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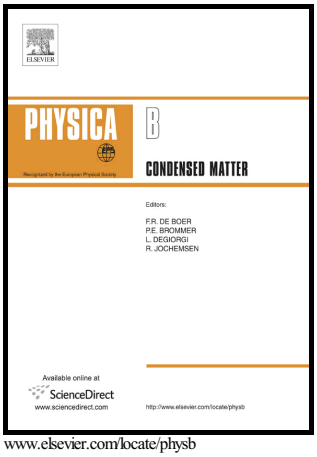

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Investigation of the longitudinal magnetic field effect on dynamic response of viscoelastic graphene sheet based on sinusoidal shear deformation theory

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Abstract

This research aims to investigate the influence of a longitudinal magnetic field on the dynamic response of single-layered graphene sheet (SLGS) resting on viscoelastic foundation based on the nonlocal sinusoidal shear deformation theory. The present model is capable of capturing both small scale effect and transverse shear deformation effects of nanoplate, and does not require shear correction factors. The material properties of graphene sheet are assumed orthotropic viscoelastic using Kelvin-Voigt model. Utilizing Hamilton's principle governing equations of motion are derived and solved analytically. The parametric study is conducted, focusing on the remarkable effects of the magnetic field, structural damping, stiffness and damping coefficient of the foundation, nonlocal parameter, aspect ratio and length to thickness ratio on the dynamic response of the SLGS. Results indicate that the longitudinal magnetic field exerted on the SLGS decreases the amplitude of dynamic response. In addition, it is observed that the magnetic field effect on the dynamic response is more distinguished as the nonlocal parameter increases while by increasing the foundation and structural damping coefficients, this effect diminishes. The results of this study can be used in design and manufacturing of nanomechanical devices in the presence of magnetic field as a parametric controller.

Keywords: Dynamic response, Magnetic field, Graphene sheet, Nonlocal sinusoidal shear deformation plate theory, Structural and external damping.

1. Introduction

Graphene, firstly discovered by Novoselov et al. [1] in 2004, is an interesting material for nano-electro-mechanical systems (NEMS) due to its excellent properties including high mechanical