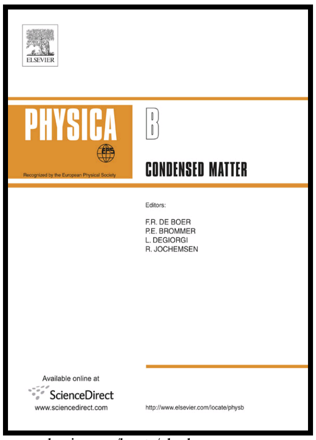

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Nonlocal and surface effects on the flutter instability of cantilevered nanotubes conveying fluid subjected to follower forces

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Abstract

On the basis of nonlocal elasticity theory, this paper studies the dynamic structural instability behavior of cantilever nanotubes conveying fluid incorporating end concentrated follower force and distributed tangential load, resting on the visco-Pasternak substrate. In order to improve the accuracy of the results, surface effects, i.e. surface elasticity and residual stresses are considered. Extended Hamilton's principle is implemented to obtain the nonlocal governing partial differential equation and related boundary conditions. Then, the extended Galerkin technique is used to convert partial differential equations into a general set of ordinary differential equations. Numerical results are expressed to reveal the variations of the critical flow velocity for flutter phenomenon of cantilever nanotubes with the various values of nonlocal parameter, mass ratios, nanotubes thickness, surface effects, various parameters of the visco-Pasternak medium, constant follower force and distributed compressive tangential load. Some numerical results of this research illustrated that the values of critical flutter flow velocity and stable region increase by considering surface effects. Also, critical flutter flow velocity decreases towards zero by increasing the value of the distributed compressive tangential load and constant follower force.

Keywords: Nanotube, Surface effects, Nonlocal effects, Follower forces, Flutter instability.