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Three-Dimensional, Non-Linear Finite Element Analysis of Bullet Penetration through Thin AISI 4340 Steel Target Plate

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Abstract : Bullet penetration in steel plate is investigated with the help of three-dimensional, non-linear, transient, dynamic, finite elements analysis using explicit time integration code LSDYNA. The effect of large strain, strain-rate and temperature at very high velocity regime was studied from number of simulations of semi-spherical nose shape bullet penetration through single layered circular plate with 2 mm thickness at impact velocities of 500, 1000, and 1500 m/s with the help of Johnson Cook material model. Mie-Gruneisen equation of state is used in conjunction with Johnson Cook material model to determine pressure-volume relationship at various points of interests. Two material models viz. Plastic-Kinematic and Johnson- Cook resulted in different deformation patterns in steel plate. It is observed from the simulation results that the velocity drop and loss of kinetic energy occurred very quickly up to perforation of plate, after that the change in velocity and changes in kinetic energy are negligibly small. The physics behind this kind of behaviour is presented in the paper.

Keywords : AISI 4340 steel, ballistic impact simulation, bullet penetration, non-linear FEM
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