PROPOSITION DE SUJET DE THESE

Intitulé : Active fault-tolerant aircraft control for flutter mitigation in the presence of control surface faults

Référence : **TIS-DTIS-2024-48**
(à rappeler dans toute correspondance)

Début de la thèse : Octobre 2024 | **Date limite de candidature :** Mai 2024

Mots clés

- Active flutter suppression
- Fault tolerant control
- Fault detection and isolation
- Model-based diagnostic

Profil et compétences recherchées

The PhD candidate should have an excellent Master's degree (or comparable) in Aerospace or Control Engineering, or a closely related field.

The ideal candidate will have:

- A strong background in control theory. Experience in aeronautic applications and/or aeroelasticity would be appreciated.
- Demonstrable experience of the use of Matlab/Simulink (other software competences are an asset)
- Good communication and writing skills in English are required, as well as the ability to work independently

Présentation du projet doctoral, contexte et objectif

In a scenario of increasing environmental constraints in aviation, great focus is placed on reducing aircraft weight to increase performance and reduce emissions. This has led to a shift from the use of metals for aircraft and wing structures towards composite materials, which present a better strength-to-weight ratio. An unwanted consequence of this change is the reduction in the rigidity of the wings that leads to a reduction in the frequency of the structural modes, which in turn may lead to their coupling with the aerodynamic loads, in a phenomenon called *flutter*. Flutter can have catastrophic effects on the wings, and is thus critical for aircraft design. In general, civil aircraft are designed such that flutter happens above operating airspeeds.

Attention has been placed recently in the problem of designing active flutter suppression (AFS) control schemes to allow aircraft to fly close to or above its open-loop flutter speed. While many developments have appeared, few consider the effect of possible faults in the actuators used in AFS. The proposed PhD thesis aims to study the synthesis of novel fault detection and isolation (FDI) and fault-tolerant control (FTC) schemes applied to an AFS system. The goal is to ensure stability and performance in the presence of faults as well as in the case of false alarms by the FDI, while minimising impact on the guidance and control laws. The issue of stability is critical, as above the flutter speed the aircraft becomes unstable, and flutter can quickly lead to structural damage.

This PhD proposal will be directed by David Henry, from IMS laboratory in Bordeaux, with supervision from Sérgio Waitman, from ONERA in Toulouse. The successful PhD candidate will be enrolled at the SPI doctoral school in Bordeaux, and a stay at ONERA during the course of the thesis is expected. Dissemination activities such as international conferences, meetings and publications are foreseen and part of the objectives.

Collaborations envisagées	
Laboratoire d'accueil à l'ONERA Département : Traitement de l'Information et Systèmes Lieu (centre ONERA) : Toulouse **Contact** : Sérgio WAITMAN (encadrant) Tél. : 05 62 25 25 32 Email : sergio.waitman@onera.fr	**Directeur de thèse** Nom : David Henry Laboratoire : IMS Tél. : 05 4000 2419 Email : david.henry@u-bordeaux.fr

Pour plus d'informations : https://www.onera.fr/rejoindre-onera/la-formation-par-la-recherche