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Diffuse-Interface Modelling of Flow in Porous Media DOUG ADDY, Department of Chemical Engineering, Imperial College, London, UK, MARC PRADAS, Department of Mathematics and Statistics, Open University, UK, MARCUS SCHMUCK, School of Mathematical and Computer Sciences and the Maxwell Institute for Mathematical Sciences, Heriot-Watt University, UK, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College, London, UK — Multiphase flows are ubiquitous in a wide spectrum of scientific and engineering applications, and their computational modelling often poses many challenges associated with the presence of free boundaries and interfaces. Interfacial flows in porous media encounter additional challenges and complexities due to their inherently multiscale behaviour. Here we investigate the dynamics of interfaces in porous media using an effective convective Cahn-Hilliard (CH) equation recently developed in [1] from a Stokes-CH equation for microscopic heterogeneous domains by means of a homogenization methodology, where the microscopic details are taken into account as effective tensor coefficients which are given by a Poisson equation. The equations are decoupled under appropriate assumptions and solved in series using a classic finite-element formulation with the open-source software FEniCS. We investigate the effects of different microscopic geometries, including periodic and non-periodic, at the bulk fluid flow, and find that our model is able to describe the effective macroscopic behaviour without the need to resolve the microscopic details.
[1] M. Schmuck, M. Pradas, G.A. Pavliotis and S. Kalliadasis, 2013, Nonlinearity **26** 3259-3277.

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