Author's Accepted Manuscript

www.elsevier.com/locate/ijmecsci

Influences of active control on elastic wave propagation in a weakly nonlinear phononic crystal with a monoatomic lattice chain

Yi-Ze Wang, Feng-Ming Li, Yue-Sheng Wang

PII: S0020-7403(15)00421-X
DOI: http://dx.doi.org/10.1016/j.ijmecsci.2015.12.004
Reference: MS3168

To appear in: *International Journal of Mechanical Sciences*

Received date: 5 October 2015
Revised date: 27 November 2015
Accepted date: 1 December 2015

Cite this article as: Yi-Ze Wang, Feng-Ming Li and Yue-Sheng Wang, Influences of active control on elastic wave propagation in a weakly nonlinear phononi crystal with a monoatomic lattice chain, *International Journal of Mechanica Sciences,* http://dx.doi.org/10.1016/j.ijmecsci.2015.12.004

This is a PDF file of an unedited manuscript that has been accepted fo publication. As a service to our customers we are providing this early version o the manuscript. The manuscript will undergo copyediting, typesetting, an review of the resulting galley proof before it is published in its final citable form Please note that during the production process errors may be discovered whic could affect the content, and all legal disclaimers that apply to the journal pertain

ACCEPTED MANUSCRIPT

Influences of active control on elastic wave propagation in a weakly nonlinear phononic crystal with a monoatomic lattice chain

Yi-Ze Wang[1*], Feng-Ming Li [2], Yue-Sheng Wang[1]

[1] Institute of Engineering Mechanics, Beijing Jiaotong University, Beijing 100044, China

[2] College of Mechanical Engineering, Beijing University of Technology, Beijing 100124, China

Abstract

Different from the linear phononic crystals, elastic waves can exhibit more interesting phenomena in periodic structures with nonlinear properties. By the active control action, elastic wave characteristics can be tuned based on the demand in practical application. This work discusses the possibility of the active control action on elastic waves in phononic crystals with the weakly nonlinear monoatomic lattice chain. Based on the Lindstedt-Poincaré method, the approximate solution of the dispersion relation is derived. Numerical calculations are performed to discuss the influences of the active control action on wave propagation properties. In order to present the features of nonlinear elastic wave dynamics, it is mainly focused on the effects of active control accompanied by the changes of the elastic wave amplitude, nonlinear degree, hard and soft nonlinearities. It is expected to extend the analysis and design of new phononic crystal devices for both the theory and application fields.

Keywords: Active control action; nonlinear phononic crystals; elastic waves; wave amplitude; hard and soft nonlinearities.

1. Introduction

Phononic crystals are composite structures constituting of different materials arranged periodically in the space [1–3]. Usually, they can be classified as the one [4–9], two [10–16] and three [17–20] dimensional cases by the geometry characteristics and arrangements. One of the most remarkable properties is the stop band in which the acoustic/elastic waves cannot propagate. With this characteristic, phononic crystals can be applied to the wave filtering, vibration and acoustic isolation and sonic transmission, etc. Therefore, phononic crystals with the stop band characteristics have received quite a lot of attention [21–25].

With the large amount of researches on band gap characteristics for linear phononic crystals, as a new subject, periodic composite structures with nonlinear properties began to receive attention [26–28]. One kind of the nonlinear phononic crystals consists of the lattice chain with the nonlinear springs, which can be considered as the weak nonlinear periodic structure. It is known that for the nonlinear vibration system, the structure can exhibit more information, such as the bending behavior for the frequency response and amplitude dependence etc. Similar to the nonlinear vibration case, the propagation of elastic waves in

* Corresponding author
Email address: wangyize@126.com (Y.-Z. Wang)

Accepted manuscript

Download English Version:

https://daneshyari.com/en/article/7174209

Download Persian Version:

https://daneshyari.com/article/7174209

Daneshyari.com