

Internship tutors:
Joel JEZEGOU – Florent LUTZ

Internship with ISAE SUPAERO - Toulouse

Location: **ISAE SUPAERO - Toulouse**

Starting Date: Start of September 2023 – Start of February 2023

Duration : 6 months

FAST-OAD-GA: Implementation of manufacturing constraints and sensitivity analysis for MDAO of aircraft designs

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 or high-tech industries.

The ISAE-SUPAERO Department of Aerospace vehicles design and control (DCAS) supports activities related to the design and development of aerospace systems. The DCAS researchers belong to three research groups:

- Aerospace vehicle design
- Decision and Control
- Neuro-ergonomics and human factors

The research groups collaborate on the following topics:

- Design and operation of safer aircraft
- Integrated multidisciplinary design of aircraft
- Advanced space concept.

The internship is related to the multidisciplinary design of innovative CS-23 aircraft architectures, as part of research chair ISAAR (Innovative Solutions for Aircraft Architectures & Regulation). The intern will be integrated in the Aircraft Design research team of DCAS Department.

The purpose of the internship is to implement, in the software FAST-OAD-GA (Future Aircraft Sizing Tool for General Aviation) codeveloped by ISAE-SUPAERO and ONERA, a methodology to allow for the sizing of a derivative aircraft based on the reuse of existing airframes.

The objectives of the internship are :

- To understand the existing structure of FAST-OAD-GA software (models, aircraft design loops, structure of variables) coded in Python in an OpenMDAO framework and the required inputs and outputs of the current models;
- To do a literature review on: constraints-based programming, the management of constraints in Multidisciplinary Optimization (MDO), design of experiments (DOE), design by shopping and how to utilize the partial derivatives of models in that context;
- To understand, among the variables inside the code and based on a literature review, which variables to set and which one to free to represent the reuse of part of an existing airframe and apply the results of the aforementioned literature review
- Implement a methodology for systematic sensitivity analysis using partial derivatives;
- Implement a methodology for the analysis of the input variable which will have the most significant impact on MDO objectives and constraints;
- Apply that algorithm to study use cases among which will be for instance: the reuse of an existing wing with an extended fuselage, the reuse of an existing airframe with a reengining, ...

REQUIRED SKILLS

Skills: aircraft design methodology; MDAO, programming

IT skills: demonstrated skills in Python – knowledge of OpenMDAO is desirable, knowledge of FAST-OAD is desirable

Soft skills : autonomy, curiosity, proactivity

APPLICATION FOR INTERNSHIP

To apply : CV and motivation letter to be send by email to Florent LUTZ (florent.lutz2@isae-supero.fr) and Joël JEZEGOU (joel.jezegou@isae-supero.fr)

For further information: please contact the above mentioned contacts.

Deliverable name	Description	Due date
To be agreed on in the first few days of the internship		