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Statistical equilibrium of bubble oscillations in dilute bubbly flows[1] TIM COLONIUS, California Institute of Technology, ROB HAGMEIJER, University of Twente, KEITA ANDO, CHRISTOPHER BRENNEN, California Institute of Technology — We examine statistical models for the dynamics of a dilute cloud of spherical bubbles with a distribution of equilibrium radii. For inviscid linear and nonlinear bubble oscillations, we prove the existence at large time of a statistical equilibrium and develop related expressions for the moments of the bubble radius distribution. In particular, we show that under statistical equilibrium, the bubble radius may be replaced by its period- averaged value. This leads to an enormous reduction in the number of bubbles that need to be tracked in order to compute accurate statistics. We also show that for sufficiently broad equilibrium radius distributions, timescales associated with relaxation to statistical equilibrium are short compared to physical damping associated with viscosity, heat conduction, and compressibility. This leads to a multiple-time expansion for a slowly evolving statistical equilibrium that we validate by comparing with straightforward (but time consuming) direct computations with many bubbles.

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