

Research project offer



Location : ISAE SUPAERO, Toulouse, France

Department : DMSM

Research group : ICA “Joining” transversal axis [MS2M and SUMO]

Supervisor : Santiago FRUTOS TARAVILLO, Yann LANDON, Éric PAROISSIEN, Sébastien SCHWARTZ

Email : santiago.frutos-taravillo@airbus.com, yann.landon@univ-tlse3.fr, eric.paroissien@isae-supaeero.fr, sebastien.schwartz@isae-supaeero.fr

OFFER DESCRIPTION

Title: Finite Element Simulation of drilling burr formation in metallic materials

Proposed duration and period: 6/7 months from January 2025 (flexible starting date)

Context

The increasing demand for high-quality structures at lower costs, particularly in aeronautics, emphasizes the need to enhance current manufacturing technologies. In this context, **drilling** is a crucial manufacturing process, especially for the assembly processes using fasteners.

Having a comprehensive understanding of the influence of drilling conditions on hole quality and structural strength (static and fatigue) is essential to enable safe optimization of manufacturing processes. Today, one of the main hole quality problems in drilling is the generation of **burrs**, which are costly to remove and reduce structural strength of mechanical joints if not carefully eliminated.

Previous studies on the influence of drilling conditions on burr formation are mostly experimental. Moreover, the conclusions of these studies are in many cases contradictory, which is due to the lack of a thorough understanding of the drilling burr formation process. The development of numerical approaches, by **finite element simulation**, to better understand this process and to develop predictive capabilities is therefore of great industrial interest.

This topic comes as a continuation of a previous 2024 internship, which served to identify the main practical challenges related to burr formation simulation and to develop some simplified ABAQUS models. The topic also comes as support of a PhD Thesis (**Airbus**) on the study of the impact of burrs on the fatigue strength of metallic assemblies of aircraft structures.

Objectives and work

- Comparative study of different material constitutive laws (thermal and viscoplastic effects), contact laws... for finite element simulation of drilling burr formation
- CAD modelling of tooling and workpiece
- Finite element simulation of drilling process, focused on burr formation study. Model validation with experimental data
- (Optional) Automatization of finite element simulation through scripting

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

REQUIRED APPLICANT PROFILE AND SKILLS

Study level

(tick possible choices)

- Undergraduate students (3rd or 4th year)
 Master students (1st or 2nd year)
 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 :

- Fundamentals of strength of materials
- Basics on the FE method

Other useful information

Feel free to take contact