PhD thesis position:

Title: Multiscale modeling of heterogeneous non-linear materials with machine learning strategies

Université Gustave Eiffel – Marne-la-Vallée (MSME) – BOSCH Research foundation

A PhD position is proposed at Université Gustave Eiffel (former name of Université Paris-Est Marne-la-Vallée) at MSME Laboratory and funded by Bosch Research foundation. The description of the topic is provided below.

1. Short description of the project

The topic of the PhD thesis will deal with multiscale modeling of heterogeneous non-linear materials with Artificial Intelligence/machine learning strategies. Recently, machine learning /data science techniques have proved to offer new possibilities to construct mechanical models of materials at different scales, by reducing the modeling efforts through appropriate use of available (experimental or numerical) data. In this project, neural network and other data-science-inspired methods will be explored for the construction of surrogate models in multiscale strategies to predict the behavior of nonlinear, heterogeneous materials. Even though such ideas have been developed recently in several specific cases, a more general framework to describe the behavior of a larger class of nonlinear materials with history-dependent behavior is still lacking.

The objective of this PhD project will be to develop such strategies based on machine learning from local numerical material simulations, to efficiently construct models of nonlinear heterogeneous materials with local time-dependent behaviors, possibly including viscoelasticity, plasticity and damage and their use in finite element simulations.

Keyword: Material modeling, multiscale methods, nonlinear mechanics, machine learning, finite elements.

2. Contact and application

Contact:

Julien Yvonnet, Professor, Université Gustave Eiffel
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Laboratoire Modélisation et Simulation Multi Echelle (MSME) UMR 8208 CNRS,
Université Gustave Eiffel, 5 Bd Descartes, 77454 Marne-la-Vallée cedex 2, France.

Application:

Interested candidates are invited to send an application file directly to julien.yvonnet@u-pem.fr including:

- A CV (in English)
- Available Master M2 academic results. Excellent academic results are expected, especially in topics related to the subject (mechanics, numerical methods).
- At least one recommendation letter from the master thesis adviser

3. Skills/required qualifications

The candidate should have a solid background in computational mechanics, continuum mechanics, material modelling, numerical methods and should have a taste for programming/code development. Good knowledge in multiscale methods/homogenization and/or machine learning/data science is appreciated but not mandatory. For practical reasons, candidates from Europe are encouraged.

Mandatory requirements:

- The candidate should speak English fluently

4. Location

The candidate will be located at Université Gustave Eiffel (former name of Université Paris-Est Marne-la-Vallée), Laboratoire MSME UMR CNRS 8208.

Laboratoire Modélisation et Simulation Multi Echelle (MSME) UMR 8208 CNRS,
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The University campus is located in Paris neighborhood, at 30 min by public transportations from Paris center (Marne-la-Vallée Campus)

https://www.univ-gustave-eiffel.fr/footer/plans-d-acces/

https://www.google.com/maps/search/Cit%C3%A9+Descartes/@48.8411442,2.5879456,15z/data=!3m1!4b1

5. Starting period

Between September 2020 and January 2021.