



工程力学

ENGINEERING MECHANICS

ISSN 1000-4750

CN 11-2595/O3

CODEN GOLIEB

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首页 | 期刊介绍 | 编委会 | 投稿指南 | 期刊订阅 | 收录情况 | 留言板 | 联系我们 | English

工程力学 » 2012, Vol. 29 » Issue (6): 338-345 DOI: 10.6052/j.issn.1000-4750.2010.09.0661

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« « 前一篇 | 后一篇 » »

考虑攻角的长杆弹斜穿透中厚铝靶机理

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MECHANISM OF PERFORATION OF INCLINED MODERATELY THICK ALUMINUM TARGET BY LONG-ROD PROJECTILE WITH YAW

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- 摘要
- 图/表
- 参考文献
- 相关文章

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摘要 攻角对长杆弹斜侵彻有重要影响,该文通过大量数值模拟研究了攻角对长杆弹斜穿透中厚铝板的影响机理。基于实验验证的有限元模型,开展了变速度和攻角的多工况数值模拟,得到了侵彻过程中弹体的减加速度大小、速度方向以及整体弯曲的变化规律,分析了侵彻速度、倾角和攻角对侵彻阻力、弹体弯曲和弹道偏转的影响。结果表明:带攻角斜侵彻时,负攻角对弹体弯曲的影响明显大于正攻角,且弹体弯曲随着侵彻速度的增大而减小;随着斜侵彻速度的增大,攻角引起弹体甩尾和弹道偏转越明显,此时带攻角的斜侵彻过程的能量损耗机理明显不同于正侵彻和无攻角的斜侵彻。

关键词: 侵彻 机理 攻角 长杆弹 侵彻阻力

Abstract: The effect of a yaw angle is important for the oblique impact of a long rod. The mechanism of perforation of a moderately thick aluminum target by a long-rod projectile at various yaw angles is investigated by a set of three-dimensional numerical simulations. Based on a finite element model, validated by the experimental results, this paper performs a set of simulations with varying velocities and yaw angles, and presents the features of projectile accelerations, the orientations of the velocity vector and bending of the rod. The effects of various velocities, the oblique angles and yaw angles on penetration resistance, the bending of the rod and ballistic trajectory offset are analyzed. The obtained results indicate that the bending of the rod is much more sensitive to a negative yaw angle than a positive one for the impact with obliquity. The bending of rod decreases with the increase of impact velocity. The whipping action on the projectile tail and the ballistic trajectory offset due to yaw become more obvious as impact velocity increases. There is a fundamental difference in the mechanism of energy loss between with and without yaw in oblique impact.

Key words: penetration mechanism yaw long-rod projectile penetration resistance

收稿日期: 2010-09-13;

PACS: TJ41

O315

基金资助:国防基础研究项目(A1420080166);国家杰出青年基金项目(10725208);“中央高校基本科研业务费”项目

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