

Research project offer



Location: ISAE SUPAERO, Toulouse, France

Department: DMSM

Research group: ICA "Joining" transversal axis [MSC and MS2M]

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OFFER DESCRIPTION

Title: Durability of structural bonded repairs

Proposed duration and period : 6 months in 2022

Context

A structural repair consists mainly in removing material around the damaged area (fatigue crack, impact, corrosion) then in adding healthy material. The addition of healthy material passes by a joining phase. The classical joining techniques are bolting, adhesive bonding and hybrid bolting / bonding. The adding material can be made in a different material from the parent one leading to the multimaterial interfaces (composite, metal).

Nowadays, the civil aviation does not use adhesive bonding for structural repairs on aircraft, due to the damage tolerance requirements applied to primary structures. One remaining lock is the ability the sizing of adhesive bonding joints taking into account for the progressive degradation of material properties against the environmental conditions [1-2].

This offer is supported by the project entitled DURECO in collaboration IRDL / ENSTA Bretagne. It follows a first work done in 2021 about the implementation of visco-elastic cohesive zone by Musto et Alfano [3] modeling within a finite element (FE) commercial codes as well as within a house-made code based on the macro-element (ME) modeling [4].

Objectives and work

This offer involves 2 main objectives.

The first objective is to both build the experimental protocols (including test specimen test design, jigs and measurement means) for both elementary test characterization and technological demonstration specimen. The second objective is to test these protocols.

An iterative procedure will be taken and makes use of numerical and experimental testing. A particular attention will be paid on an approach to identify the material parameters needed to feed the Musto and Alfano model.

[1] *Feuille de route nationale. Vers la maîtrise des Assemblages Collés Structuraux.* Aerospace Valley, Astech, Pégase, EMC2 (2014).

[2] CERTBOND, COST Action, CA18120, <https://www.cost.eu/actions/CA18120/#tabs|Name:management-committee>

[3] Musto, M., Alfano, J., 2013. A novel rate-dependent cohesive-zone model combining damage and visco-elasticity. *Computers & Sciences*, 118, 126-133.

doi : 10.1016/j.compstruc.2012.12.020

[4] Paroissien, E., 2020. *Modélisation simplifiée des transferts d'efforts dans les assemblages boulonnés et/ou collés. Mémoire d'Habilitation à Diriger des Recherches, Université de Toulouse III (FR).*

Possibility to continue with a PhD (Yes/No) : TBD

REQUIRED APPLICANT PROFILE AND SKILLS

Study level (tick possible choices)	<input type="checkbox"/> Undergraduate students (3 rd or 4 th year) <input checked="" type="checkbox"/> Master students (1 st or 2 nd year) <input type="checkbox"/> PhD students
Required profile and skills	This offer is suitable to students in last year of MSc, MEng in Solids Mechanics, Structures Mechanics. The expected specific skills are : <ul style="list-style-type: none"> • Fundamentals of strength of materials • Basics on the FE method and CAD
Other useful information	Feel free to take contact