6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

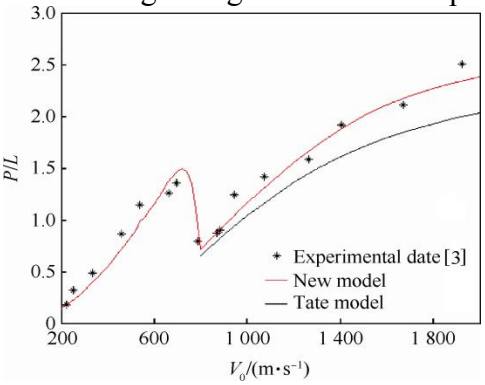
A THREE-REGIME MODEL FOR PENETRATION OVER A WIDE VELOCITY RANGE

J.F. LOU*, Y.G. ZHANG, Z. WANG AND T. HONG

Institute of Applied Physics and Computational Mathematics, Beijing, China, 100094,
jflou@iapcm.ac.cn

Key Words: *Penetration, Theoretical model, Transition zone, Threshold velocity, Long rod.*

Long-rod penetration in a wide range of velocity means that the initial impact velocity varies in a range from tens of meters per second to several kilometers per second. The long rods maintain rigid state when the impact velocity is low, the nose of rod deforms and even is blunted when the velocity gets higher, and the nose erodes and fails to lead to the consumption of long projectile when the velocity is very high due to instantaneous high pressure. That is, from low velocity to high velocity, the projectile undergoes rigid rods, deforming non-erosive rods, and erosive rods. Because of the complicated changes of the projectile, no well-established theoretical model and numerical simulation have been used to study the transition zone. Based on the analysis of penetration behavior in the transition zone, a phenomenological model to describe target resistance and a formula to calculate penetration depth in transition zone are proposed, and a method to obtain the boundary velocity of transition zone is determined. A combined theoretical analysis model for three response regions is built by analyzing the characteristics in these regions. The penetration depth predicted by this combined model is in good agreement with experimental result.



REFERENCES

[1] M.J. Forrestal, A.J. Piekutowski, Penetration experiments with 6061-T6511 aluminum targets and spherical-nose steel projectiles at striking velocities between 0.5 and 3 km/s. *Int J Impact Eng*, Vol. **24**, pp. 57-67, 2000.

[2] S.B. Segletes, The erosion transition of tungsten-alloy long rods into aluminum targets. *Int J Solids Struct*, Vol. **44**, pp. 2168-2191, 2007.

[3] M. Wickert, Penetration data for a medium caliber tungsten sinter alloy penetrator into aluminum alloy 7020 in the velocity regime from 250 m/s to 1900 m/s. *Proc 23rd Int Symp Ballistics*. Tarragona, Spain, pp.1437-1444, 2007.

[4] J.F. Lou, Y.G. Zhang, Z. Wang, et al. Long-rod penetration: the transition zone between rigid and hydrodynamic penetration modes. *Defence Technol*, Vol. **10**, pp. 239-244, 2014.