Accepted Manuscript

Multiphysics topology optimization for piezoelectric acoustic focuser

Gil Ho Yoon, Hyunggyu Choi, Shin Hur

PII: S0045-7825(17)30753-3
DOI: https://doi.org/10.1016/j.cma.2017.12.002
Reference: CMA 11694

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date : 2 June 2017
Revised date : 30 November 2017
Accepted date : 1 December 2017

Please cite this article as: G.H. Yoon, H. Choi, S. Hur, Multiphysics topology optimization for piezoelectric acoustic focuser, *Comput. Methods Appl. Mech. Engrg.* (2017), https://doi.org/10.1016/j.cma.2017.12.002

Multiphysics topology optimization for piezoelectric acoustic focuser

Gil Ho Yoon*[1], Hyunggyu Choi[1], Shin Hur[2]

School of Mechanical Engineering, Hanyang University, Seoul, Korea

Korea Institute of Machinery & Materials 156 Gajeongbuk-Ro, Yuseong-Gu, Daejeon, Korea

Abstract

The application of piezoelectric materials allows many advantages such as reducing the number of parts and manufacturing cost of a mechanical system. Despite these merits, the performance predictions and optimization of piezoelectric-material-based devices are challenging because of the mutual coupling between electricity and mechanics. The analysis and the optimization become more challenging when acoustics are to be coupled with piezoelectric-material-based devices. In the present study, the mutual couplings among electric, mechanics, and acoustics are simulated and its applications for the topology optimization of an acoustic energy focuser are presented. Owing to the local optima issue, some blurred and unsuccessful layouts are obtained. To overcome this issue and impose the manufacturing constraint, a modified morphology density filter is also developed. With the presented approach, it is possible to determine some optimized piezoelectric rings to focus acoustic energy. Compared with the existing design methods, some better designs in terms of objective value can be obtained by the present approach.

Keywords: Topology optimization, Piezoelectric material, SIMP approach, Acoustic focuser, Manufacturing constraint

* Correspondence to Associate Professor Gil Ho Yoon, E-mail: ghy@hanyang.ac.kr or gilho.yoon@gmail.com,

School of Mechanical Engineering, Hanyang University, Seoul, Korea