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The role of compressibility and vorticity in the collapse of a bubble near a rigid boundary[1] MINKI KIM, SHAHABODDIN ALAHYARI BEIG, ERIC JOHNSEN, University of Michigan, Ann Arbor — Cavitation-bubble collapse is known to cause structural damage in a variety of industrial applications such as naval hydrodynamics and turbomachinery. The concentration of energy and shock emission during the non-spherical collapse is expected to depend on the liquid compressibility, and possibly the vorticity produced during the process. Thus, a better understanding of role of compressibility and vorticity is essential to predicting cavitation erosion. In this study, we compare direct simulations to potential flow calculations to extract the effects of compressibility and vorticity on the collapse of a gas bubble near a rigid boundary. The 3D compressible Navier-Stokes are solved in the gas and liquid using a high-order shock- and interface-capturing scheme; potential calculations are conducted using a boundary integral method. We observe a delay between the two approaches, attributed to the differences in the pressure fields at early times due to compressibility effects. Nevertheless, bubble morphologies are similar for most of the collapse, with discrepancies visible only in the last stage of collapse. The vorticity evolving during the collapse may plays a role on the bubble dynamics at this stage.

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