MODELING OF PENETRATION DEPTH OF A SHAPED CHARGE JET

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Abstract:

The shaped charge effect is currently the most powerful target penetration mechanism. It relies on conversion of explosive charge detonation energy into kinetic energy of a hypervelocity metal penetrator, known as a jet. The first stage of the shaped charge mechanism is formation of the jet through processes of detonation wave propagation and interaction with a metal liner which accelerates and collapses towards the symmetry axis creating the slug and the jet. Our focus in the present research is on the second stage of the process: the jet interaction with the target material and consequent target penetration/perforation.

There are many approaches to the modeling of shaped charge jet penetration depth into target material. Two major analytical models are: the simple density law and the model with variable jet velocity. However, the most accurate is the approach based on numerical simulations using so called hydrocodes. Modeling and simulation in Abaqus/Explicit software is presented in detail. The complete process of jet formation and penetration is simulated using the Eulerian approach.

Comprehensive comparison between results obtained using various theoretical models (analytical and numerical) and experimental data has been performed providing useful insights and conclusions.

Key words: shaped charge, detonation wave, jet penetration, penetration depth, numerical simulation

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