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Fast prediction of inertial lift on particles in rectangular microchannels[1] GUOQING HU, Department of Engineering Mechanics, Zhejiang University, JINGHONG SU, School of Engineering Science, University of Chinese Academy of Sciences — Inertial migration has been extensively used for manipulation and separation of engineered particles and bioparticles in microfluidic platforms. Inertial lift stems from the asymmetry of pressure and viscous stresses on the particle surface in a Poiseuille flow with finite Reynolds numbers. To design inertial microfluidic devices for particle manipulation, researchers need to predict the focusing positions of the targeted particles under various operating conditions, mainly by estimating the lift forces acting on the particles. Direct numerical simulations provide direct and realistic images of the particle migration, but they could become dramatically burdensome for the complex microchannels encountered in the practical devices. Here we use three-dimensional direct numerical simulations to calculate about 8,000 cases to determine the inertial lift distribution under different operating conditions. Based on these simulation data, we build a database of inertial lifts over a wide range of parameters. The interpolation is performed to apply the database to obtain the inertial lift within the parameter space, by specifying Reynolds number, particle blockage ratio, and channel aspect ratio. We then implement the interpolated lift in the Lagrangian tracking method to predict the particle trajectories in two typical microchannels for the inertial microfluidic applications, yielding good agreement with the experiments.

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