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Modeling and validation of bubble-induced fluctuation in bubbly flows.[1] JUBEOM LEE, HYUNGMIN PARK, Seoul National University — The nature of two-phase turbulence is of a great interest academically and practically. In general, it is decomposed into two contributions; one from the shear-induced turbulence in the absence of bubbles and the other from the bubble-induced turbulence (agitation or fluctuation). Regarding the latter, it is further broken down into non-turbulent (a potential drift) and turbulent (perturbations due to bubble wake) parts. In the present work, we are interested in this bubble-induced fluctuation and suggest a model, which is derived based on a mixing length model (analogous to the single-phase flow turbulence) but considering the effect of neighboring bubble and bubble-induced liquid flow. As a result, we suggest models for turbulent and streamwise normal stresses that includes the contributions from gradients of liquid velocity, void distribution, and bubble velocity. That is, we try to combine the non-turbulent and turbulent parts together. Finally, we validate our models with available data in the literature, including our own, obtained from various flow configurations such as a bubble-swarm, laminar pipe, and bubbly wake flows. We discuss the advantages and limitations of our models.

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