ELASTO-PLASTIC HINGING DURING SOFT CAPTURE OF TUMBLING PROJECTILES

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ABSTRACT

Interest continues in the in-flight condition of the high-speed projectiles that often exacerbate blast hazards. For example, there are the metal fragments from cased charges. This interest has led to ongoing developments in soft capture of these projectiles, i.e. with measures to prevent significant further break-up or distortion. However, a recurring problem has been the bending of strip-like projectiles around an axis perpendicular to their length. This has been found to occur even when they are known not to have contacted anything other than very soft solids, such as plastic foams.

A new theoretical treatment of this problem has revealed that the probable cause is bending stresses that inevitably occur, as a long projectile passes through a density interface in soft capture material. This elasto-plastic hinging is predicted to be most likely when projectiles present at intermediate angles of yaw, due to in-flight tumbling following exit from the forming blast wave. Predictions of bending onset are in accordance with strengths and velocities of projectiles and density steps in capture media being within a relevant range. Bending is thought to occur regardless of the significance, if any, of strength.