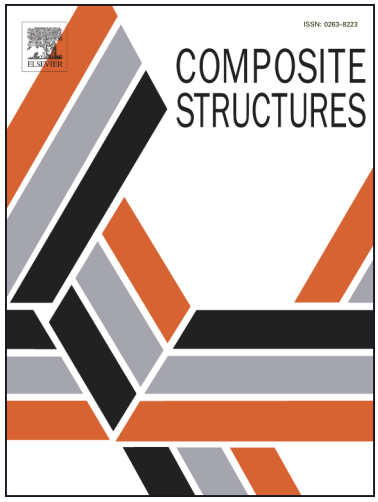

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PII: S0263-8223(18)30109-0
DOI: https://doi.org/10.1016/j.compstruct.2018.06.022
Reference: COST 9816

To appear in: *Composite Structures*

Received Date: 9 January 2018
Revised Date: 30 April 2018
Accepted Date: 4 June 2018

Please cite this article as: Yang, X., Kim, Y.Y., Topology optimization for the design of perfect mode-converting anisotropic elastic metamaterials, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.06.022

Topology optimization for the design of perfect mode-converting anisotropic elastic metamaterials

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Abstract

This work is concerned with the topology optimization of anisotropic elastic metamaterials exhibiting perfect mode conversion, a newly discovered phenomenon that an incident longitudinal (transverse) mode is solely and maximally converted to a transmitted transverse (longitudinal) mode. The wave phenomenon occurs at a series of interference frequencies due to elaborate multimodal interferences, known as the perfect transmodal Fabry-Perot interferences. Because the metamaterial must satisfy unique anisotropic relations among its effective stiffness, design of its unit cell is difficult without a systematic strategy. Here, we propose a topology optimization method based on the effective material properties to design such artificial composites. The homogenization method is employed to evaluate the effective material properties and the anisotropy requirements are treated as a special form of constraints. Because there is no natural mass constraint, we propose to maximize the effective