Title:

Toward certified metamodels for mechanical engineering

Key words: Finite element analysis, metamodel, numerical method

Profile required:

Motivated student with good academic performance.

Good knowledge of numerical techniques and computation in structural mechanics.

Skills in programming.

Project description

Nowadays the power of computer allows to simulate physical phenomena of increasing complexity to model in detail physical phenomena. In the other hand simple models are also needed in order to take decision rapidly, or simply to be implemented on connected devices. Different numerical techniques are available to develop simplifications and reduce the cost, but they introduce an error due to this surrogate model.

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 of different metamodels and preserve the computational cost. The results can be useful in different fields : dimensioning, identification…

Work plan:

To achieve this goal, the first part of the thesis work will consist in a study of existing solutions (bibliography). Secondly, it will consist in defining one or more solutions. Numerical tests will be performed first on simple academic examples in order to illustrate the interest of the developed method. More complex industrial test cases will be tested later.

References:

[1] T. Dao, Q. Serra, S. Berger, E. Florentin. Error estimation of Polynomial Chaos approximations in transient structural dynamics. International Journal of Computational Mechanics. (2020)

[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)