

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DTIS -2019-**
(à rappeler dans toute correspondance)

Lieu : Toulouse

Département/Dir./Serv. : DTIS/M2CI

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DESCRIPTION DU STAGE

Thématique(s) : Conception et optimisation des systèmes

Type de stage : Fin d'études bac+5 Master 2 Bac+2 à bac+4

Intitulé : Analysis of stiffened composite panels and uncertainty management

Sujet : In the aeronautic field, the amount of composite parts in primary structures is increasing significantly and the validation is mainly realized by experimental tests. Those tests have an important impact on the cost and the lead time of development project. It is necessary to have a numerical alternative to predict the strength and the composite material behaviour to decrease the amount of tests. To support this target, the management of uncertainties (identification and propagation) has to be taken into account at each level of test pyramid to demonstrate reliability of virtual testing, and to avoid too conservative assumptions.

In this context the industrial ambition is to develop an efficient strategy to manage uncertainty quantification and propagation to quantitatively account for the various aleatory and epistemic uncertainties.

This internship will focus on laminated composite panels. Indeed, due to their excellent strength-to-weight and stiffness-to-weight ratios, stiffened multi-layered composite panels are used in many aerospace structures. More precisely, the objective of this study is to estimate the variability in the nonlinear response of stiffened laminated composite panels, subjected to compression-after-impact loadings, due to variations in their geometric and material parameters.

With respect to this objective, a significant numerical simulation capability exists in aerospace industry and at ONERA for studying the various phenomena associated with the response, failure and performance of composite panels using deterministic models. It should be noted that the construction of a parametrized numerical model, robust to the variation of the input parameters, is essential to develop an uncertainty quantification strategy.

Thus, the main activities of this internship work, in collaboration with AIRBUS group, are resumed on the following points:

- Elaboration and evaluation of deterministic model at coupon level. A nonlinear finite element model (Abaqus model) will be used and sensitivity with respect to the solver parameter (mesh size, time step, element types, etc.) will be investigated.
- Identification of input parameters providing some uncertainties: material properties, geometrical variability, boundary conditions
- Elaboration and estimation of a probabilistic model of the random input parameters.
- Parameterization of the deterministic model following identified variables of interest
- Elaboration of the deterministic model used to analyse the stiffened laminated composite panels (Abaqus model), and comparison to experimental data available
- Sensitivity analysis of the quantity of interest with respect to the random input variables. Probabilistic modelling and sensitivity analysis will be carried out using the Python package OpenTURNS.

This Master internship may be extended into a CIFRE PhD thesis at Airbus Group within the same research subject.

Skills: Composite materials and stress analysis, numerical analysis, uncertainties, probabilistic modelling

Est-il possible d'envisager un travail en binôme ? **Non**

Méthodes à mettre en oeuvre :

- | | |
|---|--|
| <input type="checkbox"/> Recherche théorique | <input checked="" type="checkbox"/> Travail de synthèse |
| <input checked="" type="checkbox"/> Recherche appliquée | <input checked="" type="checkbox"/> Travail de documentation |
| <input checked="" type="checkbox"/> Recherche expérimentale | <input type="checkbox"/> Participation à une réalisation |

Possibilité de prolongation en thèse : **Oui**

Durée du stage : Minimum : 4 Maximum : 6

Période souhaitée : Février - Septembre

PROFIL DU STAGIAIRE

Connaissances et niveau requis :

Composite materials and stress analysis,
numerical analysis, uncertainties, probabilistic
modelling

Ecoles ou établissements souhaités :

Ecole d'ingénieur ou M2