

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DAAA-2025-05**
(à rappeler dans toute correspondance)

Lieu : Meudon

Département/Dir./Serv. : DAAA/MAPE

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Responsable(s) du stage : Olivier Marquet

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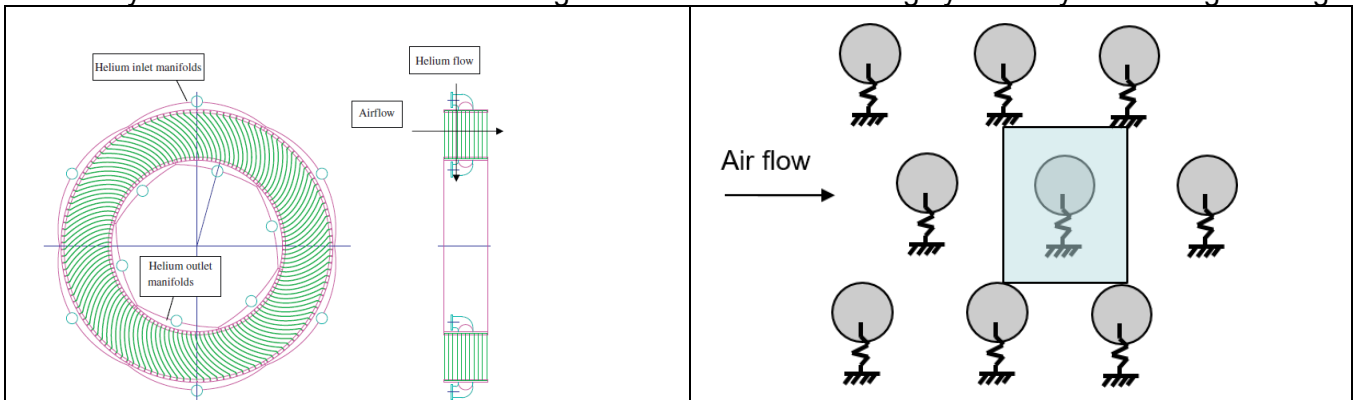
DESCRIPTION DU STAGE

Thématique(s) : Aéroélasticité

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

Intitulé : Bloch-Floquet analysis of fluid-elastic instability in micro-tube heat exchangers

Sujet : Efficient thermal management is crucial in aerospace and energy industry. In aerospace, heat exchangers are for instance crucial to cool down the air in turbofan engines. Among the various existing technologies, micro-scale tubular heat exchangers (Figure-left) are particularly promising due to their high energy density, low weight and compactness. Reducing the diameter of micro-tubes (shown green in the left figure) increases the heat transfer but may also favor their vibration. Predicting the onset of these vibration induced by the airflow is therefore crucial to guarantee the structural integrity of this system during its design.



The objective of the internship is to investigate the onset of fluid-elastic instability in a simplified model of heat exchangers, shown in the right figure. The air flow encounters an « infinite » array of cylinders that are mounted on identical springs. Due to the spatial periodicity of the spring-mounted cylinder, the Bloch-Floquet decomposition of the unsteady perturbations developing around a steady flow can be used to perform the linear analysis on the unit cell, depicted in the right figure with the light blue rectangle. Existing numerical tools developed and validated for arrays of fixed cylinders will be extended to account for the vibration of cylinders. They will be used to determine the critical parameters (cylinder's diameters, flow velocity, spring stiffness) for which vibrations of cylinders starts to grow in time.

This internship is an interesting opportunity for students in research master or engineering schools willing to apply theoretical analysis to the design of applied system in aeronautics. Discussion and interactions with engineers from ReactionsEngines, a british company developing thermal management system for aerospace, is planned during the intership.

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

Méthodes à mettre en œuvre :

- | | |
|---|--|
| <input checked="" type="checkbox"/> Recherche théorique | <input type="checkbox"/> Travail de synthèse |
| <input type="checkbox"/> Recherche appliquée | <input type="checkbox"/> Travail de documentation |
| <input type="checkbox"/> Recherche expérimentale | <input type="checkbox"/> Participation à une réalisation |

Possibilité de prolongation en thèse : Oui

Durée du stage :

Minimum : 4 mois

Maximum : 5 mois

Période souhaitée : March-July 2025

PROFIL DU STAGIAIRE

Connaissances et niveau requis :

Instability – Fluid-structure interaction / Bac+5

Ecoles ou établissements souhaités :

Engineering school – Master research

GEN-F218-4