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A Finite Element Method for Simulation of Compressible Cavitating Flows[1] EHSAN SHAMS, FAN YANG, YU ZHANG, ONKAR SAHNI, MARK SHEPHARD, ASSAD OBERAI, Rensselaer Polytechnic Institute — This work focuses on a novel approach for finite element simulations of multi-phase flows which involve evolving interface with phase change. Modeling problems, such as cavitation, requires addressing multiple challenges, including compressibility of the vapor phase, interface physics caused by mass, momentum and energy fluxes. We have developed a mathematically consistent and robust computational approach to address these problems. We use stabilized finite element methods on unstructured meshes to solve for the compressible Navier-Stokes equations. Arbitrary Lagrangian-Eulerian formulation is used to handle the interface motions. Our method uses a mesh adaptation strategy to preserve the quality of the volumetric mesh, while the interface mesh moves along with the interface. The interface jump conditions are accurately represented using a discontinuous Galerkin method on the conservation laws. Condensation and evaporation rates at the interface are thermodynamically modeled to determine the interface velocity. We will present initial results on bubble cavitation the behavior of an attached cavitation zone in a separated boundary layer.

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