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Numerical modelling of multiphase liquid-vapor-gas flows with interfaces and cavitation[1] MARICA PELANTI, ENSTA ParisTech, IMSIA — We are interested in the simulation of multiphase flows where the dynamical appearance of vapor cavities and evaporation fronts in a liquid is coupled to the dynamics of a third non-condensable gaseous phase. We describe these flows by a single-velocity three-phase compressible flow model composed of the phasic mass and total energy equations, the volume fraction equations, and the mixture momentum equation. The model includes stiff mechanical and thermal relaxation source terms for all the phases, and chemical relaxation terms to describe mass transfer between the liquid and vapor phases of the species that may undergo transition. The flow equations are solved by a mixture-energy-consistent finite volume wave propagation scheme, combined with simple and robust procedures for the treatment of the stiff relaxation terms. An analytical study of the characteristic wave speeds of the hierarchy of relaxed models associated to the parent model system is also presented. We show several numerical experiments, including two-dimensional simulations of underwater explosive phenomena where highly pressurized gases trigger cavitation processes close to a rigid surface or to a free surface.

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