Analysis of High Velocity Impact Penetration Using the Smoothed Particle Galerkin Method

Youcai Wu[1], Yong Guo[1], C. T. Wu[1], Wei Hu[1], Joseph Magallanes[2]

[1]Livermore Software Technology Corporation

7374 Las Positas Road, Livermore, CA 94550, USA

[2]Karagozian & Case

700 N. Brand Blvd, #700, Glendale, CA 91203

Abstract

Impact penetration is a very complex multi-physics procedure, which involves localized damage, large degree of material fragmentation (failure) and separation (ejecta), complicated projectile – target interaction. The mathematical models of these problems are often ill-posed and the corresponding numerical solutions are generally non-smooth. In essence, severe mesh distortion would occur if Lagrangian finite element method (FEM) is used. Furthermore, ad-hoc erosion criteria are usually needed to model the fragmentation process for the mesh-based formulation. In this paper, the smoothed particle Galerkin (SPG) meshfree method [1] in LS-DYNA® is tested for the analysis of this type of problems. SPG method is a pure particle method based on the nodal integration of nonlocal Galerkin weak formulation. Numerically, the SPG formulation [1-4] is designed to alleviate the zero-energy modes in the conventional meshfree method and to naturally handle the material separation during the failure process. Good agreement with experimental data was observed in the numerical results, which indicates the potential of the SPG formulation in modeling the material failure and associated debris tracking in impact penetration problems.

Reference:

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