

PROPOSITION DE SUJET DE THESE

Intitulé : Management of Uncertainties through Structural Test Pyramid Levels

Référence : **TIS-DTIS-2023-50**
(à rappeler dans toute correspondance)

Début de la thèse : November 2023

Date limite de candidature : July 2023

Mots clés

Uncertainties, Probabilistic approach, Composite materials and structure analysis

Profil et compétences recherchées

Probability and Statistics, Numerical analysis, Mechanics of Solids

Présentation du projet doctoral, contexte et objectif

This CIFRE PhD thesis is supporting a global dynamic of Airbus group to develop hybrid testing as a key enabler towards certification by analysis. The amount of composite parts is increasing significantly and the validation is mainly realized by tests at different scale levels (See Figure 1).

High scale 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 composite material behavior to decrease the number of tests at higher scale. To support this target, the management of uncertainties (identification and propagation) has to be considered at each level of the test pyramid to demonstrate the reliability of analysis methods. This project starts with the idea that a better identification of uncertainties at each scale (potentially with an increased number of low scale tests) could enable to reduce the number of full scale tests.

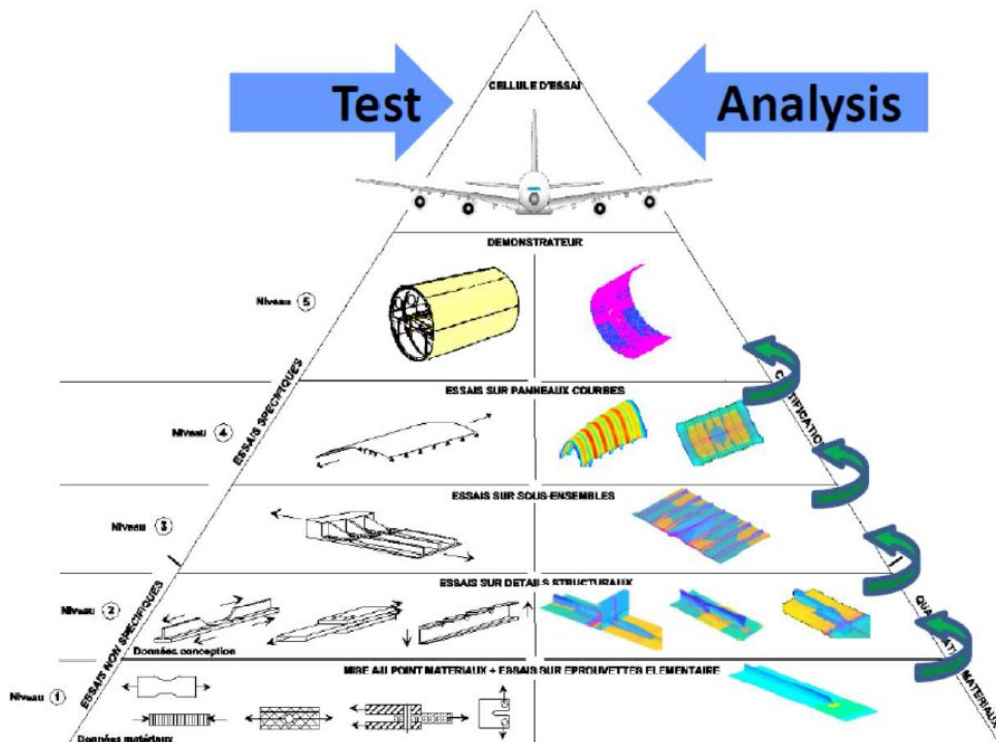


Figure 1: different scale levels of test pyramid

The main objectives of the thesis are:

- to identify and model the main sources of uncertainties at each scale,
- to propagate these uncertainties through the different scales of the test pyramid,
- to perform a sensitivity analysis to determine on which scales new tests have to be run.

This strategy should increase the credibility of the simulation results and thus reduce the need of high scale testing.

To achieve these objectives the project will be roughly organized as follows:

- 1) Selection of the main sources of uncertainties at each scale of test pyramid (model form uncertainty and parametric uncertainty). Construction of a probabilistic model according to this selection. A specific attention has to be paid on the statistical dependence between the input parameters.
- 2) Propagation of the uncertainties through the proposed multi-scale test pyramid model with combined sampling and surrogate modelling strategies. Analysis of error range should be investigated at each test level.
- 3) Analysis of the tradeoff between simulations and scale test experiments with sensitivity analysis. It could enable to determine if full scale test could be alleviated.

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Bibliographical references:

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Collaborations envisagées

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