Abstract Submitted
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Prediction of Shock-Induced Cavitation in Water[1] AARON BRUNDAGE, Sandia National Laboratories — Fluid-structure interaction problems that require estimating the response of thin structures within fluids to shock loading has wide applicability. For example, these problems may include underwater explosions and the dynamic response of ships and submarines; and biological applications such as Traumatic Brain Injury (TBI) and wound ballistics. In all of these applications the process of cavitation, where small cavities with dissolved gases or vapor are formed as the local pressure drops below the vapor pressure due to shock hydrodynamics, can cause significant damage to the surrounding thin structures or membranes if these bubbles collapse, generating additional shock loading. Hence, a two-phase equation of state (EOS) with three distinct regions of compression, expansion, and tension was developed to model shock-induced cavitation. This EOS was evaluated by comparing data from pressure and temperature shock Hugoniot measurements for water up to 400 kbar, and data from ultrasonic pressure measurements in tension to -0.3 kbar, to simulated responses from CTH, an Eulerian, finite volume shock code. The new EOS model showed significant improvement over pre-existing CTH models such as the SESAME EOS for capturing cavitation.

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