ABSTRACT

In the upcoming era, nanotechnology is becoming the essential part in the field of science, engineering and technology. Carbon nanotubes are the building blocks in this technological advancement. Regarding the analysis of the structural behavior of carbon nanotubes, nonlocal elasticity is found to be a highly effective means to predict exact results as it regards the small scale effect in the analysis.In this thesis, in particular, problems related to the analysis of structural response of carbon nanotubes via nonlocal elasticity have been investigated following a pair of chapters covering an introduction and detailed mathematical formulation (Chapters 1 and 2).

Thermal effects on the structural responses of carbon nanotubes based on nonlocal and thermal elasticity have been investigated (Chapter 3). The finite element approach is considered to solve the governing differential equations. Simply supported boundary condition is considered. The analysis includes Timoshenko beam theory. Influences of carbon nanotube geometrical properties (length, diameter and thickness), nonlocal parameter and environmental temperature change on the structural response of the carbon nanotubes are studied.

Small scale effect of carbon nanotubes in the radial direction is considered via the concept of radial nonlocal effect in the analysis of structural response of carbon nanotubes (Chapter 4). Finite element analysis, includingthe radial nonlocal effect is carried out to analyze the buckling and vibration response of carbon nanotubes considering simply supported boundary condition. It is found that there is a significant influence of the nonlocal parameter on the radial structural response of carbon nanotubes. The influence of the nonlocal parameter in the radial direction is defined as radial nonlocal effect. The radial nonlocal effect is also observed for the carbon nanotubes with four different sets of boundary conditions. Further, the radial nonlocal effect on the vibration response of carbon nanotubes supported on Winkler foundation has been studied and reported.

A study on the transverse vibration response of single-layered graphene sheets under magneto-thermal environment considering nonlocal plate theory has been carried out considering simply supported boundary condition (Chapter 5). Differential quadrature method is employed to solve the governing differential equation. Influence of geometrical properties, nonlocal parameter, in-plane magnetic field and environmental temperature change on the vibration characteristics of single-layered graphene sheets are also studied and reported.

KEYWORDS

Bending, Buckling and Vibration; Carbon nanotubes; Differential quadrature method; Finite element method; Graphene sheets; Lorentz force; Magneto-thermal environment; Magnetic field; Nonlocal elasticity; Radial nonlocal effect; Thermal elasticity; Timoshenko beam theory; Winkler foundation.