



# Nonlocal Acoustic Black Hole Metastructure

**Nonlocal acoustic black hole metastructure dissipates vibration energy in thin plates, controlling ultra-low frequency noise.**

Passive vibration attenuation has become a major challenge across various structural systems in aerospace, automotive, and more. While it is desirable to transition to thin-walled, lighter weight materials, this introduces risks from stability, structural damage, or radiated noise caused by vibration. To mitigate these issues, researchers at Purdue University pose an approach for nonlocal Acoustic Black Hole (ABH) metastructures to dissipate mechanical energy within a thin-walled structure. By orienting ABHs as a grid embedded in a thin plate, engineers are given greater control over the dynamics of the structure. This technology offers benefits in situations where it is critical to have passive control over the vibration mechanics of a structure and attenuate vibrations in the ultra-low frequency range.

## Technology Validation:

This technology was validated through a numerical analysis, where it was shown that the design could attenuate structural vibrations in the ultra-low frequency range (as low as 2 Hz).

## Advantages

- Vibration control across wide frequency range
- Attenuation of ultra-low frequencies
- Passive control

## Applications

- Aerospace
- Automotive
- Vibration Control
- Structural Dynamics

## Technology ID

2021-SEMP-69509

## Category

Aerospace & National  
Security/Hypersonics &  
Propulsion Systems  
Energy & Power Systems/Grid  
Modernization & Smart Grids  
Automotive & Mobility  
Tech/Micromobility & Smart  
Urban Infrastructure

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