International Doctorate in Civil and Environmental Engineering

Department of Civil and Environmental Engineering
University of Florence, Italy

Call for applications for a PhD position on

Development of unsupervised data-driven techniques to discover constitutive laws hidden in large volumes of data

Data-driven computing is becoming a new paradigm in several scientific fields with a tremendous impact on new technologies. In solid mechanics, the availability of large volumes of data through modern experimental techniques is enabling machine learning methods to open new perspectives in material modelling. In the framework of the research activities of Spoke 7 “Materials & Molecular Sciences” of the National Centre for HPC, Big Data and Quantum Computing, the present PhD project will be focused on the development and implementation of unsupervised data-driven techniques to automatically discover constitutive laws hidden in large volumes of data. Unsupervised approaches require no stress data. Therefore, the methods will have to rely only on full-field displacements and global reaction forces data (see, e.g., Figure 1). The project aims at developing these approaches for materials with complex behaviour, such as rate-dependent, shape memory, temperature-responsive, etc.

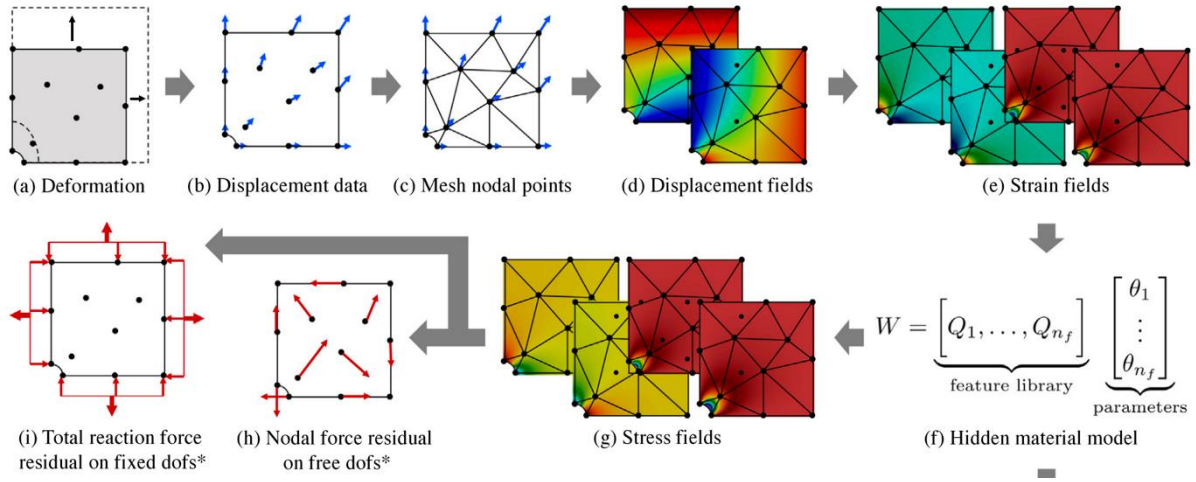

Figure 1. Schematic representation of an unsupervised algorithm for discovering constitutive laws. [Flaschel, M., Kumar, S., & De Lorenzis, L. (2021). *Unsupervised discovery of interpretable hyperelastic constitutive laws.* Computer Methods in Applied Mechanics and Engineering, 381, 113852].

How to apply

1. Applications can be submitted online at https://sol.unifi.it/domdottpnrr/login_en.jsp. The deadline for applications is **November 10th, 2022, 12:00 (Italian time).**
2. After registration, candidates will have to select the doctorate "International Doctorate in Civil and Environmental Engineering" and the scholarship "Development of unsupervised data-driven techniques to discover constitutive laws hidden in large volumes of data".
3. For the complete details on how to apply and the full admission requirements please refer to the page https://www.unifi.it/p12246.html and to document **Annex 1 - Call for applications**.

Qualification requirements

- A master's degree (or equivalent) in engineering, mathematics, physics, material science or similar disciplines. (The complete description of admission requirements is reported in **Annex 1 - Call for applications**).
- A strong background in solid and structural mechanics.
- Experience with scientific computing and programming.
- Excellent English language skills (written and spoken).

What we offer

- A 3-year scholarship with the contract starting on January 1st, 2023.
- Extra funds supporting mobility and a scholarship increase of 50% during the period abroad.
- A joint/double PhD title with a foreign university. An exciting opportunity is foreseen with TU-Braunschweig (Germany).
- At least 9 months of research stay at the partner university. The possible partner university is TU-Braunschweig (Germany) with a possible additional research stay at ETH Zurich (Switzerland).
- An attractive international work environment in a highly committed young team.

For additional information, please contact

- **Enzo Marino** (enzo.marino@unifi.it) for scientific related questions
- **INDICEE Secretariat** (dott-dicea@unifi.it) for administrative issues

Main web page for the PhD position: https://www.unifi.it/p12246.html. More information on the International Doctorate in Civil and Environmental Engineering (INDICEE) at the University of Florence can be found here https://www.indicee.unifi.it/.