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Significance of Neglected Hydrodynamic Forces on the Motion of Submerged Particles Acted on by External Body Forces DANIEL COOPER, Virginia Tech - Wake Forest School of Biomedical Engineering & Science, JOHN CHARONKO, PAVLOS VLACHOS, Virginia Tech Department of Mechanical Engineering — Recently, the manipulation of submerged particles using electromagnetic body forces has drawn increasing interest from a variety of fields, particularly medicine, where electrophoretic manipulation in lab-on-a-chip applications and magnetic drug targeting have become important areas of interest. As a direct result of this increasing interest a large number of simulations have been performed investigating the performance of devices and systems whose operation is based upon these physics. In the vast majority of cases, these simulations are based upon a force balance of the applicable body force and Stokes drag. Such simulations neglect additional hydrodynamic forces, including the added mass, Basset, Saffman, and Magnus forces. In the current study, the full equations of motion containing all of the aforementioned terms are nondimensionalized leading to a set of nondimensional parameters governing the behavior of the particle. A parametric investigation is then performed by calculating particle trajectories for both Poiseuille and Womersley flows. This analysis reveals that in many cases, the forces neglected in previous simulations are significant and should not be neglected in future studies.

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