AN EXPERIMENTAL AND NUMERICAL STUDY OF GROUND SHOCKPHENOMENA IN A PMMA CUBE

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Shock propagation in a PMMA cube is captured by the shadowgraph technique. The shock is produced by the explosion of a piece of millimeter-size aluminum foil located at the center of the top surface of the cube. The explosion is initiated by laser-heating the foil to several electron volts. The subsequent explosion of this foil produces an airblast and a strong 'ground' shock. The numerical study consists of two parts. The first is a set of airblast calculations using the 1-D spherical HAROLD code. This set of calculations defines the pressure-time histories on the surface of the block. The second is the ground shock calculations. The shock in the cube is calculated by the 2-D axisymmetric small-strain code, LAYER. In LAYER, the energy from the exploding foil that is directly coupled to the PMMA cube is modeled in a hemispherical coupling region. In this region, the coupled energy is represented as a prescribed average pressure and a velocity distribution. The expansion of this coupling region produces the ground shock in the calculation. With reasonable adjustments in the timing and the yield of the surface airblast, and the pressure and velocity in the coupling region, the calculated ground shock is made to agree almost exactly with the shadowgraphs at two different times after the explosion. Considering the complexity of the phenomena, this agreement is considered a validation of the physics in the codes.