

NUMERICAL METHODS FOR COUPLED PROBLEMS IN GEOMETRICALLY COMPLEX DOMAINS

FRANCESCO BALLARIN^{*}, ANDREA BORIO[†]
AND FABIO VICINI[†]

^{*} Dipartimento di Matematica e Fisica, Università Cattolica del Sacro Cuore
via Garzetta 48, 25133 Brescia, Italy
francesco.ballarin@unicatt.it, <http://www.francescoballarin.it>

[†] Dipartimento di Scienze Matematiche, Politecnico di Torino
Corso Duca degli Abruzzi 24, 10129 Torino, Italy
andrea.borio@polito.it, fabio.vicini@polito.it

ABSTRACT

Complex geometries in partial differential equations (PDEs) may arise in many applications of relevant practical interest nowadays, such as fractures in subsurface, geological porous media with artificial wells, roots-soil interactions or vascularized biological tissues.

Often, a further challenge arises due to the multiphysics nature of such problems.

In several cases, the geometrical complexity and the coupled structure of the problem can be tackled at the same time by means of mixed-dimensional mathematical models, in which heterogeneous topological dimensions are obtained through geometrical reductions. Therefore, the resulting numerical discretization usually involves novel mathematical and numerical techniques especially tailored for these heterogeneous domains, e.g. VEM, HHO and XFEM.

In other cases, practitioners may tackle separately the geometrical complexity and a reduction of the computational complexity of the coupled problems; reduced order models (ROM) based on either Galerkin methods or data-driven approaches are notable examples of reduction for the latter.

This invited session aims to investigate state-of-the-art numerical schemes for coupled problems in geometrically complex domains.

Example of numerical methods of interest for this session are (but not limited to) non-conforming meshes at domain interfaces, advanced domain decomposition strategies and model order reduction techniques.

We also particularly welcome applied cases and contributions to fracture mechanics, biomedicine or geology of relevant practical, industrial or medical interest.