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Upscaling reactive flow and transport in evolving porous media

Tuesday, 1 June 2021 11:00 (15 minutes)

Porous media naturally exhibit a heterogeneous structure including two different spatial scales: The pore/micro-scale is the fundamental scale, on which flow and reactive transport processes take place whereas the macro-scale, i.e. the scale of the porous medium, is of practical relevance for geoscientific applications. What is more, mineral dissolution and precipitation alter a porous medium's structure and its bulk properties. Due to the medium's heterogeneity and lack in dynamic pore-scale measurements, there has been an increasing interest in effective models accessing such phenomena on the macro-scale without disregarding available micro-scale information.

In this talk, we start from a pore-scale model for reactive flow and transport in evolving porous media and derive an effective micro-macro model by formal two-scale asymptotic expansion in a level-set framework. As such, our approach comprises reactive flow and transport equations on the macroscopic scale including effective hydrodynamic parameters (porosity, reactive surface, diffusion, and permeability). These are calculated from representative unit cells. On the other hand, the macroscopic solutes'concentrations trigger mineral reactions, which alter the unit cells' geometrical structure.

Finally, we present numerical simulations of the fully coupled micro-macro problem with application to dissolution of calcite and dolomite.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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