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New GSD modeling for air blast wave supported by non-uniform flow SUNHEE YOO, Torch Technologies, GEORGE BUTLER, University of Dayton Research Institute; Air Force Research Laboratory — This paper describes our research to find a way to model complex shock interactions using Geometrical Shock Dynamics (GSD) as a more efficient alternative to computationally expensive hydrodynamic simulation. The "classical" GSD, as initially described by Whitham, describes shock propagations in which the flow immediately behind the shock front is uniform. However many other shock dynamics phenomena in air, such as the Taylor point blast wave, are not characterized by a uniform flow behind the shock, so Whitham's GSD theory cannot provide an accurate shock simulation. We thus have developed a new expanded GSD (EGSD) model that can portray shock propagation with a non-uniform flow state behind the shock, which can arise from Taylor point blast and from a finite-sized, condensed explosive detonation. The new EGSD model is the first model to our knowledge that relates GSD theory to explosive properties to study the intensity of air blast waves from an explosive detonation. In this paper we have also introduced a spline technique, a shape preserving approximation in the EGSD simulation, for stable and accurate numerical simulation. This is critical for tracking the transition from regular to irregular shock reflections and the dynamics of local discontinuities, which come from shock reflections and the formation of Mach stems.

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