Dislocated transducer methodology for the nonreciprocal transmission of sound and vibration

DR. Neven ALUJEVIC

Associate Professor at University of Zagreb

We propose a study of an active acoustic metamaterial cell for nonreciprocal sound transmission in a broad frequency band. In order to achieve the nonreciprocity, dislocated sensor-actuator pairs are used. This contrasts with traditional vibroacoustic active control methods which rely on collocated sensor-actuator pairs to ensure the closed-loop system stability. The cell is activated with two independent decentralised velocity feedback loops, connecting feedback actuators to dislocated sensors through a constant feedback gain. Transducers induce spatially asymmetric control force which makes the propagation of acoustic energy through the cell direction-dependent and thus nonreciprocal. Despite the fact that the two decentralised feedback loops are based on dislocated transducers, and the distributed parameter nature of the cell, simple and practical conditions for a stable closed-loop system with efficient and broadband performance of the active cell are found. Special attention is paid to the power analysis of the reflected and transmitted waves, and the power dissipated within the metamaterial cell.

17 juin 2025, 13h, Bâtiment Sophie Germain, Salle Bellecour