Computational Mechanics Group
Prof. Dr. Laura De Lorenzis
www.compmech.ethz.ch

Master's thesis (with industry)

AI-based simulation of the manufacturing process in industrial products

An important component of digital product development is the numerical simulation of the manufacturing process. For products made of porous materials, computer-based simulation of the individual manufacturing steps is a challenge, as time-dependent phenomena take place during production including highly non-uniform deformation. Due to the complexity of the underlying material behavior, finding its suitable mathematical description is a difficult and time-consuming task. We have recently proposed a strategy based on machine learning to automatically discover material models, which we call EUCLID (Efficient Unsupervised Constitutive Law Identification and Discovery). Until now, this framework was successfully applied to purely mechanical behavior of different types.

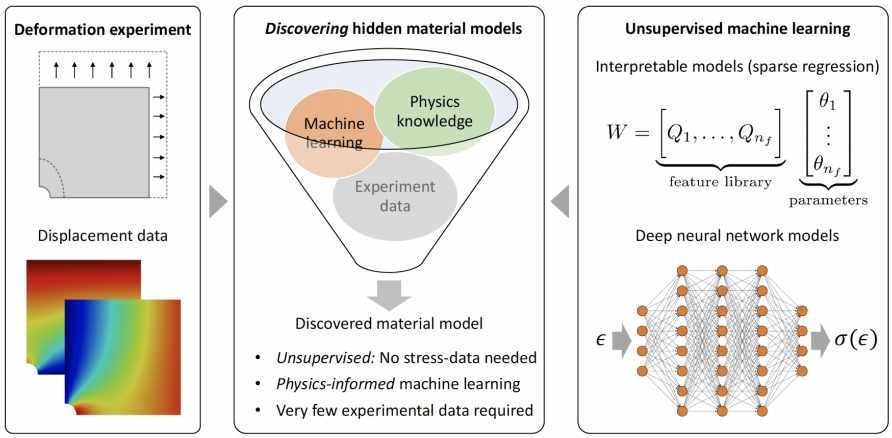

Figure: schematics of EUCLID.

Goal

The main aim of this project, in cooperation with an industrial partner, is to develop a simulation tool to accurately predict the complex deformation that occurs during the manufacturing process of their products. To achieve this goal, we will extend EUCLID to a broader application scenario involving thermo-poro-mechanical behavior.

Subtasks

1. Literature study on modeling of the manufacturing process in porous materials
2. Formulation of an extended EUCLID framework to account for temperature data
3. Extension of the EUCLID code to the case at hand and validation with artificial data
4. Application to real data provided by the industrial partner
5. Validation, parametric study, possible extension to different geometries

Prerequisites

Solving the described tasks requires prior knowledge of continuum mechanics and basic coding language (preferentially Python).

Contact
Saeid Ghouli
Computational Mechanics Group
Tannenstrasse 3, CLA G 27
E-mail: sghouli@ethz.ch