elasticity theory. The governing partial differential equations have been derived based on the Euler-Bernoulli beam theory utilizing the von Karman strain-displacement relations. Subsequently, using the Galerkin method, the governing equations is reduced to a nonlinear ordinary differential equation. The closed form analytical solution of the nonlinear natural frequency is then established using the homotopy analysis method. Finally, the effects of different parameters such as length, nonlinear elastic foundation parameter, thermal loading, non-local parameter and gradient parameters are comprehensively investigated on the FG nano-beams vibration using homotopy analysis method. As the main results, it is observed that by increasing the non-local parameter, the frequency ratio for strain-inertia gradient theory has increasing trend while it has decreasing trend for non-local elasticity theory. Also, the nonlinear natural frequencies obtained using strain-inertia gradient theory are greater than the results of non-local elasticity and classical theory.

کلمات کلیدی:

FG Nano-beam, Homotopy Analysis Method, Nonlinear Foundation, Strain-Inertia Gradient Theory