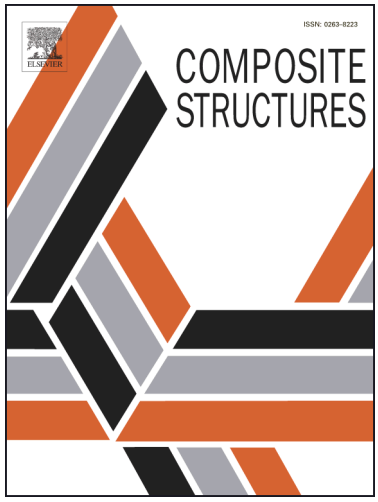

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Broadband locally resonant metamaterial sandwich plate for improved noise insulation in the coincidence region

Zibo Liu*, Romain Rumpler**, and Leping Feng**

The Marcus Wallenberg Laboratory for Sound and Vibration Research (MWL), Department of Aeronautical and Vehicle Engineering, KTH Royal Institute of Technology, SE-100 44, Stockholm, Sweden

Abstract

A new design for locally resonant metamaterial sandwich plates is proposed in this paper for noise insulation engineering applications. A systematic method to tune the resonance frequency of local resonators is developed in order to overcome the coincidence phenomenon. This method, based on an impedance approach, additionally explains the ability to overcome the antiresonance associated with these local resonators. The influence of the radiated sound from these local resonators is further investigated with finite element (FE) models, particularly in connection with the sound transmission loss (STL) of the resulting metamaterial sandwich plates. The new sandwich design proposed emerges from these analyses, encapsulating the resonators inside the core material. In addition to overcoming the coincidence effect and limiting the noise radiation by the resonators, the proposed design allows to improve the mass ratio of the metamaterial sandwich structure. This, in turn, enables to broaden the working frequency band independently of the material adopted for the resonator. The proposed metamaterial sandwich plate thus combines improved acoustic insulation properties, while maintaining the lightweight nature of the sandwich plate and its good static properties.

Keywords:
acoustic metamaterial, sandwich plate, sound transmission loss, coincidence frequency

*zibo@kth.se
**rumpler@kth.se, fengl@kth.se