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INFLUENCE OF MICROSTRUCTURE ON NONLINEAR VIBRATIONS AND MODES INTERACTIONS IN HETEROGENEOUS SOLIDS

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Nonlinear vibrations of a 1D periodically heterogeneous solid are considered. Geometrical nonlinearity is described by the Cauchy–Green strain tensor. Physical nonlinearity is modelled expressing the energy of deformation as a series expansion in powers of the strains. The governing macroscopic dynamical equation is obtained by the higher-order asymptotic homogenization method. An asymptotic solution is developed by the method of multiple time scales. The effects of internal resonances and modes coupling are predicted. The specific objective of the paper is to analyse how the presence of the microstructure influences on the processes of mode interactions. It is shown that depending on a scaling relation between the amplitude of the vibrations and the size of the unit cell different scenarios of the modes coupling can be realised. Additionally to the asymptotic solution, numerical simulation is performed using the Runge-Kutta fourth-order method. The obtained numerical and analytical results demonstrate good agreement.

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