	INTERNSHIP 5-6 MONTHS **YEAR 2023**
Internship tutors: Yoann LE LAMER yoann.le-lamer@isae-supaero.fr Emmanuel BENARD emmanuel.benard@isae-supaero.fr	Internship with ISAE SUPAERO – Toulouse Targeted level: final year of Diplôme d'Ingénieur or MSc in Aerospace-Mechanical Engineering Grant: standard ISAE-SUPAERO rates, approx. 600 euros/month

Development of a methodology to enrich low-fidelity models using available high-fidelity data

Context:

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 internship subject is within the scope of the chair AIRBUS-ISAE CEDAR II for Eco-Design of Aircraft. This chair is intended to conduct different actions in order to contribute to the sustainable development of future air transportation, taking into account the many dimensions of that ambition (environment, society, economic & industrial issues …). The proposed project will contribute to computational methods to be used for the evaluation of high-aspect wings transport aircraft, studied within the European project U-HARWARD [1] [2].

Objectives:

The aerodynamic analysis is mandatory in the Overall Aircraft Design (OAD) process of FAST-OAD (https://github.com/fast-aircraft-design/FAST-OAD), jointly developed with ONERA [3]. The analysis could correspond to several analytic models such as for estimating the different loads affecting the aircraft performance. The analysis is thus instantaneous. When higher accuracy is required, the aerodynamic analysis through high-fidelity external tools is necessary at the expense of computation time. The objective of this internship is to implement methods that would allow to integrate high-fidelity aero-structural data in preliminary design studies within FAST-OAD, while alleviating the computation cost burden. A first step would be to perform a bibliographic review on multifidelity approaches, surrogate modelling and other available methods that could enhance low-fidelity models with high-fidelity data. Then, it would require to develop and test appropriate methods. A specific focus will be given to surrogate modelling on high-fidelity aero-structural models making use of the Surrogate Modelling Toolbox (SMT) [4]. These will be applied to different aircraft configurations, such as strut-braced wing (SBW).

Missions:

- Bibliographic review of associated methods, multifidelity approach
- Determine relevant methodologies that could enhance existing low-fidelity models
- Familiarize with the Surrogate Modelling Toolbox (SMT)
- Develop a method to generate surrogate models with regard to several parameters (to be determined)
- Propose and possibly implement other promising approache(s)

[1] https://www.u-harward-project.eu/
[2] Carrier G., Arnoult G., Fabbiane N., Schotté J.-S., David C., Defoort S., Delavenne M., Bénard E. (2022). Multidisciplinary analysis and design of strut-braced wing concept for medium range aircraft. SciTech conference,2022.
[3] David, C., Delbecq, S., Defoort, S., Schmollgruber, P., Benard, E., & Pommier-Budinger, V. (2021). From FAST to FAST-OAD: An open source framework for rapid Overall Aircraft Design. In IOP Conference Series: Materials Science and Engineering (Vol. 1024, No. 1, pp. 012062). IOP Publishing.
[4] https://smt.readthedocs.io/en/latest/

REQUIRED SKILLS

Skills : Python programming (essential), data analysis, aircraft aerodynamics (essential), reporting (English)
Soft skills : Autonomy, reporting & scheduling, curiosity, knowledge of aviation