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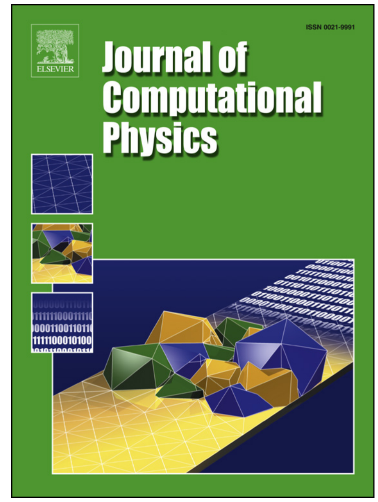


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# Fluid-structure interaction involving dynamic wetting: 2D modeling and simulations

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**Abstract**

In this paper, we propose a hybrid model to compute the capillary force acting on moving solid objects, and combine it with the diffuse-interface immersed-boundary method [J. Comput. Phys. 294 (2015) pp. 484-502] to simulate fluid-structure interaction (FSI) involving dynamic wetting. Dynamic wetting is very important in the dynamic interaction between fluid-fluid interfaces and small moving objects. Numerical simulations of these flow problems require accurate computation of the capillary force acting on the structure, which depends on the instantaneous position of and the effective surface tension at the moving contact line. In order to achieve this, we use the diffuse-interface immersed-boundary method to simulate the dynamic wetting on moving objects, and propose a hybrid model to compute the effective surface tension at the contact line. Specifically, a diffuse interface model for the interface profile out of equilibrium, e.g. at the onset of formation or detachment of contact lines, and a sharp interface model is used for the interface profile at equilibrium. The performance of the method is examined by a variety of numerical experiments. We simulate the sinking of a circular cylinder due to gravity, and study the capillarity-dominated impact dynamics of a solid sphere on a water pool. In both cases the numerical results are quantitatively compared against the experimental data, and good agreements have been achieved. The momentum conservation of the system is carefully checked by studying head-on collision between a drop and a solid sphere. Finally, we apply the method to the self-assembly process of multiple floating cylinders on water surface.

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