Comparison and Validation of Compressible Flow Simulations of Laser-Induced Cavitation Bubbles ⋆

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Abstract

The numerical simulation of compressible two–phase fluid flows exhibits severe difficulties, in particular, when strong strong variations in the material parameters and high interface velocities are present at the phase boundary. Although several models and discretizations have been developed in the past, a thorough quantitative validation by experimental data and a detailed comparison of numerical schemes are hardly available.

Here two different discretizations are investigated, namely, a non-conservative approach proposed by Saurel and Abgrall (SIAM J. Sci. Comput. **21**, 1115 (1999)) and the real ghost fluid method developed by Tang, Liu and Khoo (SIAM J. Sci. Comput. **28**, 278 (2006)). The validation is performed for the case of laser-induced cavitation bubbles collapsing in an infinite medium. For the computations, initial data are deduced implicitly from the experimental data. In particular, the influence of numerical phase transition caused by smearing of the phase boundary is investigated.

Key words: spherical bubble collapse, stiffened gas model, ghost fluid method

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