Nonlinear free vibration of a bilayer graphene nanoribbon with interface shear effect

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Abstract

The nonlinear free vibration of a bilayer graphene nanoribbon with interface shear effect is investigated. Each nanoribbon is assumed to have Euler-Bernoulli kinematics, and a nonlinear tangential spring model, which allows nonlinear elastic tangential slip between adjacent layers but guarantees perfect adherence in the transversal direction of the bilayer nanoribbon and is the unique source of nonlinearity, is adopted to examine the interface shear effect. The equations governing the nonlinear free vibration are derived by the Hamiltonian principle. The multiple time scale method, which is a useful mathematical tool for analytical, although approximate, computation of the nonlinear effects, is applied to solve the resulting equations. The linear and nonlinear natural frequencies under different boundary conditions are computed explicitly.

Keywords: Bilayer graphene nanoribbon, Nonlinear interface, Multiple time scale method, Free vibrations