

Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Effect of Center of Mass-Offset on Settling and Rising Spheres¹

JELLE WILL, DOMINIK KRUG, Univ of Twente — We experimentally investigate the effect an offset center of mass has on rising and settling spheres in a still fluid. We find that the dynamics and kinematics of the particles are extremely sensitive to offsets as small as 1% of the particle radius. We uncover that the governing parameter for the particle behaviour is the particle Froude number, which is defined as the ratio between a rotational timescale of the particle and the characteristic time of the vortex shedding. It is found that the frequency and the amplitude of particle oscillations, as well as the particle drag coefficient vary strongly as a function of Fr . These effects are strongest for $0.08 \leq Fr \leq 0.14$, where resonance occurs between the rotational and vortex shedding frequencies. Furthermore, our results indicate that the particle drag does not correlate well with the amplitude of path oscillations but more sensitively depends on the amount of particle rotation. In rising particles, such rotations are enhanced by the Magnus lift force resulting in an increase in drag. Contrary to this, for settling particles the Magnus lift force counteracts the particle rotation, such that no drag increase is observed in this case.

¹This work was supported the Netherlands Organisation for Scientific Research (NWO) under VIDI Grant No. 13477.

Jelle Will
Univ of Twente

Date submitted: 04 Aug 2020

Electronic form version 1.4