

Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Dynamics and wakes of freely settling and rising cubes¹ ANTHONY WACHS, University of British Columbia, ARMAN SEYED-AHMADI, Department of Chemical & Biological Engineering, University of British Columbia — In this investigation, we present numerical simulations of freely settling and rising cubes in a quiescent Newtonian fluid for various values of the Galileo number $70 \leq Ga \leq 250$ and of the solid-to-fluid density ratio $0.2 \leq m \leq 7$. Ultimately, we obtain a comprehensive two-parameter flow map for a freely moving cube and characterize prominent features of each regime of motion such as trajectories and wake structure. Unlike the case of a sphere, helical motion is observed for all density ratios, marking it as a characteristic type of motion for a cube. Furthermore, we present an in-depth force analysis relevant to the induced lateral motions, and we show that there is a significant jump in the drag coefficient coincident with the onset of the helical regime where large-amplitude lateral displacements appear. The enhancement of the drag coefficient is explained to be a combined effect of the vortex-induced drag and the orientation angle of the cube.

¹Natural Sciences and Engineering Research Council of Canada

Anthony Wachs
Department of Mathematics, Department of Chemical & Biological Engineering, University of British Columbia

Date submitted: 01 Aug 2019

Electronic form version 1.4