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Diffuse-Interface Modelling of Interfacial Flows DOUG ADDY, Department of Chemical Engineering, Imperial College London, UK, MARC PRADAS, Department of Mathematics and Statistics, Open University, Milton Keynes, UK, BENJAMIN AYMARD, Department of Chemical Engineering, Imperial College London, UK, MARKUS SCHMUCK, Maxwell Institute of Mathematical Sciences and School of Mathematics and Statistics, Heriot-Watt University, Edinburgh, UK, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, UK — Multiphase processes are ubiquitous in many engineering applications and their modeling can help us to understand phenomena occurring across different scales, from microfluidic devices to oil recovery. However, this is not without difficulties as for instance the presence of complexities on the solid boundaries of the system, such as topological and/or chemical heterogeneities, and the inherent separation of length scales in the medium, impose a number of challenges. Here, we study several examples of interfacial flows by making use of a diffuse-interface approach. In particular, we use the Cahn-Hilliard equations for the evolution of an order parameter (the phase field) coupled with the Navier-Stokes equation for fluid flow. These equations are then solved using FreeFem++. The examples considered in our work include the effects of the solid geometry and wetting properties on the process of confined phase separation, and the process of fluid flow through a porous medium. For the latter in particular, we also make use of a homogenized theoretical model with the aim to determine in which regimes an effective macroscopic description is able to reproduce the full multiscale system.

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