

عنوان مقاله:

Nonlocal Analysis of Longitudinal Dynamic Behavior of Nanobars with Surface Energy Effect

محل انتشار:

مجله مکانیک سازه های پیشرفته کامپوزیت، دوره 6، شماره 2 (سال: 1398)

تعداد صفحات اصل مقاله: 12

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خلاصه مقاله:

Due to considerable stored energy in surfaces of nano-scales in comparison with the stored energy in their bulk, considering the surface energy is necessary for the analysis of various behaviors of nano-scales for more precise design and manufacturing. In this article, the longitudinal dynamic behavior of nanobars in the presence of the surface energy parameters is studied. To this end, the longitudinal dynamic behavior of nanobars is modeled based on the simple theory. To consider the effects of the surface energy parameters, the surface elasticity theory is used. In addition, the nonlocal elasticity theory is implemented to capture the size effect. Then, the governing equation of motion and corresponding boundary conditions are derived from Hamilton's principle. The governing equation becomes the inhomogeneous cause of considering the surface energy parameters while in none of the previous researches like the investigation of transverse vibration of nanobeams and torsional vibration of nanobars, the surface energy parameters would not cause inhomogeneity of the governing equation. Due to inhomogeneity of the governing equation, the homogeneous case is firstly solved, and frequencies and mode shapes of nanobar are obtained for fixed-fixed and fixed-free boundary conditions. Then, using the modal analysis method and Duhamel's integral, the inhomogeneous governing equation of motion is solved, and the overall dynamic response of nanobar is reported.

کلمات کلیدی:

Nanobar, Surface energy, Nonlocal elasticity theory, Longitudinal dynamic behavior, Simple theory

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