Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : Breitkopf Given names : Piotr

Status (prof., assistant prof., ...) : Ingénieur de Recherche CNRS, HDR

Laboratory : Roberval Website address : www.utc.fr

Institution : Université de Technologie de Compiègne Website address : roberval.utc.fr

Scientific competence of the supervisor:

Computational mechanics, reduced order modeling, design optimization and high performance computing.

Two major publications in the field proposed for the PhD :

1. L Meng, P Breitkopf, G Le Quilliec, B Raghavan, P Villon, Nonlinear shape-manifold learning approach : concepts, tools and applications, Archives of Computational Methods in Engineering, 2016
2. B Raghavan, Xia, P Breitkopf, A Rassineux, P Villon,Towards simultaneous reduction of both input and output spaces for interactive simulation-based structural design, CMAME, 2013

Website address of the personal page : www.utc.fr/~breit

Supervisor's email : piotr.breitkopf@gmail.com

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-6 (I-1,I-8)

Title : Towards Data-Driven Computational Mechanics: Manifold Learning andDigital Twins.

Subject :

The goal of the thesis is to propose a set of numerical tools allowing to build data-driven computational models combining reduced-order modeling computation with machine learning for data-driven prediction and decision making.
The modern-day experimental techniques produce high volumes of data, giving access to unprecedented detail when observing material microstructure and its evolution under service loads. However, existing constitutive models are not always able to fit the experimental data due to measurement and modeling errors. Machine learning techniques are increasingly used to manage massive quantities of experimental data. However, there are two reasons, preventing their use as replacement for the traditional physical modeling approaches. The first reason is the cost of experiments. The second reason is the lack of physical bases in ML.
Therefore, rather than to replace models by data, the idea proposed in this thesis is to enrich existing models by the data, possibly leading to implicit models, and in fine to simulation from data only. The proposed approach is meant to be general, and will be tested on actual experimental data to be defined in collaboration with research/industry partners of Roberval Laboratory.

Keywords :

computational mechanics, machine learning, digital twins, reduced-order modeling

Expected collaborations :

Background required from the applicant :

The successful candidate will have a bacground in applied mathematics, mechanical engineering or computer science. Competence in linear algebra, programming skills (matlab) are expected. Finite element modeling is a plus.

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

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