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Bubble Density Functionals and Stochastic Fluid Flow Models
RAY B. STOUT, RhoBetaSigmaAffaires, Livermore, CA 94450 — Arbitrary spatial domains containing a stochastic density of gas pressurized bubbles in a fluid material are statistically decomposed such that the probable relative position between two arbitrary spatial points is a time dependent, but path independent, integral functional of fluid material and the bubble density function. Since the relative position vector is an invariant physical quantity, the line integral is stochastically path independent. Using this spatial decomposition vector, arbitrary spatial domains for probable fluid and probable bubble areas and volumes are derived. To address instability in bubble density dependent fluid flows, bubble density evolution in fluids is then formulated with: (1). A Boltzmann bubble density field equation to describe discrete bubble species size(radius) and gas content(atoms) evolution; (2). Relative deformation and velocity functionals of bubble density; (3). Fluid material and bubble gas mass transport functionals of bubble density; and (4). Momentum transport and stress/bubble-pressure functionals of bubble density. These stochastic equations embed finite physical length scales of bubble density fluids.

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