NAPLES, ITALY 30 JUNE - 4 JULY
ACEX2025 NAPLES
18th International Conference on Advanced Computational Engineering and Experimenting

ABSTRACT

Automated Discovery of Material Models: From Theoretical Concepts to Experimental Validation

Laura De Lorenzis
Computational Mechanics Lab, ETH Zürich, Tannenstrasse 3,
8092 Zürich, Switzerland

Recent research conducted by the speaker's group and collaborators on the automated discovery of material models advocates for a paradigm shift, moving away from the traditional approach of calibrating unknown parameters within a preselected material model towards a new objective of model discovery. This entails the simultaneous selection, generation, or encoding of the most suitable model to interpret given experimental data, along with the calibration of its unknown parameters. To achieve this goal, a variety of tools are employed, ranging from sparse regression to Bayesian learning, and from formal grammars to symbolic regression. Each of these tools possesses distinct features but shares the common aim of ensuring the fulfilment of physics constraints and a varying degree of interpretability of the discovered model(s). Initially developed to discover a specific model within a predetermined category (i.e. hyperelasticity, viscoelasticity or plasticity), the approach was then extended to the general case of a material belonging to an unknown class of constitutive behavior. This talk discusses the latest development in this research area, especially focusing on specimen design and experimental validation.