

PhD proposal 2020-2023

Physico-numerical modeling of the fracture of structures under severe conditions

Context

The global project this PhD study belongs to aims at reproducing numerically the response until fracture of (naval, aeronautical, etc) metallic structures of large dimensions when submitted to accidental overloads (e.g. collision, shock, etc.) involving large deformation and high rate of deformation.

Objectives :

The purpose of this PhD study is to reproduce within a unified FEM-based methodology the successive steps leading to the ultimate ruin of the structure. These steps are: ductile damage, strain localization and crack propagation.

Recent works (Konstantinos Nikolakopoulos's PhD work in progress) have shown at the scale of a 3D structure that the association of the microporous plasticity GTN model with the embedding of a cohesive segment then a strong discontinuity in the finite element within X-FEM formulation (developed in the commercial code Abaqus) gives promising results.

The first scientific challenge of this PhD study is to formulate the GTN/cohesive segments/XFEM methodology in large elasto-plastic deformation.

The second scientific challenge of the PhD study is to apply it in the context of transient dynamics.

A particular attention will be paid for the criteria of 'damage-towards-localization' and 'localization-towards-crack' transition. From the available experimental results, the objective is indeed to introduce more physics. The influence of plastic heating and strain rate during the different steps (transition/evolution)

will be studied and taken into account.

Keywords :

Ductile damage, crack propagation, XFEM, cohesive law, severe conditions

Conditions and prerequisites:

European Union or Swiss citizen

Master of Science or equivalent

Skills : Computational mechanics (finite element method) or/and Mechanics of materials

The applicant should appreciate coding (fortran, python)

Mobility

Supervision :

Advisor : Patrice Longère

ISAE-SUPAERO / ICA (UMR CNRS 5312)

Co-advisor : Jean-Philippe Créte

SUPMECA/QUARTZ (EA 7393)

Location :

Laboratoire Quartz EA7393, Saint-Ouen, France

Institut Clément Ader CNRS 5312, Toulouse, France

Salary :

Around 1500 Euros net per month

Start :

October 2020 (possibility of preparation in the context of a 6-month internship at Quartz Lab.)

Contact

CV and letter of motivation to be sent to

patrice.longere@isae.fr

jean-philippe.crete@supmeca.fr