Politecnico di Torino

DIMEAS
Department of Mechanical and Aerospace Engineering

MUL²

Connecting Materials Science and Continuum Theory for Smart Materials via Machine Learning

GUEST SPEAKER

Dr.-Ing. habil. Adrian Ehrenhofer

Institute of Solid Mechanics · Technische Universität Dresden

DAY
30 settembre 2026

TIME
14:30–16:30

LOCATION
DIMEAS · 2° piano
Aula Ferrari

ABSTRACT

The specific pairing of materials and the layering setup determine which kind of functionality can be realized in a smart composite structure. Designing active-passive systems therefore connects the fields of materials science - with a focus on the Processing-Structure-Property-Performance relationship for predicting a material's capabilities - to the field of continuum theory, which is focused on the geometry and functionality of a material in a specific setup. The end-to-end engineering framework combines machine learning methods with continuum approaches, starting from abstract representations of synthesis/processing descriptors and ending at the actuation performance of a smart material in a specific composite functionality.
The specific methods that are combined range from (i) latent space representations via embeddings (known from Large Language Models), over (ii) classical Feed Forward Neural Networks, to (iii) continuum-based multi-field modeling with the Stimulus-Expansion-Model and (iv) its integration into structural mechanics approaches. The practical applicability of the approach will be highlighted for an active hydrogel-coated mesh that can open and close in reaction to hydration level.

PRACTICAL CASE STUDY

An active hydrogel-coated mesh that opens and closes in response to hydration.

ABOUT THE SPEAKER

Dr.-Ing. habil. Adrian Ehrenhofer is a Research Group Leader at the Institute of Solid Mechanics at Technische Universität Dresden. His work connects multi-field modeling of smart structures, data-driven material discovery with classical machine learning and generative AI, and multi-field biomechanics. From September to October 2026, he will visit the group of Prof. Carrera at DIMEAS.