

Acoustic Metamaterials for Low Frequency Industrial Applications

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Abstract

This poster focuses on the development of practical acoustic metamaterials for the reduction of low frequency industrial noise.

High noise levels generated by industrial machinery can cause major environmental problems and stakeholders are looking for novel solutions. Particular examples include the low frequency "hum" emitted by power transformers, gas/steam turbines and compressors.

Sonobex have developed the first commercially available acoustic metamaterial-based technologies; extended from our understanding of Phononic Crystals. The noise control solutions that we provide are targeted towards the attenuation of key tonal frequencies and more specifically in the difficult to treat low frequency regime (34dB @ 100Hz, $\alpha = 0.91$).

Acoustic Metamaterials hold great potential for blocking noise propagation in certain frequency ranges by tuning the material's design and making use of internal periodic structures and localised tuned resonators to create bands in which limited wave propagation occurs.

By tuning the periodic structures and resonant dampers to the specific frequency ranges of troublesome noise sources; optimised noise abatement can be obtained. During our development process we have made extensive use of the COMSOL® Acoustics module. This allowed us to rapidly iterate through potential designs and reduced the number of rounds of prototyping and testing needed. Parametric models were used to vary the dimensions of the metamaterial structure and find a good compromise between the desired noise reduction characteristics and ease of manufacturing. When the general metamaterial panel design was finalised, more specialised models were used to investigate application-specific situations, e.g. enclosure corner details and panel eigenmodes