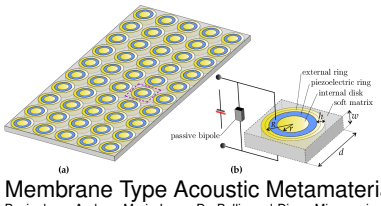
Chair of Vibroacoustics of Vehicles and Machines
School of Engineering and Design
Technical University of Munich

Master's or Semester Thesis

Elastic Acoustic Metamaterials for Noise Reduction in Aircraft Engines

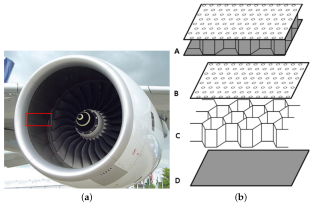
Your Task

Vibration control is a critical and evolving area of research across various industries, including automotive, aerospace, and maritime sectors. Its growing significance stems from the impact of mechanical vibrations, which can both enhance and impair system performance by influencing acoustic properties and altering mechanical behavior. Such effects can affect a system's ability to perform its intended function reliably over time. To address these challenges, a range of vibration control techniques has been developed, broadly classified into active and passive strategies.



Membrane Type Acoustic Metamaterials
Bacigalupo, Andrea, Maria Laura De Bellis and Diego Misseroni. "Design of active acoustic metamaterials with periodic piezoelectric microstructure." Applied Physics (2019)

Passive acoustic metamaterials rely on their carefully designed structural configurations to exhibit unique properties such as effective negative density or stiffness, enabling efficient noise mitigation without the need for external power or adaptive components. These materials are typically optimized for specific frequency ranges and achieve desired acoustic effects through their static geometry and material properties. Although they lack real-time adaptability, passive metamaterials offer robust and maintenance-free solutions for many noise control applications. The aim of this study is to investigate the potential of passive plate and membrane type acoustic metamaterials for effective and reliable noise reduction, with a particular focus on applications in aircraft turbines, where managing complex and broadband acoustic environments remains a significant engineering challenge.



Acoustic Liners in Aircraft turbines
Martin, C.A.; Mendez, A.C.; Sainges, O.; Petiot, E.; Barasinski, A.; Piana, M.; Ratier, L.; Chinesta, F. Empowering Design Based on Hybrid TwinTM: Application to Acoustic Resonators. Designs 2020, 4, 44.

Your Skills

- Good knowledge in engineering mechanics and mathematics
- Basic knowledge in Dynamics of Structures
- Basic knowledge in FEM/COMSOL simulations
- High interest in understanding of mathematical equations
- Programming skills in Python or Matlab

Contact

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