PhD position

Aeroacoustics of wake-airfoil interaction with application to aircraft noise

Institut PPRIME, UPR CNRS 3346, Université de Poitiers, France
Contacts: peter.jordan@univ-poitiers.fr, florent.margnat@univ-poitiers.fr, vincent.valeau@univ-poitiers.fr,

Apply before September 17th 2021

Left : Landing airplane. The noise mechanism under investigation is the interaction of the gear wake with the flap (underlined in red). Right: the anechoic wind-tunnel at Institut PPRIME.

Keywords: aircraft noise ; aeroacoustics ; hydrodynamic stability ; airfoil ; wind-tunnel.

In order to comply with increasingly stringent aircraft noise regulations, prediction tools are required from the early stages of aircraft design. Important noise sources at landing are those associated with landing gear and high-lift devices. The interaction between the landing-gear wake and the deployed flap is an aeroacoustic phenomenon of particular importance that has received little attention and is poorly understood.

The objective of the PhD is to develop simplified models for the aeroacoustics of wake-airfoil interaction. Experiments will be performed in the anechoic wind tunnel BETI at the *Institut Pprime.* The experiments will be used to guide the development of a modelling strategy that combines linear mean-flow analysis and a suitable acoustic analogy.

A generic configuration will be considered comprising an upstream obstacle (a simplified representation of a landing gear strut) and a downstream airfoil. The wake of the upstream obstacle will be modelled using linear analysis of the mean flow (global stability / resolvent). PIV measurements will be used: to provide the mean flow for the linear model; to identify (using Spectral Proper Orthogonal Decomposition) the dominant flow modes at play in the wake-airfoil interaction; and to provide flow-mode amplitudes for calibration of the linear model. Aeroacoustic modelling of the wake-airfoil interaction will rely on an acoustic analogy, where the source field is prescribed by the calibrated modes of the linear mean-flow analysis. Extensive acoustic measurements will be performed in parallel using a microphone array. The acoustic measurements will serve both to validate the model, and to aid in the eventual tuning of model parameters.

The PhD will be carried out in collaboration with Airbus, who will perform high-fidelity simulations, and the DYNFLUID laboratory (ENSAM, Paris), who will perform additional linear modelling.

Start and duration of the thesis: from October 2021 (flexible start date), over 3 years.
Net salary: 1776 € monthly
Funding: Direction Générale de l'Aviation Civile.
Partners : AIRBUS, DYNFLUID.
Specialisation: Master 2 or Engineering Diploma, with skills in acoustics and/or fluid mechanics, and in signal processing.