PhD position at ONERA (Salon) and IRPHE (Marseille)

Vorticity Transport Model for rotary wing aircraft: application to the predesign of advanced hybrid VTOL aircraft

Cora (generation 5) – Autonomous aerial taxi – Wisk Aero (https://wisk.aero)

Description

In the context of the development of electric aircraft, many recent concepts include multiple rotary wings (rotors) and fixed wings, in order to distribute the generation of lift and propulsion and to increase air mobility. The interaction between these elements must be taken into account as early as possible in the design of these aircraft. The proposed thesis aims at using the Vorticity Transport Method (VTM) to characterize the aerodynamic interactions between multiple lifting surfaces during the preliminary design of new aircraft. This method presents an interesting compromise between "high precision" and "reduced computation time" for applications in design/preliminary evaluation, flight dynamics and controls, and pilot assistance.

After a state of the art on the VTM and a comparison with other CFD approaches (DNS, LES, vortex methods of the "free wake" type, reduced-order models, etc.), the method will be implemented in an ONERA code modelling the flight dynamics of the aircraft equipped with any combination of rotary and fixed wings. This will allow to evaluate the relevance of this approach for the analysis of flight regimes including hover (in or out of ground effect), vertical and low-speed flights, transition flights to or from cruise conditions, as well as steep descent flights, for which there is a risk of a dangerous transition of the generated flow towards a Vortex Ring State (VRS).

This work is part of a collaboration between ONERA, The French Aerospace Lab, in Salon and the Institut de Recherche sur les Phénomènes Hors Equilibre (IRPHE) in Marseille. The work will mainly be carried out at ONERA Salon. – Further information: **Link 1**, **Link 2**.

Candidate qualifications

Engineering School or Master degree in aeronautics or fluid mechanics. Good oral and written communication skills in English (delivering presentations, writing scientific articles). Experience in programming under Python. European Union nationality.

Start date	October 2023 (3 years)
Funding	Shared scholarship from ONERA and Région Sud – PACA (France)
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Application	A motivation letter, detailed CV and contact information of at least one person of reference should be sent by e-mail to the above contacts.
Deadline	21 July 2023