Postdoctoral position at CEMEF

June 2018

Multiscale modeling of glued assemblies failure

Context

Safran Aircraft Engines (SAE) designs, develops and produces aircraft engines. The new generation LEAP engine uses innovative material solutions (composite materials and high temperature alloys). These pieces made of composite materials are designed, by combining them with glued titanium parts, to ensure a significant structural strength.

For many years, CEMEF has been developing expertise in the field of material forming and assembling at different levels going from material analysis and characterization to fracture modeling.

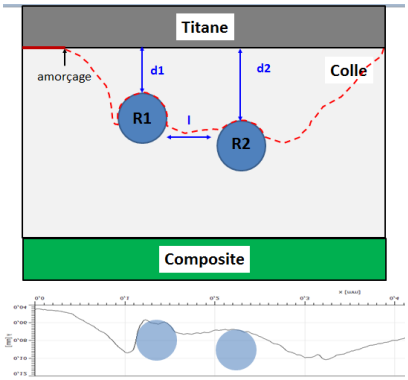
Goals of the postdoctoral study

The objective of the study is to **model the fracture of glued Titanium/Composite assemblies at two scales**.

1. At a macroscopic scale, the objective is to identify the parameters of the various materials of the assembly (volumetric behavior accounting for damage) and the cohesive zone models used at the interfaces (CZM) from experimental tests type single lap shear (SLS), double beam cantilever (DCB), end notch flexure (ENF) or peeling. Two failure modes have been identified: adhesive and cohesive. These two failure modes will be studied during the first phase of the project (6 months) by using numerical simulations and experimental measurements available. 2D simulations in plane deformation will be performed by using ABAQUS Finite Elements (EF) code.

2. At the mesoscopic scale, multiple assembly geometries as well as different glue reinforcing configurations will be taken into account. The reinforcing elements will in a first step be considered as an interface modeled by CZMs. In the final step, a computational library developed at CEMEF using Level-set techniques coupled with automatic remeshing will be used. The objective is to evaluate the capacities of the library CIMLIB to reproduce a cracking path by using cohesive zone models. The proposed approach is enhanced with a remeshing approach that allows to obtain a mesh independent crack propagation.

The correlation - measurement of the crack location will be performed using experimental 3D optical fracture roughness data provided in this study.



Example of crack propagation path.

Tools	*Abaqus finite elements simulations*
Keywords	Adhesion, crack propagation, numerical modeling, glued assemblies
Type of project / collaboration	1-year postdoctoral study funded by Safran Aircraft Engines (SAE)
Profile and skills sought	The candidate must have a PhD in computational mechanics or materials science and engineering. He should have strong skills in mechanics and numerical modeling of materials as well as mechanics of damage and fracture. Knowledge of Abaqus software (or equivalent software) is also desirable. Dynamism, rigor, team working capacities and skills in English will also be important qualities for the selection.
Salary	36 k€ gross annual
Workplace	The study will take place at the Center for Material Forming (CEMEF), in Sophia-Antipolis. During his postdoc, the candidate will be strongly encouraged to publish and participate in national and international conferences.
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