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The Terminal Velocity of a Bubble in an Oscillating Flow L.A. ROMERO, A.M. KRAYNIK, J.R. TORCZYNSKI, Sandia National Laboratories — A bubble in an acoustic field experiences a net "Bjerknes" force from the nonlinear coupling of its radial oscillations with the oscillating buoyancy force. It is typically assumed that the bubble's net terminal velocity can be found by considering a spherical bubble with the imposed "Bjerknes stresses". We have analyzed the motion of such a bubble using a rigorous perturbation approach and found that one must include a term involving an effective mass flux through the bubble that arises from the time average of the second-order nonlinear terms in the kinematic boundary condition. The importance of this term is governed by the dimensionless parameter $\alpha = R^2\omega/\nu$, where R is the bubble radius, ω is the driving frequency, and ν is the liquid kinematic viscosity. If α is large, this term is unimportant, but if α is small, this term is the dominant factor in determining the terminal velocity. 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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