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THE ANALYSIS OF DETONATION AND ITS EFFECT ON WITNESS PLATE DENT CURVATURE USING A FINITE DIFFERENCE 2-D AXISYMETRIC HYDROCODE

Emily M. Johnson[1], Rachel L. Bauer[1], Keith Clutter[2], Catherine E. Johnson[1]

[1]Missouri S&T Energetics Research Team, 290 McNutt Hall, 1400 N Bishop Ave, Rolla MO 65409, USA;
[2]SciRisq, 448 W. 19th St #210, Houston TX 77008, USA.

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Abstract: When a detonation wave interacts with air, a rarefaction wave is sent into the reaction zone slowing the detonation wave and changing its shape. Casing material around the explosive can mitigate this effect, but will not eliminate it. Factors such as casing material density, bulk sound speed, and thickness impact the detonation. This has been observed in previous experimental work in which the casing material around a cylindrical charge was varied and unique dents were produced in a witness material. For this study, a two-dimensional axisymmetric explosive hydrocode was built in c++ to model a cased cylindrical charge resting on a steel witness plate and was validated against experimental work. The casing and witness material were modeled using a Linear *U-u* equation of state (EOS). The explosive charge was represented by compressible reactive Euler equations with a polytropic EOS. For this study, material parameters of the casing material and explosive were varied within the code to analyze their impact on the detonation wave and its subsequent impact on the witness material. The varied parameters include the explosive diameter, the casing thickness, and the EOS parameters of the casing. The resulting detonation wave was observed as it traveled through the explosive in the form of a pressure gradient and velocity. The varied material parameters were evaluated based on the resulting detonation behavior to quantify each parameter’s influence on the reaction. Additionally, the wave shape, pressure, and velocity were compared to the dent produced in the witness plate to diagnose the correlation between the shape of the dent and detonation wave. From this study a clearer understanding of the impact each material parameter has on the detonation wave was drawn and the link between detonation wave characteristics and observed damage to witness material was identified.