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Sharp Interface Cartesian Grid Method for High Speed Multi-material Dynamics Problems SHIV KUMAR SAMBASIVAN, H.S. UDAYKUMAR, The University of Iowa — The dynamic response of materials to high-speed and high-intensity loading conditions due to shock waves, detonation waves, high-velocity impact and penetration processes is important in several applications including high-speed flows with droplets, bubbles and particles, and hypervelocity impact and penetration. To simulate such complicated high-pressure physics problems,a fixed Cartesian grid approach in conjunction with level set interface tracking is attractive. In this work, a sharp interface, Cartesian grid-based, Ghost Fluid Method is developed for resolving embedded fluid, elasto-plastic solid and rigid objects in hyper-velocity impact and high-intensity shock loaded environment. The embedded multi-material interface is tracked and represented by virtue of the level set interface tracking technique. The evolving interface and the flow are coupled via the GFM approach by meticulously enforcing the boundary conditions and jump relations exactly at the interface. A reflective boundary condition based approach is used to enforce the conditions on the interface. The subcell position of the interface and the topology of the interface are carefully embedded in the interpolation procedure. In addition, a tree-based Local Mesh Refinement scheme is employed to efficiently resolve the desired physics. The broad range of results presented in this work demonstrates the flexibility and robustness of the current approach.

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