

LMS Seminar series 2024 – 25

Data-driven computational mechanics and physics of materials

Laurent Stainier
École Centrale Nantes

Date and Time: January 09, 2025 (2 – 3 pm)

Venue: Amphi Becquerel (Polytechnique)

Abstract

The Data-Driven Computational Mechanics (DDCM) paradigm was introduced by Kirchdoerfer and Ortiz in 2015. Contrarily to the now popular approaches based on machine-learning, DDCM aims to use material data directly, without training / fitting stage. We will recall the basics of the method, and illustrate how it can be interpreted as an approach constructing a constitutive distance from the data, and how such representation leads to specific strategies to solve boundary value problems. In particular, DDCM offers an interesting approach in the concurrent multiscale framework, where data can be constructed on the fly, and adapted to the problem at hand, leading to efficient simulations. These concepts will be illustrated on examples in elasticity and elasto-plasticity.

About the speaker

Laurent Stainier received his Ph.D. degree in 1996 from the University of Liège, in Belgium (where he also obtained his Master in Aerospace Engineering in 1992). After post-doctoral positions at University of California, San Diego, and California Institute of Technology, Pasadena, he became in 2001 FNRS Research Associate (Chercheur Qualifié) with the Belgian National Science Foundation, at the Aerospace and Mechanics department of the School of Engineering, University of Liège. In 2008, he took a Professor position at Ecole Centrale Nantes, in France, and joined the Research Institute of Civil and Mechanical Engineering (GeM, UMR 6183 CNRS). From 2012 to 2016, he served as director of GeM. From 2017 to 2021, he headed the "Modelling & Simulation" research group at GeM. Since 2022, he is co-heading the "Multiscale Mechanics and Physics of Materials" group at GeM. Prof. Stainier research interests revolve around mathematical modeling and numerical simulation of non-linear, dissipative, physical systems encountered in mechanical and aerospace engineering, with a specific emphasis on multi-scale, multi-physics aspects, under model-based and data-based paradigm.

