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Red Blood Cell Deformation Index and Simulation Performance in Lattice-Boltzmann Method and Dissipative Particle Dynamics KACPER OSTALOWSKI, MICHAEL HOOD, JIFU TAN, Northern Illinois University — Cardiovascular disease is the leading cause of death in the United States. Taking up roughly 40% of blood volume, red blood cells (RBC) are the main cell component of blood. Thus, an accurate and efficient RBC model is needed to study complex biological flows. In this study, we present two different approaches to model blood flow with cells: a dissipative particle dynamics (DPD) model and a hybrid particle-continuum model. In DPD, all the particles interact through DPD interactions. The effects of high-viscosity cytoplasm inside the RBC is also studied by separating the internal and external fluids on each side of the membrane. In the particle-continuum model the fluid is solved by the lattice Boltzmann Method (LBM). The immersed boundary method is used to handle fluid-solid interactions. Viscosity of the RBC cytoplasm is maintained by tracking the RBC membrane and adjusting the viscosity of the LBM fluid inside the RBC. The deformation index is measured and compared between the two methods and experimental results. The effects of thermal fluctuations on the system is studied using DPD. The performance of DPD simulations is compared against the performance of LBM simulations, with advantages of either method also being explored.

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