2SC7692 – Shape optimization and drag reduction in aeronautics

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Language of instruction: ANGLAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 80
On-site hours (HPE): 48,00

Description

Project topic in partnership with ONERA.

Air traffic is steadily increasing each year to the point that, without improvements in aircraft performance in terms of energy consumption, the share of air transport in greenhouse gas emissions may become unsustainable in the future.

Aircraft consumption can be decreased by either increasing the engine efficiency or by improving the aerodynamic design of the aircraft, e.g. reducing the aircraft weight. Computational tools have been widely used in aeronautics for a long time to help design and optimize systems. For example the shape of a wing can be improved to reduce its drag, lift, or its inner structure can be lightened.

Technical details of the system and methodology:

Optimization methods require successive calculations for different wing geometries including the calculation of *adjoint models*. The computational costs for each step can become prohibitively expensive for high fidelity numerical models.

The only way to reduce computing times such that results can be obtained fast enough to integrate optimization methods into the industrial design cycle is to use parallel computers. In the case of optimization methods like efficient descent methods (such as the gradient method or the Newton method), the different configurations are not known a priori but determined successively by the algorithm. It is therefore necessary to parallelize each calculation of the *primal problem* and then the *adjoint problem*.

The objective of this project is to achieve the parallelization of the most expensive phase of the optimization loop, namely the resolution of large