# Thesis proposal 2023-2026

## Diagnose the acoustics of a room using signal processing and machine learning

Keywords : Acoustics - Building - Machine learning

### Subject

Noise pollution is cited as the primary source of discomfort by the population and constitutes an important health and social issue, contributing in particular to stress, attention deficits in class, or tinnitus. The discomfort is often linked to the poor acoustic quality of the room due to excessive reverberation (canteen, swimming pool, nursery, etc.).

Within the framework of the acoustic rehabilitation of rooms, the proposal of a solution requires a good knowledge of the geometrical and acoustic characteristics of the existing room (dimension of the room, absorption and diffusion of its various coatings). To estimate these unknown parameters, acousticians in the field rely on sound field measurements combined with *a priori* geometrical and acoustic knowledge of the location and the device used (sources and microphones). The estimation is typically done by manual and iterative calibration of the input parameters of analytical or numerical acoustic models on the measurements. The whole process of a diagnosis is therefore long, costly and sometimes imprecise depending on the models used.

Faced with this observation, the development of so-called *inverse* methods allowing to automatically find the acoustic parameters of interest from audio measurements alone would constitute a major breakthrough for building acoustics, opening the way to the development of simpler, faster and more reliable tools for acousticians.

The proposed thesis aims at achieving methodological breakthroughs on these open and difficult inverse problems, by combining innovative approaches from the fields of signal processing and machine learning.

### Contacts

The whole thesis will be carried out in Strasbourg, the PhD student sharing his week between the ICube team (Télécom-Physique Strasbourg) with Sylvain Faisan, and the Cerema team in Strasbourg with Cédric Foy and Antoine Deleforge. Sylvain Faisan, Associate Professor, Director of the thesis (HDR), University of Strasbourg, Icube Laboratory (UMR7357), IMAGeS Team, 300 Bd Sébastien Brant, 67400 Illkirch-Graffenstaden, https://images.icube.unistra.fr/index.php/Sylvain\_Faisan, Mail : faisan@unistra.fr.

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