CONSTITUTIVE MODEL FOR POLYURETHANE ELASTOMER IN RESPONSE TO LINEAR SHAPED CHARGE

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Abstract: Metals are commonly included in hardening systems. Despite their high strength and ductility, they are subject to penetration by a variety of weapons because of their vulnerability to direct shearing under high-rate loading. Metals can be combined with geomaterials, such as soil or concrete, to spread the loading from a given weapon. To be effective, however, geomaterials commonly add significant mass and volume to the hardening system.

To reduce this additional mass, a polyurethane (PU) elastomer has been studied for incorporation into composite metal-PU hardening. Anecdotal evidence from field testing suggests that the PU, when combined with metals, increases resistance to blast and penetration. Material characterization of the PU is necessary for calculating its contribution to composite hardening. To address this need, an approach to modeling the PU response to linear shaped charge has been examined. The approach is a combination of constitutive modeling options in the commercial solver LS-DYNA including a Johnson-Cook strength model, Gruneissen equation of state and viscoelasticity added using the keyword *MAT_ADD_INELASTICITY.

In this paper, the explosive test selected for modeling is described, and the geometry and meshing of the threat and target are detailed. The approach to constitutive modeling the PU is then presented. Results from the calculation are validated against the explosive test, and points of verification are discussed. Finally, conclusions are drawn regarding the performance of this approach to modeling the PU, and recommendations are made for future work.