PROPOSAL FOR A

MASTER RESEARCH PROJECT

2017

Subject title: ***Fragmentation of brittle structures: simulation driven testing***

Field : *computational mechanics , numerical methods; particle based methods*

Institution: Institut Clément Ader (ICA), Université de Toulouse, CNRS 5312-INSA-ISAE-Mines Albi-UPS, 3 Rue Caroline Aigle, 31400 Toulouse, France

Place of work: *Department of Mechanics of Structures and Materials* (DMSM) of the *Institut Supérieur de l'Aéronautique et de l'Espace* (ISAE-SUPAERO)

Supervisors of the project:

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Topic: Fragmentation of composite structures during rapid loading conditions such as crash.

Subject description:

Fragmentation of composite or brittle structures during very rapid loading conditions (such as crash or impact) is due to 3D dynamic loading waves that activate the combination of the material basis ruin modes because stresses and strains exceed admissible values. Values and criteria are driven by the material behavior, whereas the loading waves are generated by the kind of loading. To represent the fracture path (ignition and growth) without mesh connectivity constraints, discrete particle methods a the Material Point Method are new modeling strategies that have proved to be adapted to multipath cracking for transient loadings, event for brittle materials. The purpose of the internship is to take benefit of the ability of this method to reproduce the interaction of the ruin modes of simple composite samples during a dynamic compression. The study will be handled in two steps: continue and enhance the development the home MPM code in the laboratory, use the MPM code to help the analysis of dynamic compression tests that will be done during the internship. 1D testing will be done in purpose of evaluating the ability of the numerical methods to model the separation and contact of fragments. Comparisons with test results will be done for 2D elementary structures under tension or compression loading. The applicant will be involved in a scientific publication.

Pre-requisites or bibliography:

Mandatory : programming (algorithm and coding), numerical methods, brittle behavior (classes)

Appreciated : experience in nonlinear rapid dynamics (class or practice), object oriented programming (class or practice)

The applicant will be given an extended bibliography support, and some references to consult books available at the documentation center. He/she will work in collaboration with a PhD student