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Hydrodynamic Mass of Bluff Bodies with a Cavity[1] MOHAMED ELGABAILI, California State University, Northridge, KENNETH DESABRAIS, US Army NSRDEC, HAMID JOHARI, California State University, Northridge — Hydrodynamic mass of an object may be used to compute the contribution of unsteady drag resulting from potential flow. Even though the hydrodynamic mass of certain bluff bodies such as cylinder and sphere have been available from analytical considerations for a long time, there are no analytical solutions for a general bluff body with a cavity such as a cup facing the flow or a round parachute canopy. There is, however, an analytical solution for spherical shells of various concavities. The translational hydrodynamic mass of cups having various depth and thickness as well as round parachute canopies during inflation was computed using a finite element solver. The kinetic energy of the potential flow around the body was used to extract the hydrodynamic mass. Results indicate that the hydrodynamic mass of a cup can be decomposed into two components, the hydrodynamic mass of a cylinder whose axis is aligned with the flow and the mass of fluid within the cup cavity. Similarly, the hydrodynamic mass of a parachute canopy during various stages of inflation may be written as the hydrodynamic mass of a disk having the same area as the projected area of the canopy plus the mass of fluid enclosed by the canopy.

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