Abstract Submitted
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Bubble interactions with a traveling vortex tube JUSTIN FINN, EHSAN SHAMS, SOURABH APTE, Oregon State University — We simulate the interaction of large bubbles with a traveling vortex tube using an Eulerian-Lagrangian discrete bubble model. The cases presented are 2D simplifications of a vortex ring studied experimentally by Sridhar & Katz [JFM vol 397, 1999]. A plane jet is pulsed into a rectangular domain. After roll up into a vortex tube, eight bubbles are injected into its path to study the subsequent entrainment and vortex distortion. Three modeling approaches are considered: (a) one-way coupling; where the bubbles travel passively in the fluid, (b) two-way coupling; where the momentum exchange between the fluid and the bubbles is modeled, and (c) volumetric coupling; where the volume displacement of the fluid by the bubble motion and the momentum-exchange are modeled. It is found that a volumetric coupling model is critical to obtain any vortex distortion due to entrained bubbles. Parametric studies varying buoyancy effects relative to the vortex strength indicate that the greatest distortion of the vortex results from bubbles which continue to circle the vortex core after entrainment. Despite the two-dimensional approximation, bubble settling locations agree well with the experimental data.

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