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PROCEEDINGS

Three-Dimensional Numerical Manifold Method for Low-Speed Impact Simulation of PBXs

Ge Kang[1,*], Qiumeng Ouyang[1] and Pengwan Chen[1]

[1]Stake Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology, Beijing, 100081, China
[*]Corresponding Author: Ge Kang. Email: kangge@bit.edu.cn

ABSTRACT

It is of great significance to study the dynamic mechanical response of explosive charge to ensure the safety and reliability of weapon system. The manifold method is a novel numerical theory proposed in recent years to simulate the static and dynamic mechanical behavior of solid material. In the present work, a three-dimensional numerical manifold software (3D-NMM) based on continuous-discontinuous coupled theory is developed to solve the impact response of PBX. Firstly, based on the 3D finite element topology, a four-node tetrahedral coverage system is established, and the shape function and displacement function, element stiffness matrix and inertial force matrix of the 3D-NMM are derived. Giving the cover-based contact theory, the contact detect algorithm is realized, and the 3D-NMM program framework is compiled. Through the classical Steven confined model and viscoelastic statistical crack model, the effects of different impact velocities, sizes and projectile shapes on the impact mechanical response of PBX charge were analyzed. The mechanical response and ignition of PBX explosives under low-velocity impact were predicted, and the low-velocity impact response mechanism of PBX explosive charge was revealed. The simulation results show that the 3D-NMM and contact algorithm developed in the present work are effective for three-dimensional structure collision simulation.

KEYWORDS

Numerical manifold method; contact algorithm; PBX; low-velocity impact

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