[2021 – Final Year Master Internship] Modeling the acoustical performance of ultra-ventilated insulating panels and their experimental characterisation using synthetic excitation in a semi-anechoic room.

Tutors:

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Dates: As from February-March 2021 – Duration 6 months

Location: Laboratory of Mechanics and Acoustics (LMA) – Sounds Group, Marseille, France

Payment: according to hourly rate, total amount less than 3.300 Euros

Background: One of the challenges encountered in the field of building acoustics is to design facade openings, such as apartment windows, able to provide an efficient air flow circulation to ensure regular ventilation of housing (current recommendation of national health agencies) while protecting the occupants from external noise pollution. This problem is particularly present in urban areas and near transportation zones. In warm places, such natural ventilation systems also ensure a minimum level of thermal comfort (recommendation of the standard for the environmental quality of buildings).
Solutions using micro-perforated panels have been developed to be integrated into windows [1] or ventilation ducts [2] without obstructing the air flow. In 2015, a passive-active hybrid system was patented to reduce, using mineral wool, the sound transmitted, at medium and high frequencies (500 Hz - 4000 Hz), through a 10 cm opening while attenuating the low frequencies (80 Hz - 500 Hz) using an active electro-acoustic system integrated into the window pillar [3]. However, this system requires the use of fibrous materials (maintenance, presence of micro-fibers) and the active part induces energy consumption.

Objectives: The main objective of the proposed internship is to study the acoustical performance of a non-fibrous acoustic panel, totally passive, which is effective in attenuating the transmission of low frequency sound through a surface of 1 m^2 while being ultra-permeable to the circulation of an air flow. It will be made up of resonant cells whose acoustic properties will be modeled analytically under Matlab, then under COMSOL Multiphysics in order to integrate the effect of an air flow. A second part of the internship will consist in measuring in a semi-anechoic room the panel transmission loss under various acoustic

excitations (plane waves, diffuse field, etc.) synthesized using a robotic test bench developed at LMA during the the VIRTECH project funded by the French National Research Agency.

[1] J. Kang and M. W. Brocklesby, Feasibility of applying micro-perforated absorbers in acoustic window systems, Applied Acoustics, 66(6), 669-689, 2005.

[2] T. Bravo, C. Maury and C. Pinhède, Absorption and transmission of boundary layer noise through flexible multi-layer micro-perforated structures, Journal of Sound and Vibration, 395(12), 201-223, 2017.

[3] https://www.cnrs.fr/lettre-innovation/actus.php?numero=371

Skills: Fundamentals of Acoustics and wave propagation, Finite Element Modeling software (COMSOL Multiphysics), experience in Computer-Aided Design, experimental methods in Acoustics.