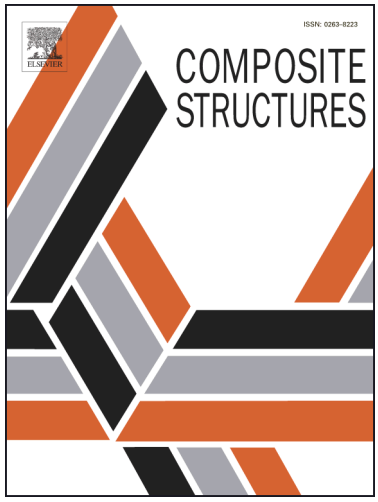

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Effect of pre-load on wave propagation characteristics of hexagonal lattices

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Abstract

The aim of this paper is to investigate the effect of the applied pre-load on wave propagating behaviors of hexagonal lattices in terms of band structures, band gap distributions and phase/group velocities. The structure is composed of the repeat elementary unit cell, and the elementary unit cell is assembled with the axial pre-loaded elastic Timoshenko beams. The finite element method is adopted to solve the wave propagation problems. By calculating the band structure, we show a lower band gap is produced when the negative pre-load is applied. Band gap distributions are also calculated to gain the insight into the effects of the applied pre-load and the geometric parameters (internal angles and the relative density) on the wave propagation. The shift of the frequencies at specific points of the Brillouin zone due to the effect of pre-load is quantified. Special attention is devoted to the effect of pre-load on the directional energy flow. The phase constant surfaces and phase/group velocities are obtained for different pre-loads in order to demonstrate the influence of pre-load on the directional wave motion.

Keywords: Band gap distribution, Wave Propagation, Hexagonal lattices, Pre-load, Phase constant surface

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