Workshop Flow in Deformable Porous Media
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Upscaling of mathematical models defined in time dependent geometries

I.S. Pop[1]

ABSTRACT

We consider a model for flow and transport of species in porous media, where the pore geometry is changing due to dissolution and precipitation encountered at the pore walls. After introducing the mathematical model a few mathematical analysis aspects are discussed. Then the upscaling (from the pore scale to the Darcy scale) is discussed for various applications and in various geometries: a simple strip [3], a domain with rough boundaries [4] and a medium with periodically repeating perforations [1] (the solid grains in the medium).

The considered models have gradually increasing difficulty, including non-isothermal models and convection dominating flow regimes [2]. In all cases, the derived upscaled models are defined in the fixed domain (the porous medium) but include components accounting for the change in the porosity of the medium. The latter are due to the evolving geometry at the pore scale.

Finally, some numerical results where the solution to the upscaled model is compared to the averaged solution to the pore scale model.

This is a joint work with I. Berre, C. Bringedal, K. Kumar, F.A. Radu (University of Bergen) and T.L. van Noorden (Comosol B.V.).

References

[1] C. Bringedal, I. Berre, I.S. Pop and F.A. Radu Upscaling of non-isothermal reactive porous media flow with changing porosity. *Transp. Porous Med.*, DOI: 10.1007/s11242-015-0530-9, (2015).

[2] C. Bringedal, I. Berre, I.S. Pop and F.A. Radu Upscaling of non-isothermal reactive porous media flow under dominant Péclet number: the effect of changing porosity *CASA Report 15-32*, Eindhoven University of Technology, 2015.

[3] K. Kumar, T. L. van Noorden and I.S. Pop Effective dispersion equations for reactive flows involving free boundaries at the microscale. *Multiscale Model. Simul.* **9** (1), 29–58, (2011).

[4] K. Kumar, T. L. van Noorden and I.S. Pop Upscaling of reactive flows in domains with moving oscillating boundaries. *Discrete Contin. Dyn. Sys. Ser. S* **7** (1), 95–111, (2014).

[1]Dept of Mathematics and Computer Science
Eindhoven University of Technology
PO Box 513, 5600 MB Eindhoven, The Netherlands
I.Pop@tue.nl

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