Numerical Simulation of Shaped Charge Jet Penetrating a Plate using Smoothed Particle Hydrodynamics

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ABSTRACT

The shaped charge jet has a stronger penetration effect onto the structure than normal charges. The SPH method with mesh-free and Lagrange properties has an advantage to solve extremely dynamic problems, such as large-deformation, moving interface and multiphase mixing and so on. Therefore, the SPH method is applied to simulate shaped charge detonation, jet formation and its penetration into a plate. And a SPH model of the shaped charge penetrating the plate is established. Firstly, the simulation of the shaped charge detonation is conducted to study the shock wave propagation and underwater explosion shock loading. Secondly, the formation of the metal jet is studied, and the jet velocity and the pressure are investigated in detail. Finally, the damage characteristics of the plate subjected to the metal jet and underwater explosion shock loading are discussed, including the failure mode and the crevasse. The whole analysis and conclusions provide a reference for the structural design of shaped charge warheads.

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