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Effect of Nonlocal Elasticity on Vibration Analysis of Multi-Layer Graphene Sheets Using Sandwich Model

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Abstract

The essence of nonlocal elasticity for vibration analysis of multi-layer graphene sheets (MLGSs) is investigated in the following study. The van der Waals interactions of every two adjacent layers are considered in analysis which results in interlayer shear effect. The proposed formulation is according to sandwich model (SM). Molecular Dynamic (MD) simulation is implemented to verify our model. We present an investigation to obtain the consistent values for SM parameters to comply with MD results. Afterward, the SM is integrated with nonlocal elasticity. The new calibrated values for nonlocal parameter lead to the best conformity of nonlocal SM with MD.

Keywords: *Graphene sheets, Nonlocal elasticity, Sandwich model, Vibration analysis, Interlayer shear effect; Molecular dynamics*

1. Introduction

In the past few years, the study of properties of graphene and its mechanical behavior has been rapidly increasing. Because of astonishing material properties, graphene is the best material for design and development of nanoelectromechanical systems (NEMS) in which graphene NEMSs hold promise as extremely good detectors of mass, force and charge. Graphene is a two-dimensional grid of carbon atoms arranged in hexagons flattened to form a sheet. When sheets of graphene contact, they bonded together by weak van der Waals (vdWs) forces and a multilayer graphene sheet (MLGS) is born. Static and dynamic behaviors of MLGS will change since the weak interlayer vdWs bindings cause considerable changes in electrical and mechanical properties of MLG structures [1, 2]. For sensors and actuators based on a resonant mechanism, frequencies for the eigen-modes are pivotal, since the changes in resonant frequencies under

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