ONERA
THE FRENCH AEROSPACE LAB

www.onera.fr

POST-DOCTORATE PROPOSAL

Title : Design of experiments and surrogate models for aerodynamic data

Reference : **PDOC-DTIS-2020-03**
(to be recalled in all correspondence)

Start of contract: january 2021	**Application deadline:**

Duration: 12 months, possibly extendable to 24 months - Net yearly salary: about 25 k€ (medical insurance included)

Keywords

Surrogate model, aerodynamics, wind-tunnel testing

Profile and skills required

Knowledge in applied mathematics and aerospace sciences, Python programming

Presentation of the post-doctoral project, context and objective

This post-doctoral position will extend the state-of-the-art in design of experiments and surrogate modelling in order to apply these techniques to aerodynamic data, particularly experimental data from wind-tunnel experiment as well as simulation data.

In aerodynamic design, simulation and testing processes are complementary in terms of cost, turnover time and modeling accuracy. They both deliver data that must be jointly considered to predict and optimize the aerodynamic performance of the aircraft. Although the use of surrogate models is now becoming a common practice to replace simulation outcomes, this is less the case for wind-tunnel experiments. It is a developing application which might bring significant efficiency improvement in analyzing databases and in allocating resources (see e.g. DeLoach).

The post-doctoral activities will include:

- apply state-of-the-art surrogate modeling techniques to the available databases (experimental and simulation) and identify their shortcomings;
- adapt and extend the capabilities of these techniques (more especially Kriging/Gaussian processes) to deal with the specificities of experimental data (large number of points, unadapted coverage of the design space, varying uncertainty, hysteresis, physical constraints…)
- develop a dynamic sampling technique suited to the constraints of experimental activity and able to produce an optimal testing program and propose enrichment points during the course of the experiment.

The position will benefit from already existing experimental and numerical databases produced at ONERA using the NASA Common Research Model and using world-class wind-tunnels and simulations software. He/she will contribute to the development of the SMT python package jointly developed by NASA, University of Michigan, ISAE-SUPAERO and ONERA.

References:

R. DeLoach, The Modern Design of Experiment for Configuration Aerodynamics: a Case Study, AIAA 2006-923.

A. Chiplunkar, Incorporating Prior Information from Engineering Design into Gaussian Process Regression: with applications to Aeronautical Engineering, PhD, ISAE-SUPAERO, 2017

External collaborations

A collaboration with DLR (Prof. Dr S. Goertz, Institut für Aerodynamik und Strömungstechnik Braunschweig) is proposed.

Host laboratory at ONERA

Department : Traitement de l'Information et Systèmes

Location (ONERA centre): Toulouse

Contact: Nathalie Bartoli

Phone: +33 5 62 25 26 44……. Email : Nathalie.Bartoli@onera.fr