FM16S_10565

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Hydrodynamic Interaction of a Spherical Particle in Poiseuille Flow Between Planar Walls

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By using a two-dimensional Fourier representation of the Green tensor for Stokes flow between parallel walls, we calculate all friction and mobility functions for a single spherical particle moving between two walls subject to Poiseuille flow. The method readily generalises to N particles. For a channel narrow with respect to particle size, superposition of one-wall results is not an accurate approximation for the two-wall problem. Translation-rotation coupling is significant and changes its sign as the lateral position of the particle ranges across the channel. We illustrate these two-wall effects by calculating the trajectories of a magnetic colloid particle in Poiseuille flow subject to an external magnetic field.

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