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Low-Reynolds-Number Motion of a Drop Beween Two Parallel Plane Walls

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The motion of a deformable drop between two parallel plane walls in Poiseuille flow at low Reynolds number is examined using a novel boundary-integral method. Instead of the more commonly employed free-space Green's function, the Green's function for a point force between two infinite plane walls is utilized, which permits direct incorporation of the wall effects without discretization of the walls. Three-dimensional results are presented for neutrally-buoyant spherical and deformable drops of arbitrary fluid-to-drop viscosity ratio, drop size, and position within the channel. For spherical drops, the decrease in translational velocity from the undisturbed fluid velocity increases with drop size, proximity of the droplet from one or both walls, and drop-to-fluid viscosity. For off-centerline placement of deformable drops, lateral migration trends are given as a function of capillary number and viscosity ratio.

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