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A Newtonian fluid meets an elastic solid: Simulating fluid flow past compliant walls ROLF VERBERG, GAVIN BUXTON, DAVID JASNOW, ANNA BALAZS, University of Pittsburgh — We present a novel algorithm that couples the dynamics of a fluid with the mechanical behavior of the confining walls. The fluid is simulated with the lattice Boltzmann model, an efficient solver of the Navier-Stokes equations. The solid walls are modeled by the lattice spring model, which simulates the dynamics of a continuum elastic material. We implemented solid-fluid interactions that give stick boundary conditions for the fluid and allow for a dynamic interaction between the elastic walls and the confined fluid. Here, the fluid and the solid are coupled through pressure and shear forces that are excerted across the interface. We applied the model to a study of the impact of a microcapsule (a fluid-filled elastic shell) with a regular smooth wall as well as an adhesive surface for varying fluid and shell properties. The results show that we can accurately and efficiently simulate the interaction between microcapsules and a variaty of solid surfaces. This is crucial in the study of many bio-mechanical applications.

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