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Apparent Mass Nonlinearity for Paired Oscillating Plates KENNETH GRANLUND, MICHAEL OL, US Air Force Research Lab — The classical potential-flow problem of a plate oscillating sinusoidally at small amplitude, in a direction normal to its plane, has a well-known analytical solution of a fluid "mass," multiplied by plate acceleration, being equal to the force on the plate. This so-called apparent-mass is analytically equal to that of a cylinder of fluid, with diameter equal to plate chord. The force is directly proportional to frequency squared. Here we consider experimentally a generalization, where two coplanar plates of equal chord are placed at some lateral distance apart. For spacing of ~ 0.5 chord and larger between the two plates, the analytical solution for a single plate can simply be doubled. Zero spacing means a plate of twice the chord and therefore a heuristic cylinder of fluid of twice the cross-sectional area. This limit is approached for plate spacing <0.5c. For a spacing of 0.1-0.2c, the force due to apparent mass was found to increase with frequency, when normalized by frequency squared; this is a nonlinearity and a departure from the classical theory. Flow visualization in a water-tank suggests that such departure can be imputed to vortex shedding from the plates' edges inside the inter-plate gap.

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