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Simulation of flows with moving contact lines on curved substrates by immersed boundary methods[1] HANG DING, HAO-RAN LIU, University of Science & Technology of China — We propose an approach to simulate flows with moving contact lines (MCLs) on curved substrates. The approach combines an immersed boundary method with a three-component diffuse-interface model and a characteristic MCL model. The immersed boundary method circumvents the penetration of the gas and the liquid into the solid by convection while the three-component diffuse-interface model can prevent the diffusive fluxes of the gas and liquid from infiltrating into the solid substrate. The characteristic MCL model not only allows for the motion of contact lines, but makes the gas-liquid interface to intersect the solid object at an angle in consistence with the prescribed contact angle, even with tangent variation at the solid surface. We examine the performance of the approach through a variety of numerical experiments: mass conservation and interface shapes at equilibrium were tested through the simulation of drop spreading on a circular cylinder, while the dynamic behavior of MCLs on the curved boundaries was investigated by simulating water entry of and drop impact on a sphere, respectively. At last, we studied the penetration process of a drop into a cluster of circular cylinders.

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