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A Diffuse Interface Method with Adaptive Mesh Refinement for Simulation of Incompressible Multi-Phase Flows with Moving Contact Lines YI SUI, PETER D.M. SPELT, Department of Chemical Engineering, Imperial College London, HANG DING, Department of Chemical Engineering, University of California, Santa Barbara — Diffuse Interface (DI) methods are employed widely for the numerical simulation of two-phase flows, even with moving contact lines. In a DI method, the interface thickness should be as thin as possible to simulate spreading phenomena under realistic flow conditions, so a fine grid is required, beyond the reach of current methods that employ a uniform grid. Here we have integrated a DI method based on a uniform mesh, to a block-based adaptive mesh refinement method, so that only the regions near the interface are resolved by a fine mesh. The performance of the present method is tested by simulations including drop deformation in shear flow, Rayleigh-Taylor instability and drop spreading on a flat surface, et al. The results show that the present method can give accurate results with much smaller computational cost, compared to the original DI method based on a uniform mesh. Based on the present method, simulation of drop spreading is carried out with Cahn number of 0.001 and the contact line region is well resolved. The flow field near the contact line, the contact line speed as well as the apparent contact angle are investigated in detail and compared with previous analytical work.

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