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A generalised multi-rate model for conjugate transfer in heterogeneous media[1] FEDERICO MUNICCHI, MATTEO ICARDI, University of Nottingham — In fluid dynamics, conjugate heat/mass transfer refers to the problem of coupling a "mobile" fluid domain, where a flow field is established and thus advection-diffusion is the main transport mechanism, with "immobile" inclusions, where diffusion dominates. This is therefore relevant to a wide range of problems in subsurface flows, porous media, and heat transfer applications. Fully resolved simulations of this coupled process are often unfeasible due to the difficulties in capturing the possibly complicated, heterogeneous, and often uncertain micro-structures, and because of the wide range of spatio-temporal scales involved. Most of the times, studies at industrial or geological scale rely on appropriate upscaled models, where the conjugate transfer is not resolved directly, but is computed using a set of coupling parameters. In this talk, we present a novel generalised multi-rate model (GMRM) that provides a formal upscaling of the conjugate transfer problem in heterogeneous media where the coupling parameters can be computed from a cell problem. We also show that, unlike previous multi-rate models, the GMRM can be combined with standard homogenisation theory to account for non-uniform interface temperature distributions and non-equilibrium.

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