Title:

Estimation of quality of approximated solutions of mechanical problems with stochastic data.

Key words: Finite element analysis, uncertainties, numerical method

Profile and skills required:

Motivated student with good academic performance.

Good knowledge of structural mechanic computations and numerical techniques.

Skills and sense in programming.

Description of the project

Background, context:

Ever-growing computational power allows to simulate physical phenomena of increasing complexity. In particular, it can be interesting to take into account the lack of knowledge about the parameters of the model concerning geometry, material behavior, boundary conditions or about the model itself. Different numerical techniques for solving these types of problem have been developed recently.

Description of the work:

In this work, we study the efficiency of numerical methods employed in this framework. In particular, we are interested in studying errors due to approximations done. The goal is to develop techniques that improve the computation quality and preserve the computational cost. An optimal choice of the simulation parameters can be done using an error indicator. The objective is to design a tool which can be efficient on industrial structures.

Work plan:

To achieve this goal, the first part of the thesis work will consist in a study of existing solutions (bibliography) and the second in the definition of one or more solutions. To illustrate the interest of the developed method, numerical tests will be performed first on simple academic examples, then more complex industrial test cases will be tested.

References:

[1] L. Gallimard, E. Florentin, D. Ryckelynck. Towards error bounds of the failure probability of elastic structures using reduced basis models. International Journal for Numerical Methods in Engineering. n°112, issue 9, p1216--1234 (2017)

[2] E. Florentin, P. Diez. Adaptive reduced basis strategy based on goal oriented error assessment for stochastic problems. Computer Methods in Applied Mechanics and Engineering. n°225-228, pp 116-127 (2012)

[3] P. Ladevèze, E. Florentin. Verification of Stochastic Models in Uncertain Environments Using the Constitutive Relation Error Method. Computer Methods in Applied Mechanics and Engineering n°196, pp 225-234 (2006)