

Advanced Multiscale and Multiphysics Couplings in Mechanics: Methods and Applications

Vincent Faucher[†], Maria Adela Puscas^{*}, Isabelle Ramière[‡], and Guillaume Ricciardi[†]

* Université Paris-Saclay, CEA, Service de Thermo-hydraulique et de Mécanique des Fluides, 91191, Gif-sur-Yvette, France.

† CEA, DES, IRESNE, Nuclear technology departement, Center of Cadarache, 13108, Saint-Paul-Lez-Durance Cedex, France.

‡ CEA, DES, IRESNE, DEC, Center of Cadarache, F-13108, Saint Paul les Durance, France.

ABSTRACT

Modern computational mechanics generally rely on coupled problems. How to accurately and efficiently simulate systems where mechanics interacts with thermal, fluid, or material phenomena — and possibly across multiple scales simultaneously?

This mini-symposium brings together researchers from computational mechanics, applied mathematics, and engineering around this shared challenge, with a consistent focus on couplings where mechanics plays a central role.

Topics include fluid–structure interaction, thermo-mechanical coupling, contact and impact, multiscale modelling and computational homogenization, reduced-order approaches, heterogeneous and multiphase materials, as well as numerical coupling strategies (partitioned, monolithic, hybrid). Special attention is given to localized phenomena, validation and uncertainty quantification. Scalability toward high-performance computing environments is also of interest.

The symposium aims to bridge methodological innovation and engineering relevance. Contributions may address both fundamental and applied aspects, from theoretical developments to industrial-scale simulations, including numerical methods.