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Unstructured Finite Elements and Dynamic Meshing for Explicit Phase Tracking in Multiphase Problems[1] ANIRBAN CHANDRA, FAN YANG, YU ZHANG, EHSAN SHAMS, ONKAR SAHNI, ASSAD OBERAI, MARK SHEPHARD, Rensselaer Polytechnic Institute — Multi-phase processes involving phase change at interfaces, such as evaporation of a liquid or combustion of a solid, represent an interesting class of problems with varied applications. Large density ratio across phases, discontinuous fields at the interface and rapidly evolving geometries are some of the inherent challenges which influence the numerical modeling of multi-phase phase change problems. In this work, a mathematically consistent and robust computational approach to address these issues is presented. We use stabilized finite element methods on mixed topology unstructured grids for solving the compressible Navier-Stokes equations. Appropriate jump conditions derived from conservations laws across the interface are handled by using discontinuous interpolations, while the continuity of temperature and tangential velocity is enforced using a penalty parameter. The arbitrary Lagrangian-Eulerian (ALE) technique is utilized to explicitly track the interface motion. Mesh at the interface is constrained to move with the interface while elsewhere it is moved using the linear elasticity analogy. Repositioning is applied to the layered mesh that maintains its structure and normal resolution. In addition, mesh modification is used to preserve the quality of the volumetric mesh.

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