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Experimental Study of Oscillatory Motion of Particles and Bubbles with Applications to Coriolis Flow Meters DAVID R. KASSOY, JOEL A. WEINSTEIN, University of Colorado at Boulder, MARK J. BELL, Micro Motion, Inc. — The experimental study is designed to measure the motion of a spherical particle in a non-inertial reference frame when the environment oscillates horizontally at a prescribed frequency and amplitude. Measurements are compared with equations of motion over a wide range of fluid to particle density ratios and amplitude ratios as well as inverse Stokes numbers, the three most critical non-dimensional parameters. The experimental configuration consists of a bubble or solid sphere rising or falling in a vertical column while vibration occurs in the horizontal direction. Motion is measured with a high speed video camera and contemporary image and signal processing techniques are used to evaluate the data. Excellent agreement for amplitude and phase shift is found between theory and experiment over the full range of testing, which is defined by small oscillatory Reynolds numbers, finite Strouhal numbers, widely varying density ratios, inverse Stokes numbers, and amplitude ratios. The setup closely resembles multiphase flow in a Coriolis flow meter, a device which measures mass flow rate and density by oscillating two tubes at resonance. Accurate predictions of the motion of the sphere may lead to estimates of measurement errors due to entrained gas or solid particles.

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