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The sedimentation of a sphere in a vertical cylinder with periodically varying radius WATSON L. VARGAS, LYDA M. PINEDA, CARLOS A. RIANO, School of Engineering Universidad Militar Nueva Granada, Bogota, D. C., Colombia — The problem of evaluating the forces acting on a rigid body in stagnant or moving fluids is a long standing issue. It has important implications in several engineering applications which involve multiphase flows. We study both experimentally and numerically the motion of a solid sphere settling under gravity through a viscous incompressible Newtonian fluid confined within a vertical cylinder whose radius changes periodically along its length. We explore the response of a settling particle to sudden changes in the geometry of the container which due to hydrodynamic wall effects induces periodic accelerations and decelerations of the particle. Experimental observations are presented for the case where the periodic changes in cylinder radius take place abruptly as well as for the case when the change is gradual. The experimental data are obtained for Reynolds numbers of the particle in the range 1×10^{-4} to 1000. These results are compared to those predicted theoretically by Dorfman *et al.*[Phys. Fluids 2003] for a Brownian sphere in a similar geometry. A comparison is made by solving the equation of motion of the sphere –Maxey & Riley (1983)– with and without the history integral term. The experimental observations indicate the relevant role played by the Boussinesq–Basset force which gives a more precise prediction of the particle sedimentation velocity.

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