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Simulations of Three-dimensional Droplet Deformation in a Square-Duct at Moderate Reynolds numbers[1] JEREMY HORWITZ, PURUSHOTAM KUMAR, PRATAP VANKA, University of Illinois at Urbana-Champaign — We present results of numerical simulations of deformation of a confined droplet in a three-dimensional square-duct flow using a multiphase Lattice Boltzmann Method. We have studied the effects of capillary number, Reynolds number, and viscosity ratio on the droplet deformation characteristics. Unlike in the Stokes' limit where deformation is governed by a competition between viscous shear and interfacial tension, at higher Reynolds numbers, inertial effects play an increasingly important role. We observe that the deformation history is non-monotonic and contains an overshoot before relaxing to a steady deformed state. In contrast, the capillary number is seen to affect the magnitude of the deformation history and the time at which the peak deformation occurs. The viscosity ratio has a relatively modest effect on the magnitude of the deformation compared with the effects of Reynolds and capillary numbers. However, compared with the Reynolds number, the viscosity ratio and capillary number have a significant effect on the time to reach a steady state.

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