Identifiant de la contribution : **280** Type : **non spécifié**

JISFA4#1 - Absorption and transmission of boundary layer noise through micro-perforated panel structures: measurements and modellings

mercredi 12 juillet 2023 14:00 (20)

Reducing the airframe noise under a low-speed flow is a challenging problem in the acoustic design of automotive and aircraft cabins as it should comply with low drag, space- and mass-saving constraints. Moreover, the use of lighter and stiffer structures with low critical frequencies transmit more efficiently mid-frequency noise components towards the cabin, such as those induced by a turbulent boundary layer (TBL) of air. Backed or unbacked micro-perforated panels (MPP) are potential lightweight and low-drag solutions that may enhance the absorption and decrease the transmission of flow-induced noise. This work describes experimental and modelling studies that show the effect of MPP partitions, either flush-mounted or over a cavity floor, on the wall-pressure fluctuations induced by a low-speed TBL.

Measurements have been performed in a low-speed wind-tunnel to determine the frequency-averaged power flow injected by TBL wall-pressures into flush-mounted MPP partitions. They were assessed against modal simulations of the power absorbed and transmitted by flexible MPP partitions forced by a TBL. At low frequencies, a large part of the power injected by the aerodynamic pressures is transmitted through the apertures with inefficient back-scattering properties. As frequency increases, the absorption steeply decays due to the MPP apertures that efficiently back-scatter small-scale turbulence into sound. Absorption peaks are observed at the MPP aerodynamic coincidence frequency and at the Helmholtz resonance frequency.

Numerical and experimental studies have also been carried out to assess the effect of microperforating the base wall of shallow cavities in transitional and closed flow regimes to reduce their tonal and broadband noise components under a low-speed TBL. Measurements showed that the first peak levels observed towards the leading edge of the cavity were reduced by up to 8 dB whereas flow-induced noise was generated towards the trailing edge. This trends were confirmed by Lattice-Boltzmann simulations that predict an attenuation of the dominant peaks at the floor and at the mouth of the cavity. It was found that the dissipation of energy occurs at the regions of maximum velocity fluctuations induced by well established outflow conditions within and at the inlet-outlet of the base wall apertures.

Presenter(s) : CÉDRIC MAURY (Aix Marseille Univ. CNRS Centrale Marseille, Laboratory of Mechanics and Acoustics (LMA UMR 7031)); TERESA BRAVO (Instituto de Tecnologías Físicas y de la Información (ITEFI) , Consejo Superior de Investigaciones Científicas (CSIC)); DANIEL MAZZONI (Aix Marseille Univ. CNRS Centrale Marseille, Institut de Recherche sur les Phénomènes Hors Equilibres (IRPHE UMR 7342))

Classification par session : JISFA 4 / Passive and Active Control of Aeronautical Noise