Transmission of sound through perforated honeycomb sandwich panels

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Introduction

In many environments, transmission of sound through walls is unwanted. One-dimensional analytical models predict that sound transmission can be reduced by the application of tube resonators [1]. Because the models are relatively simple, they could be used as fast analysis tools for optimisation and design. An easy way to manufacture such a panel with tube resonators is by perforating one of the skin panels of a common honeycomb (HC) sandwich panel (see Figure 1).

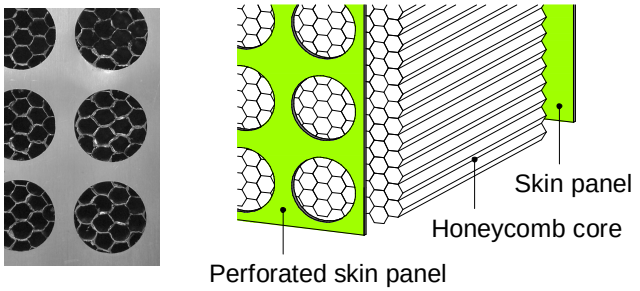

Figure 1 : Detail of perforated HC sandwich panel

Objective

The objective of the present study is to verify whether the one-dimensional analytical models give a good indication of the transmission of sound through these panels.

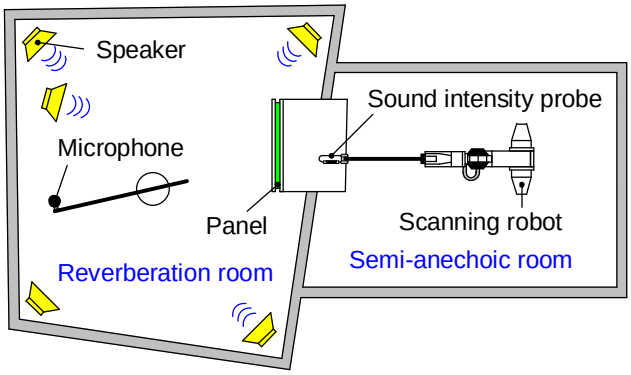

Figure 2 : Experimental setup for measuring sound transmission loss

Methods

Sound transmission loss measurements were performed on a 1 m x 1 m large perforated HC sandwich panel. In a reverberation room, sound was generated by five speakers and measured by a microphone on a rotating boom (see Figure 2). The part of the sound that was transmitted through the panel into a semi-anechoic receiving room was measured by a sound intensity probe. The measured reduction in sound power level is the so-called sound transmission loss.

Results

Figure 3 shows the results of a panel with resonators which were tuned for a frequency range of 1000-2000 Hz. A comparison is made with a panel of the same mass, without resonators (mass law).

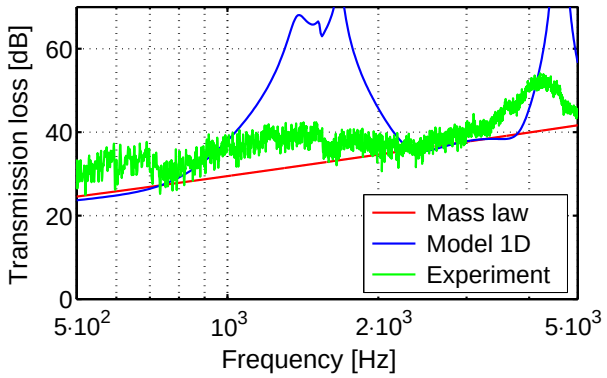

Figure 3 : Sound transmission loss of a perforated HC sandwich panel

Discussion

Large increases in transmission loss are measured over a broad frequency range (maximum increases of 7.2 dB and 9.2 dB compared with the mass law), though not as large as predicted analytically. The one-dimensional analytical model predicts the trends fairly well. To get a better indication of the magnitude of the transmission loss, also possible effects of, for example, the flexibility of the structure, random incident sound and acoustic coupling between the resonators should be taken into account.

Reference

1. Hannink, M.H.C. (2006) Improvement of the sound transmission loss of panels by means of acoustically tuned resonators, ICAS, Hamburg, Germany.