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An experimental and finite element investigation of the ballistic performance of laminated GFRP composite target

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Abstract

The ballistic performance of Glass Fiber Reinforced Polymer (GFRP) composite $[0^\circ/90^\circ]_s$ target has been studied against 19 mm diameter conical nosed steel projectiles. The effects of target thicknesses, geometry and boundary conditions have been studied on contact force, residual velocity and induced damage. The ballistic tests have also been reproduced by carrying out three dimensional finite element simulations on AUTODYN hydro code. The nonlinear material behavior of GFRP has been modeled employing shock effect for studying the different modes of failure in the target. The energy absorbing capacity and ballistic limit velocity of the target have also been discussed with varying target thickness, aspect ratio and boundary conditions. The numerical results show the significant contribution of aspect ratio and boundary condition on the ballistic perforation characteristic of the target. The propagation of pressure wave that causes the generation of various stresses in laminate due to projectile impact has been discussed and the numerical results thus obtained in terms of residual velocities and damage have been found to have close correlation with the experimental results.

Keywords: GFRP laminate; Material characterization; Ballistic impact; FE model; Aspect ratio