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Migration of deformable droplets caused by microfluidic inertial effects[1] GUOQING HU, CHUNDONG XUE, XIAODONG CHEN, LNM, Institute of Mechanics, Chinese Academy of Sciences — The inertial effect is an effective way of focusing and sorting droplets suspended in microchannels. Here we conduct numerical simulations and experiments on the droplet motion and deformation in a straight microchannel. In contrast to most existing literature, the present simulations are three-dimensional and full length in the streamwise direction. The migration dynamics and equilibrium positions of the droplets are obtained for different fluid velocities and droplet sizes. Droplets with diameters larger than half of the channel height migrate to the centerline in the height direction and two equilibrium positions are observed between the centerline and the wall in the width direction. In addition to the well-known Segre-Silberberg equilibrium positions, new equilibrium positions closer to the centerline are observed. This finding is validated by preliminary experiments that are designed to introduce droplets at different initial lateral positions. Small droplets also migrate to two equilibrium positions in the quarter of the channel cross section, but with the coordinates between the centerline and the wall. The distributions of the lift forces, angular velocities and the deformation parameters of droplets along the two confinement direction are also investigated in details.

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