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Computational Fluid Dynamics of Acoustically Driven Bubble Systems CONNOR GLOSSER, JIE LIE, DANIEL DAULT, SHANKER BALASUBRAMANIAM, CARLO PIERMAROCCHI, Michigan State University — The development of modalities for precise, targeted drug delivery has become increasingly important in medical care in recent years. Assemblages of microbubbles steered by acoustic pressure fields present one potential vehicle for such delivery. Modeling the collective response of multi-bubble systems to an intense, externally applied ultrasound field requires accurately capturing acoustic interactions between bubbles and the externally applied field, and their effect on the evolution of bubble kinetics. In this work, we present a methodology for multiphysics simulation based on an efficient transient boundary integral equation (TBIE) coupled with molecular dynamics (MD) to compute trajectories of multiple acoustically interacting bubbles in an ideal fluid under pulsed acoustic excitation. For arbitrary configurations of spherical bubbles, the TBIE solver self-consistently models transient surface pressure distributions at bubble-fluid interfaces due to acoustic interactions and relative potential flows induced by bubble motion. Forces derived from the resulting pressure distributions act as driving terms in the MD update at each timestep. The resulting method efficiently and accurately captures individual bubble dynamics for clouds containing up to hundreds of bubbles.

Connor Glosser
Michigan State Univ

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