Laboratoire de Mécanique des Fluides de Lille
Kampé de Fériet

Internship proposal

Data Assimilation for Coandă-effect actuators for active flow control

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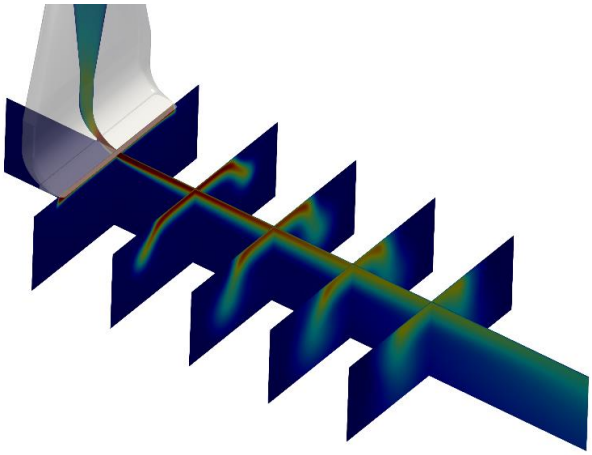
Location: ENSAM Lille, 8 Boulevard Louis XIV, 59046 Lille
Duration*:* 6 months
Level: M2
Expected skills and knowledge: fluid mechanics, numerical simulations (OpenFOAM)

Subject: The Coandă effect is used to inject momentum near a wall on which the actuator is flush mounted (see figure). The resulting jet is used to control the flow in an axial compressor and, in particular, to postpone or even suppress dangerous spike instabilities.



Velocity Magnitude inside a single Flow Actuator

Previous M2 stages focused on numerical simulations and experiments with single and multiple injectors. A parametric meshing tool has been developed to investigate spatial discretization. Despite significant efforts, disparities persist between experimental measurements and simulation results, primarily due to limited knowledge of inlet boundary conditions. To address this challenge, we are currently implementing Data Assimilation techniques. By integrating observational data into simulations, we aim to refine boundary conditions dynamically, reducing discrepancies and enhancing the accuracy of numerical experiments. This approach holds the promise of advancing scientific understanding and improving engineering applications.

Team:

This internship focuses on active flow control for aircraft engine axial compressors, a key lab research area. Numerical simulations will be reviewed with the ENSAM research team to benefit from their turbomachinery flow control expertise, aiding the understanding of inlet flow conditions for Coanda-effect actuators.

Preliminary organization of the work:

- Bibliographical study, especially data assimilation and Coandă effect.
- Contribution to simulation plan.
- Realization of simulations and development of Data Assimilation techniques based on a set of distorted inflow.
- Comparing the numerical simulations with already available experimental measurements.

Expected competences:

- Fluid mechanics
- Numerical simulations (OpenFOAM preferred)
- Python / C++ language