THREAT AGENT DEFEAT MODELING AND TESTING

Numerical Modeling Of Liquid Dispersion By An Explosive Charge

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The numerical modeling of liquid dispersion from a thin-wall container by an internal explosive charge requires the modeling of many complex physical processes using several advanced numerical schemes. While modeling the initial explosive detonation is relatively simple, the interaction of the detonation front with the inner water interface results in one form of the Richmyer-Meshkov instability, as bubbles appear due to the lower density detonation products penetrating the heavier water. As the water is being accelerated, the inertially-driven external water-air interface develops a instability, as the heavier water penetrates the lighter ambient air. This begins with small amplitude perturbations followed by a nonlinear growth regime with growth of water ligaments. The water ligaments typically develop a Kelvin-Helmholtz instability which results in the ligament being snipped at the base, followed with later snipping to large blobs, a process describes as the Reitz break-up. The blobs further break into large droplets, which then break into smaller droplets due to aerodynamics shear (shuttering).

The paper will present the development of the coupled compressible-incompressible methodology linked to a volume-of-fluid method, required to accurately track the interfaces, and the modeling of all the complex controlling physical phenomena