

Internship tutors:
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Internship with ISAE SUPAERO - Toulouse

Location: **ISAE SUPAERO - Toulouse**

Starting date: To be defined (estimated 2nd trimester of 2023)

Duration : 6 months

Title : UNSTEADY EXERGY ANALYSIS OF A PITCHING AIRFOIL AND WING

ISAE-SUPAERO is an institute dedicated to aerospace engineering higher education and research. ISAE-SUPAERO develops a research focused on the future needs of aerospace and high-tech industries.

At ISAE-SUPAERO, the Department of Aerodynamics, Energetics and Propulsion department – (DAEP) researchers belong to three research groups:

- Fundamental fluids dynamics (D2F)
- External aerodynamics (AEX)
- Turbomachines and propulsion (TMP)

The research groups collaborate on the following topics:

- Modelling and Simulation of flows
- Experimental and digital acoustics for aeronautics applications
- Aerodynamics and propulsion of resilient, silent, convertible drones
- Innovation in aircraft and propulsion system integrated architecture

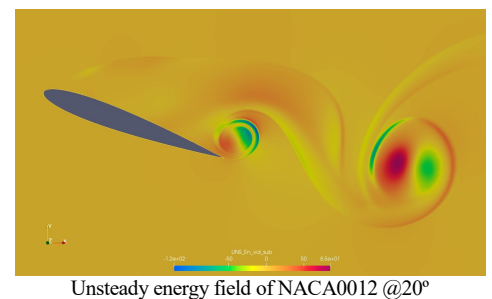
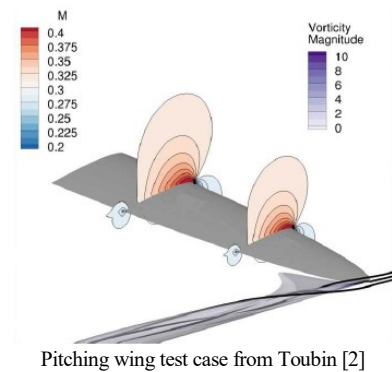
The intern will be integrated in the DAEP department especially the TMP group.

The internship is related to the test of a recently developed formulation for the unsteady aerodynamics analysis from an exergy point of view. Exergy analysis has proven to be an appropriate tool to evaluate the aerodynamics of innovative aircraft configurations in which the propulsion system is highly integrated.

The final objective of the internship is to be able to evaluate a pitching airfoil and wing from an exergy point of view in order to validate the proposed unsteady formulation with the nearfield results as benchmark. Then, to perform a detailed analysis of the configuration thanks to exergy approach.

The objectives of the internship are :

- To establish a state-of-the-art review of pitching airfoil and wing studies in order to choose the test case;
- To implement the mobile surfaces unsteady exergy contribution in Epsilon (already existing tool developed at ISAE for exergy analysis [1]);
- To perform the simulation of the test case chosen (Fluent or STAR-CCM);
- To validate the results from the new unsteady exergy formulation versus nearfield values obtained (exergy, energy, profile drag, vortex drag, etc);
- Due to the novelty of the topic, the opportunity to publish



a research paper may arise depending on the maturity of the results reached.

REQUIRED SKILLS

Skills: Aerodynamics, CFD, Python (basic).
Soft skills : autonomy, curiosity, innovation

APPLICATION FOR INTERNSHIP

To apply : CV and motivation letter to be send by email to the tutors (juan.ruscio@isae-superaero.fr ; nicolas.binder@isae-superaero.fr ; sebastien.duplaa@isae-superaero.fr).

For further information: please contact (juan.ruscio@isae-superaero.fr)

[1] Epsilon web site: <https://websites.isae-superaero.fr/epsilon-exergy-analysis-tool/epsilon/epsilon>

[2] Helène Toubin. Prediction and phenomenological breakdown of drag for unsteady flows. Mechanics of the fluids [physics.class-ph]. Université Pierre et Marie Curie - Paris VI, 2015.