

Lattice Boltzmann Simulation of Sedimentation of a Single Elastic Dumbbell in a Newtonian Fluid

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Abstract: Based on the lattice Boltzmann method (LBM), the sedimentations of a single elastic dumbbell in a Newtonian fluid under different initial positions and orientations, and also that of the elastic dumbbells with different free lengths of the spring under the same initial conditions have been simulated. All of the numerical results show that the final orientations of the elastic dumbbells are in the same horizontal direction, and the final positions of their centroids are all on the centerline of the tube no matter what the initial positions and orientations of the elastic dumbbell or the free lengths of the spring are. When the elastic dumbbell finally falls down vertically, the two circular cylinders of the elastic dumbbell rotate around their own symmetry-axis respectively, and their angular velocities are equal but opposite to each other. For the sedimentations of the elastic dumbbells with different free lengths of the spring, the shorter of the free length is, the faster the final angular velocity and vertical velocity of the circular cylinder will be.

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