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Vibration Behavior of Nanoparticle Delivery in a Single-Walled Carbon Nanotube Using Nonlocal Timoshenko Beam Theory

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Abstract : In the paper, the coupled equation of motion for the dynamic displacement of a fullerene moving in a (10,10) single-walled carbon nanotube (SWCNT) is derived using nonlocal Timoshenko beam theory, including the effects of rotary inertia and shear deformation. The effects of confined stiffness between the fullerene and nanotube, foundation stiffness, and nonlocal parameter on the dynamic behavior are analyzed using the Runge-Kutta Method. The numerical solution is in agreement with the analytical result for the special case. The numerical results show that increasing the confined stiffness and foundation stiffness decrease the dynamic displacement of SWCNT. However, the dynamic displacement increases with increasing the nonlocal parameter. In addition, result using the Euler beam theory and the Timoshenko beam theory are compared. It can be found that ignoring the effects of rotary inertia and shear deformation leads to an underestimation of the displacement.

Keywords : single-walled carbon nanotube, nanoparticle delivery, Nonlocal Timoshenko beam theory, Runge-Kutta Method, Van der Waals force
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