P20 A Multimaterial Fluid Dynamics Solver for Simulation of Detonation and Airblast on Unstructured Grids

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Abstract:

Simulations of real-world high explosive applications often require consideration of non-spherical charge shapes, off-center initiation, or utilizing specific material equation of state (EOS) parameters. To tackle this problem, a new multi-material computational fluid dynamics (CFD) solver for compressible flow has been developed within the *μSICS* simulation framework at IHPC. The solver is based on a finite volume methodology for three-dimensional discretization on unstructured grids. Materials having widely different equations of state are represented using a general Mie-Grüneisen EOS with a “five-equation” multimaterial model. A second order accurate scheme is developed based on Runge-Kutta time discretization and reconstruction of the primitive variables for use with the HLLC approximate Riemann solver. Several test cases are presented to demonstrate the flexibility of the method for handling a wide range of materials and severe shock conditions. A program-burn detonation model for energetic materials is implemented and validated for applications involving detonation and airblast. Finally, the solver is used to investigate airblast characteristics for different charge shapes. Numerical simulations show a good agreement to near-field pressure history data from experiments with hemispherical and sheet charges.

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