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Title:Wave propagation in single-walled carbon nanotube under longitudinal magnetic field using nonlocal Euler-Bernoulli beam theory

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Abstract:In the present work, the effect of longitudinal magnetic field on wave dispersion characteristics of equivalent continuum structure (ECS) of single-walled carbon nanotubes (SWCNT) embedded in elastic medium is studied. The ECS is modelled as an Euler-Bernoulli beam. The chemical bonds between a SWCNT and the elastic medium are assumed to be formed. The elastic matrix is described by Pasternak foundation model, which accounts for both normal pressure and the transverse shear deformation. The governing equations of motion for the ECS of SWCNT under a longitudinal magnetic field are derived by considering the Lorentz magnetic force obtained from Maxwell's relations within the frame work of nonlocal elasticity theory. The wave propagation analysis is performed using spectral analysis. The results obtained show that the velocity of flexural waves in SWCNTs increases with the increase of longitudinal magnetic field exerted on it in the frequency range; 0-20. THz. The present analysis also shows that the flexural wave dispersion in the ECS of SWCNT obtained by local and nonlocal elasticity theories differ. It is found that the nonlocality reduces the wave velocity irrespective of the presence of the magnetic field and does not influences it in the higher frequency region. Further it is found that the presence of elastic matrix introduces the frequency band gap in flexural wave mode. The band gap in the flexural wave is found to independent of strength of the longitudinal magnetic field. © 2011 Elsevier Inc.

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Uncontrolled terms:Elastic matrix - Elastic medium - Equivalent continuum - Euler Bernoulli beam theory - Euler Bernoulli beams - Frame-work - Frequency ranges - Governing equations of motion - Higher frequencies - Longitudinal magnetic fields - Lorentz - Magnetic force - Nonlocal - Nonlocal elasticity - Nonlocalities - Normal pressure - Pasternak foundation - Transverse shear deformation - Wave dispersion - Wave velocity

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