

عنوان مقاله:

NONLINEAR FREE VIBRATION OF NANOBELMS WITH CONSIDERING SURFACE EFFECTS

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خلاصه مقاله:

A phenomenon that has attracted considerable attention is the size-dependent mechanical behavior of nanobeams due to surface effects. In traditional continuum mechanics the effect of surface energy is generally neglected. These size-dependent phenomena cannot be explained by the classical elastic theory, which plays an essential rule in the study of NEMS. Fortunately, it is found that the continuum model by incorporating surface elasticity can predict the same accurate elastic response of nanobeams as the case of atomistic modeling if the proper surface constitutive constants are used. In this article we consider a nanobeam and obtain the equation of motion based on classical Euler-Bernoulli beam theory. Also we used from linear relation between surface stress and the axial strain and the other related relations. As it is shown in the article the nonlinear free vibration of nanobeams in presence of surface is considered and the effect of surface elasticity is studied based on the Euler-Bernoulli beam theory. Natural frequency of the nanobeam is obtained for a fixed-free boundary condition and Influence of surface effects on the corresponding relations is taken in to account. In order to general behavior of the solution, a numerical example is considered, then for that particular constants the figures for normalized natural frequencies versus nanobeam length and vibration modes are derived. It should be noted here that the natural frequency is normalized with respect to the natural frequency without surface effects.

کلمات کلیدی:

free vibration; surface effects; nanobeams

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