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Acoustic Black Hole based Helmholtz Resonators

A novel resonator design integrates an acoustic black hole concept to achieve broadband noise and vibration control for automotive and aerospace confined cavities.

Helmholtz resonators (HR) are widely used in acoustic engineering to control noise and vibrations. These resonators are typically narrowband (as opposed to broadband), meaning they can only exhibit their optimal performance in very specific ranges of sound frequencies. There have been many approaches to improve HR, but despite the extent of research, systems still exhibit narrow operational bandwidth while HR arrays have practical limitations. There is a need to increase the range of frequencies a Helmholtz resonator can control.

Researchers at Purdue University have developed a novel design that combines a traditional Helmholtz resonator with the concept of an acoustic black hole (ABH) to achieve broadband performance in noise/vibration control. The main cavity of the device produces a periodic ABH to deliver broadband absorption of soundwaves. This passive device produces large amounts of noise reduction in enclosed cavities and helps with interior noise control. Noise reduction would be beneficial to aerospace and automotive industries for confined cavities such as fairings in launch systems, motorcycles, and high performance vehicles.

Advantages:

-Noise reduction

-Broadband

Potential Applications:

-Fairings

-Room acoustics

-Aerospace

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