Numerical Simulation of Cavitation Bubbles by Compressible Two-Phase Fluids

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The talk deals with the numerical investigation of collapsing cavitation bubbles in compressible fluids. Here the fluid of a two-phase vapor-liquid mixture is modeled by a single compressible medium. This is characterized by the stiffened gas law using different material parameters for the two phases.

For the discretization of the stiffened gas model the approach of Abgrall and Saurel is employed where the flow equations for the conserved quantities are approximated by a finite volume scheme and an upwind discretization is used for the non-conservative transport equations of the pressure law coefficients. The original 1st order discretization is extended to higher order applying 2nd order ENO reconstruction to the primitive variables. The derivation of the non-conservative upwind discretization for the material parameters is presented for arbitrary unstructured grids.

The efficiency of the numerical scheme is significantly improved by employing local grid adaptation.For this purpose multiscale-based grid adaptation is used in combination with a multilevel time stepping strategy to avoid small time steps for coarse cells. The resulting numerical scheme is then applied to the numerical investigation of the collapse of a vapor bubble near to a rigid wall.