



PostDoc @ ISAE-SUPAERO, 18 months

MBSE-MDAO for design of an Unmanned Aerial System

Project CONCORDE (DGA/AID)

European applicants only

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Funding: DGA

Scientific domain: systems engineering, computer science, applied mathematics

Keywords: modelling, interoperability of models, design analysis, optimization

Description

The research activities of the department of Complex Systems Engineering at ISAE-SUPAERO mainly focus on developing the new assets of MBSE (Model Based Systems Engineering) approach at early-design phase. Similarly, the department ONERA/CT/DTIS has an expertise in this field according to three pillars for engineering namely languages, methods and tools. The objective is to propose trade-offs and to guide the analysis by evaluating performances and by optimising the design. These two departments are involved in the CONCORDE project aiming at dealing with the design of UAS under distinct and complementary aspects. This CONCORDE project offers new perspectives in order to bridge the gap between MBSE and MDAO (Multi-Disciplinary Analysis and Optimization) in the context of the drone certification.

The objective of this postdoc is to implement the transition and the consistency between methods and tools in the framework of MBSE and MDAO approaches. The methods preferably rely on opensource software such as Papyrus, TTool for the sake of MBSE, and WhatsOpt, OpenMDAO for MDAO. The use of other tools is worth considering, yet the extension of the toolset including software is a key feature, especially as MBSA (Model-Based Safety Assessment) is also a target.

An important part of our research activities relates to the setting out and the evolution of current systems engineering facilities supporting those approaches by implementing a proven methodology to be defined. It is crucial to come up with a solution which allows any researcher, student, even industrialist, to perform a few analyses and evaluations of drone architectures from the viewpoint of performances optimization, safety and other aspects. The concept of architectures covers the overall system until the embedded systems.

Work agenda

The interoperability of models is of the utmost importance in the context of current systems engineering. The profusion of modelling tools makes the development of interactions at the level of software cumbersome. The objective of this postdoc project is to design a prototype of the toolset first, which allow us to integrate models from MBSE and models from MDAO in accordance with PhD projects.

Secondly, the validation of the toolset will as well be accounted for by the study case of a drone or UAS, focusing on change impacts throughout models in terms of modularity and changeability.

Expected skills

The applicant holds a PhD degree in computer science or systems engineering. In addition to the tasks about the setting out of a domain specific modelling language and method, the applicant will develop one or several prototypes. Fluency in English and soft skills are required abilities.

IT skills are as follows:

- languages: C, **Java**, **Python**, R
- modelling: **SysML**, NAF, existing tools (Arcadia/Capella, Model Center...), formal methods

References

R. Lafage, S. Defoort, and T. Lefebvre. *WhatsOpt: a web application for multidisciplinary design analysis and optimization*. In AIAA Aviation 2019 Forum, page 2990, 2019.

Justin S Gray et al. *OpenMDAO : An open-source framework for multidisciplinary design, analysis, and optimization* . In Structural and Multidisciplinary Optimization 59.4 (2019), p. 1075-1104.

O. Aiello, D. S. Del Rio Kandel, J.-C. Chaudemar, O. Poitou, and P. de Saqui-Sannes. *Populating MBSE Models from MDAO Analysis* . In IEEE ISSE 2021 (submission).