Abstract Submitted
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Characterizing the collapse of a cavitation bubble cloud in a focused ultrasound field[1] KAZUKI MAEDA, TIM COLONIUS, California Institute of Technology — We study the coherent collapse of clouds of cavitation bubbles generated by the passage of a pulse of ultrasound. In order to characterize such collapse, we conduct a parametric study on the dynamics of a spherical bubble cloud with a radius of $r = O(1)$ mm interacting with traveling ultrasound waves with an amplitude of $p_a = O(10^2 - 10^6)$ Pa and a wavelength of $\lambda = O(1 - 10)$ mm in water. Bubbles with a radius of $O(10)$ um are treated as spherical, radially oscillating cavities dispersed in continuous liquid phase. The volume of Lagrangian point bubbles is mapped with a regularization kernel as void fraction onto Cartesian grids that defines the Eulerian liquid phase. The flow field is solved using a WENO-based compressible flow solver. We identified that coherent collapse occurs when $\lambda \gg r$, regardless of the value of p_a, while it only occurs for sufficiently high p_a when $\lambda \approx r$. For the long wavelength case, the results agree with the theory on linearized dynamics of d'Agostino and Brennen (1989). We extend the theory to short wave length case. Finally, we analyze the far-field acoustics scattered by individual bubbles and correlate them with the cloud collapse, for applications to acoustic imaging of bubble cloud dynamics.

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