

Research Topic 20 for the ParisTech/CSC PhD Program

FOR APPLICATION, PLEASE CONTACT ADVISOR(S) BY EMAIL WITH COPY TO:

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Subfield: Mech. Eng.

ParisTech School: Arts et Métiers

Title: Modeling of composites structures with variability: a data based reduce strategy

Advisor(s):

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Short description of possible research topics for a PhD: (10-15 lines in English + optional figure)

The development of reliable mechanical model for composites structures is a complex issue. This kind of materials is multi-scale, with multiple failure modes and with a high natural variability. In this project we consider the modeling of the failure of a composite structure in static and in dynamic, including potentially the propagation of cracks. The modeling of crack propagation is complex and the numerical methods based on the fracture mechanics are generally very costly in computational resources.

The aim of this project is to develop and assess the performance of a modeling strategy based on model order reduction. Significant companies are now really interested in such approaches. The idea is to use the data from experiment and model to extract the most relevant information and build some reduced basis (Proper Generalized Decomposition). These basis should include the natural variability of the structural response and can be enrich being given some new set of data. The objective is to be able to perform fast simulation of complex problems using at the same time efficient models and big data.

Required background of the student: (Which should be the main field of study of the applicant before applying)

Mechanical engineering, composites materials, numerical methods, programming

A list of 5 (max.) representative publications of the group: (Related to the research topic)

S. Metoui, E. Prulière, A. Ammar, F. Dau, I. Iordanoff, The proper generalized decomposition for the simulation of delamination using cohesive zone model, à paraître dans International Journal for Numerical Methods in Engineering, 99:13 (2014), pp 1000–1022

S. Metoui, E. Pruliere, A. Ammar, F. Dau, I. Iordanoff, A multiscale separated representation to compute the mechanical behavior of composites with periodic microstructure, Mathematics and Computers in Simulation, In Press (published online)

E. Prulière, F. Chinesta, A. Ammar, On the deterministic solution of multidimensional parametric models using the Proper Generalized Decomposition, Mathematics and Computers in Simulation, 81:4 (2010), pp 791-810