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The Role of Confinement in Bubble Collapse in a Channel[1]
MAURO RODRIGUEZ, SHAHABODDIN ALAHYARI BEIG, ERIC JOHNSEN, Univ of Michigan - Ann Arbor, CHARLOTTE BARBIER, Oak Ridge National Laboratory — In a variety of applications, cavitation bubbles collapse near solid objects give rise to damage in certain extreme cases. Numerous detailed computational studies have been conducted of a single bubble collapsing near a rigid wall. However, there are known situations where the bubbles collapse in a confined configuration, such as in biomedical applications and in the spallation neutron source. However, the effect of confinement (e.g., in the case of bubble collapse in a narrow channel) is poorly understood. In the present work, we quantify the effect of confinement on the bubble dynamics, pressures and temperatures produced from a single bubble collapsing in a channel. An in-house, solution-adaptive, high-order accurate shock- and interface-capturing method is used to solve the 3D compressible Navier-Stokes equations for gas/liquid flows. We demonstrate the conditions under which the channel walls strengthen/weaken the violence of the collapse and result in amplifying/reducing the wall pressures and temperatures. We further determine the smallest channel width, relative to the initial bubble radius, for which the presence of a second wall affects the collapse. Additional simulations of multiple bubbles collapsing in a channel are underway and will be discussed.

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