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BAND STRUCTURES IN CARBON NANOSTRUCTURE PHONONIC CRYSTALS

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During the last few years many researches have been interested in the field of wave propagation in periodic structures called phononic crystals (PCs). The PCs are characterized by presenting heterogeneous inclusions with periodic distribution. Due to its periodic structure, some frequency ranges may exist where elastic waves are forbidden to propagate (band gaps). In this study we have investigated the band structure of elastic waves propagating in an inhomogeneous isotropic elastic medium reinforced by carbon nanostructures arranged periodically in a square and hexagonal lattice. We also studied the influence of the carbon nanostructures geometry – nanotube, nanowire, nanorod, and nanowire and nanorod of square cross sections – and the filling fraction in the PC band structure. The wave equation ignoring microscopic size effects and considering in-plane and transverse vibrations is solved using the plane wave expansion (PWE) method. The complete band gaps are observed to all geometries considered. Our findings show that the band gap width depends on the thickness of hollow inclusion and the lattice geometry. We suggest that the carbon nanostructures phononic crystals are feasible for elastic vibration management.