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SDOT: A Three-dimensional Mesh-free Detonation Tracking Package[1] JIN YAO, Lawrence Livermore Natl Lab — A three-dimensional mesh-free detonation-shock-dynamics (DSD) front tracker that explicitly solves the detonation front propagation and boundary-angle condition is implemented. Compared to previously existing mesh-based DSD implementations, the new method has advantages with enhanced capabilities and potential lower computing cost. The new DSD front tracker uses marked particles to present the HE fronts and tracks the motion of these particles with a set of time dependent ODEs. The difficulty associated with an implicit DSD boundary treatment in three-dimensions is much reduced by an explicit methodology. In the case the solution enforcing a DSD angle on boundary does not exist, a dead-zone is naturally defined with trace of front-boundary particles. Particles are redistributed on the front with a desired resolution to maintain the quality of surface presentation. Comparisons between reactive-flow simulation and DSD tracking with SDOT show that with a properly calibrated evolution equation, the quality of DSD mesh-free tracking is comparable to DNS. Nevertheless, the SDOT DSD mesh-free tracking is several orders more efficient even in two-dimensions.

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