

Abstract Submitted
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Motion of a Bellows and a Free Surface in a Closed Vibrated Liquid-Filled Container J.R. TORCZYNSKI, L.A. ROMERO, T.J. O'HERN, Sandia National Laboratories — The coupled motion of a bellows and an idealized free surface in a closed container that is filled with an incompressible viscous liquid and that is vibrated vertically is investigated computationally and theoretically. The bellows and the free surface exhibit rectified motion in the sense that their displacements from their equilibrium positions averaged over a cycle are nonzero. Two types of rectification that arise from two sources of nonlinearity are identified. “Geometric rectification” results from the time variation of the bellows/free-surface geometry. “Advective rectification” results from the advection term in the Navier-Stokes equations. An approximate theory based on these ideas agrees well with direct numerical simulations over a broad range of frequencies from well below to well above resonance. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000.

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