**XII International Conference on Coupled Problems in Science and Engineering, COUPLED 2027**
**June 27-30, 2027, Palma de Mallorca, Spain**

# DISCRETIZATION AND CONTROL OF COUPLED PROBLEMS

**PETER BETSCH*AND PAUL KOTYCZKA†**

* Karlsruhe Institute of Technology (KIT)
Institute of Mechanics
peter.betsch@kit.edu and https://www.ifm.kit.edu/english/Team_Prof_Peter_Betsch.php

† Technical University of Munich (TUM)
Chair of Automatic Control
kotyczka@tum.de and https://www.epc.ed.tum.de/en/rt/pk/

## ABSTRACT

This invited session deals with the structure-preserving discretization and the control of coupled problems. Structure-preserving schemes come with the promise of enhanced numerical stability and robustness. They can be viewed as extensions of conserving schemes, which were previously developed in the context of conservative Hamiltonian systems with symmetry, to coupled dissipative systems. The coupling of several fields makes the design of structure-preserving schemes particularly demanding. Moreover, the interactions of different fields may cause numerical instabilities when applying standard discretization techniques. Structure-preserving methods have the potential to correctly reproduce coupling effects in the discrete setting and are thus less prone to numerical instabilities.

The discretization in space and time of coupled problems is strongly affected by the way in which the underlying field equations are written, including the choice of variables. The structure of the underlying balance laws is built into specific descriptions such as GENERIC, metriplectic dynamics or the port-Hamiltonian formulation which thus might be of advantage for the design of structure-preserving schemes. Exploiting the structure of thermodynamically consistent models can be beneficial for the optimization of coupled processes and the efficient numerical solutions of control problems.

The present invited session aims at bringing together researchers from different fields dealing with the design of structure-preserving discretization methods for coupled problems, their optimization and control. Applications may focus on both dissipative solids as well as fluids. Specific applications may deal with, among others, large-strain thermo-elasticity, electro-magneto-mechanics, or thermo-chemo-mechanics. Also control-theoretic contributions, which leverage the physical structure are welcome.