Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Gas-Induced Rectified Motion of a Solid Object in a Liquid-Filled Housing during Vibration: Analysis and Experiments J.R. TORCZYNSKI, T.J. O'HERN, J.R. CLAUSEN, T.P. KOEHLER, Sandia National Laboratories — The motion of a solid object (a piston) that fits closely within a housing filled with viscous liquid is studied. If a small amount of gas is introduced and the system is subjected to axial vibration, then the piston exhibits rectified motion when the drag on the piston depends on its position within the housing. An idealized system, in which the piston is suspended freely between two springs and the gas is replaced with two compressible bellows, is analyzed theoretically and studied experimentally. For a given vibration amplitude or frequency, the piston either remains near its original position ("up") or moves to a different position ("down"), where its spring suspension is compressed. Analytical and experimental regime maps of the amplitudes and frequencies at which the piston is up or down are in good agreement. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

John Torczynski
Sandia National Laboratories

Date submitted: 07 Jul 2017 Electronic form version 1.4