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ONERA
THE FRENCH AEROSPACE LAB

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DAAA-2025-03**
(à rappeler dans toute correspondance)

Lieu : Meudon

Département/Dir./Serv. : DAAA/H2T

Tél. :

Responsable(s) du stage : Mikel Balmaseda

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DESCRIPTION DU STAGE

Thématique(s) : Coupling, structural mechanics, fluid mechanics, advanced numerical methods.

Type de stage : ☒ Fin d'études bac+5 ☒ Master 2 ☐ Bac+2 à bac+4 ☐ Autres

Title : Implementation and analysis of the aeroelastic stationary state of slender structures with rapid methods.

Subject :

Context

The aeronautics sector is increasingly involved in reducing the carbon footprint of aircraft. New ultra high bypass ratio (UHBR) turbofans and ORAS (Open Rotor And Stator) type propellers provide an improved performance up to a 20% reduction in carbon footprint. However, the physics phenomena of these configurations become more complex and require advanced tools for their design and analysis.

Figure 1 (G) Open Rotor Vs actual engines ©Safran; (C) plane equiped with Open Rotor ©Safran; (D) UHBR engine ©Safran.

Nowadays, there are high-fidelity methods capable of representing the coupled aeroelastic response, however, their computational cost is very high for analysis and design activities in an industrial environment. Therefore, the use of rapid methods for both aerodynamic and structural analysis is complementary to high-fidelity methods.

Objectives of the internship

Therefore, the main objective of the internship is to analyze the impact of structural modeling on the aeroelastic equilibrium on a wing with a large wingspan and on the blades of a propeller.

Thus, you will carry out a review of the existing literature in order to understand the theoretical bases of fluid/structure coupling. Then, the analysis stage will begin with the study of the aeroelastic impact using projection-based reduced order models for the structure and on the ring method for aerodynamics. You will implement an aeroelastic coupling using an existing Vortex Particle Method (VPM) code to improve the representativeness of the aerodynamics.

Depending on the progress of the internship, you will carry out an analysis on the nonlinear physics to study the rotation of the aeronautical structures.

The results of this internship will allow maturing the rapid methods for the fluid/structure coupling for the design and the analysis of new configurations of aeronautical engines and will establish the bases for the PhD that will follow this internship.

Profile and expected competencies

Enrolled in the last year of a Research Master or Engineering School, you have notions in structural mechanics and fluid mechanics and ideally in aerodynamics. You show an interest in aeronautics, research and innovation. You have a taste for programming and have skills in Python programming language. With excellent interpersonal skills, you will not hesitate to communicate with experts within ONERA. You demonstrate a good sense of critical analysis and an autonomy allowing you to adapt quickly to a technically demanding work environment. Your interest in pursuing a PhD thesis will be appreciated.

Est-il possible d'envisager un travail en binôme ? **Non**

Méthodes à mettre en œuvre :

☐ Recherche théorique	☒ Travail de synthèse
☒ Recherche appliquée	☒ Travail de documentation
☐ Recherche expérimentale	☐ Participation à une réalisation

Possibilité de prolongation en thèse : **Oui**

Durée du stage : Minimum : 5 Maximum : 5

Période souhaitée : Mars 2025 – Août 2025

PROFIL DU STAGIAIRE

Connaissances et niveau requis :	Ecoles ou établissements souhaités :
Mécanique, Aérodynamique ; Programmation	Master Recherche et/ou Ecole d'Ingénieur