PhD in computational mechanics & scientific machine learning

Location: Ecole Nationale des Ponts et Chaussées, Champs-sur-Marne, France
Contract: 3 years full-time position, funded by ERC grant AUTOMATIX - 101229452.
Start date: September/October 2026 (flexible)
Application: Please submit a detailed CV, at least one recommendation letter or contact information of people who can recommend you, a short statement of interest and transcripts of master degree by email to Jeremy Bleyer, jeremy.bleyer@enpc.fr – Deadline: **March 31st 2026**

Position summary

Within the scope of the ERC Consolidator project AUTOMATIX (see details below), we are seeking a **PhD candidate** to develop machine learning approaches for constitutive modeling.

Context

With the advent of machine-learning (ML) techniques, numerous studies have explored replacing traditional constitutive models with black-box neural networks or other data-driven approaches. However, it has been shown that such black-box models may perform poorly outside their training domain if no physics-based constraints are imposed on the learning architecture. Current research therefore focuses on designing physics-informed or physics-constrained learning strategies for various classes of materials.

This PhD project will focus on dissipative material behaviors such as elastoplasticity, viscoelasticity, and related phenomena. Learning dissipative behaviors is particularly challenging due to inherent path dependence and the evolution of unobservable internal state variables. The objective of this PhD is to propose novel hybrid modeling architectures that combine classical phenomenological constitutive models with neural-based components.

Training data will initially rely on synthetic datasets generated from high-fidelity microstructural simulations at the scale of a Representative Volume Element (RVE). In a second stage, learning at the structural scale based on full-field experimental images will also be addressed within the project.

Qualifications

The PhD candidate should:

- have a strong background in solid mechanics;
- demonstrate a good understanding of dissipative behaviors such as plasticity or viscoelasticity;
- have experience in programming and scientific computing (Python, Julia, C++, or similar);
- be able to work collaboratively in a research team and communicate scientific results clearly.

Previous experience with finite element software such as FEniCSx and/or machine-learning frameworks (JAX, PyTorch, etc.) is a plus but not required.

Research environment

This full-time PhD position is fully funded for at least 3 years within the ERC project. The PhD candidate will be supervised by Jeremy Bleyer and will be a core member of the AUTOMATIX research team.

The PhD will be carried out at the Navier Laboratory, a joint research unit of École Nationale des Ponts et Chaussées, CNRS, and Université Gustave Eiffel. The candidate will benefit from a stimulating interdisciplinary research environment at the interface of computational mechanics, mechanical/civil engineering, and scientific machine learning.

The PhD candidate will also have opportunities to present their work at international conferences, contribute to open-source software, and collaborate with partners of the project.

The AUTOMATIX project

Principal Investigator: Jeremy Bleyer[1], Ecole Nationale des Ponts et Chaussées, IP Paris
Funding period: 2026-2031

The AUTOMATIX project aims to improve the modeling of material behavior in solid mechanics. Accurately capturing complex phenomena (such as plasticity, damage, or environmental effects) remains a major challenge in many applications. AUTOMATIX leverages advances in *machine learning* to automatically build models from experimental data while directly embedding physical and mathematical knowledge within the learning architecture. This hybrid approach produces more reliable models, consistent with mechanical laws and less dependent on large datasets.

A key outcome will be an open-source, modular, and high-performance library accessible to both academia and industry. AUTOMATIX will be applied in particular to the modeling of 3D-printed concrete at the Navier laboratory, to better predict complex phenomena such as material curing and crack formation.

[1] https://bleyerj.github.io/