17th World Congress on Computational Mechanics
10th European Congress on Computational Methods in Applied Sciences and Engineering
WCCM-ECCOMAS2026
July 19-24, 2026, Munich, Germany

RECENT ADVANCES IN NUMERICAL METHODS FOR MIXED-DIMENSIONAL PDES

100 - ADVANCED DISCRETIZATION TECHNIQUES

O. COLOMÉS[*], E. NEIVA[†], A. MASSING[‡] AND M. KUCHTA[7]

[*] Delft University of Technology
j.o.colomesgene@tudelft.nl

[†] Centre de Recherche Interdisciplinaire en Biologie, CNRS, Collège de France
eric.miranda-neiva@college-de-france.fr

[‡] Norwegian University of Science and Technology
andre.massing@ntnu.no

[7] Simula Research Laboratory
miroslav@simula.no

Keywords: Mixed-dimensional PDEs, interface-coupled multiphysics, moving boundaries and interfaces, unfitted finite elements.

ABSTRACT

Mixed-dimensional PDE systems arise when coupling unknown fields defined over domains of different topological dimension. They characterize a broad range of relevant problems in many scientific and engineering fields, such as fluid flows in fractured porous media, the design of very large floating sea structures, coupled cortex-cytoplasm dynamics in living cells. They can also be used to impose non-standard interface conditions on a lower-dimensional embedded subspace, e.g., through a Lagrange multiplier.

The aim of this minisymposium is to share and discuss the latest advancements, challenges and perspectives around the numerical approximation of mixed-dimensional PDEs, with a special interest in problems with moving boundaries and interfaces, and advanced discretization techniques. Topics of interest range from modelling aspects, mathematical analysis, computer implementation, solvers and innovative applications. We will address both parametric and immersed boundary approaches, including (but not limited to) arbitrary Lagrangian-Eulerian, unfitted finite element methods, phase-field, virtual element methods or formulations based on tangential differential calculus.