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An efficient algorithm to analyze wave propagation in fluid/solid and solid/fluid phononic crystals

Eric Li[1,2,3], ZC He[1*], Gang Wang[1], GR Liu[4]

[1]*State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha, 410082 P. R. China*
[2]*Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong, Shatin, NT, Hong Kong, China*
[3]*State Key Laboratory of Structural Analysis for Industrial Equipment, Dalian University of Technology, Dalian 116024, P.R.China*
[4]*Department of Aerospace Engineering and Engineering Mechanics, University of Cincinnati, Cincinnati, OH 45221-0070, USA*

Abstract

The paper presents an efficient and accurate algorithm to analyze the fluid/solid and solid/fluid phononic crystals (PCs) with fluid structure interaction (FSI). In the proposed mass-redistributed finite element method (MR-FEM), the dispersion error in the longitudinal wave of fluid domain is minimized by re-distributing the mass elements in the mass matrix to "tune" the balance, while the lumped mass matrix is employed to analyze the elastic wave within the solid. In addition, different Bloch boundary conditions including the square and triangular lattice using MR-FEM are also formulated in this work. The accuracy of the proposed MR-FEM is verified by using the commercial software COMSOL, and the computational efficiency of MR-FEM is significantly greater than the conventional finite element methods (FEM) based on six different numerical examples. The MR-FEM with excellent features has a great potential to extend 3D multi-physics domain of PCs.

***Key words*:** Phononic Crystals; Fluid Structure Interaction; Band Gap; Mass-redistributed Finite Element Method (MR-FEM)

[1]* *State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha, 410082 P. R. China* Email address: hezhicheng815@hnu.edu.cn