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Simulations of the dynamics of polymer solutions in unidirectional flows[1] BERK USTA, University of Florida, JASON BUTLER, TONY LADD — We investigate migration and dispersion of polymer chains in unidirectional channel flows by numerical simulation. The algorithm combines the fluctuating lattice-Boltzmann equation with a bead-spring model of a flexible polymer. The method has been shown to be very efficient, capable of simulating polymers in excess of 1000 beads with Oseen level hydrodynamic interactions. The grid-based solution of the fluid equations makes it straightforward to incorporate complex confining boundaries, but here we examine flows in a narrow channel. We observe lateral migration of a single polymer chain in both shear and Poiseuille flows. The direction and extent of migration depend on the degree of confinement as well as the Peclet number, contrary to previous reports. Numerical results show that the longitudinal dispersion deviates from the Taylor dispersion theory at high Peclet numbers, resulting in smaller dispersion coefficients. We will discuss the underlying mechanisms for the reduced dispersion, and also the possibility of improved separation scenarios.

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