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**A size-dependent beam model for stability of axially loaded carbon nanotubes
surrounded by Pasternak elastic foundation**

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Abstract

Microstructure-dependent buckling behavior of single-walled carbon nanotubes (SWCNTs) surrounded by a two-parameter elastic foundation is investigated. The governing equations and corresponding boundary conditions in buckling are achieved by implementing minimum total potential energy principle via modified strain gradient theory and several beam theories. The resulting equations are analytically solved by employing Navier's solution procedure for simply supported boundary conditions. A detailed parametric study is performed to indicate effects of diameter-to-length scale parameter ratio, diameter-to-length ratio, shear deformation, shear correction factor and foundation parameters on buckling loads of SWCNTs. Numerical results reveal that the classical buckling loads evaluated by all shear deformation beam theories agree well with each other while a discrepancy occurs between the size-dependent buckling loads of parabolic beam theory (PBT), sinusoidal beam theory (SBT) and Timoshenko beam theory with proposed shear correction factor (TBT*), and those of Timoshenko beam theory (TBT).

Keywords: Size dependency; Carbon nanotube; Non-classical continuum theory; Stability; Sinusoidal beam theory; Pasternak foundation

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