عنوان مقاله:

Vibrations of piezoelectric microbeams reinforced by carbon nanotubes in electrical and magnetic fields on viscoelastic foundation using sinusoidal shear deformation theory

محل انتشار:

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خلاصه مقاله:

This paper presents a nonlocal sinusoidal shear deformation beam theory (SSDT) for vibration of piezoelectric polymeric microbeams made from polyvinylidene fluoride (PVDF) reinforced by carbon nanotubes under magnetic field and electrical field are of particular interest to researchers. The piezoelectric microbeam is subjected to an applied voltage. The microbeam is reinforced by carbon nanotubes (CNTs). Using Maxwell's equations, The dimensionless governing equations pertinent to the vibration of a microbeam due to a generalmagnetic field were derived. The microbeam is modeled as an elastic environment containing visco Winkler and visco Pasternak modules. Using representative volume element (RVE) based on micromechanical modeling, mechanical and electrical characteristics of the equivalent composite were determined. The present model is capable of capturing both small scale effect and transverse shear deformation effects of microbeams, and does not require shear correction factors. Based on the nonlocal differential constitutive relations of Eringen, the equations of motion as well as the boundary conditions of the beam arederived using Hamilton's principle. Analytical solutions for natural frequency are presented for a simply supported beam. The comparison firmly establishes that the present beam theory can accurately predict thevibration responses of short microbeams where the small scale and transverseshear deformation effects are significant.

کلمات کلیدی:

Vibration, Beam, Magnetic field, Piezoelectric, Viscoelastic, Sinusoidal