DEVELOPMENT OF A PHYSICS-BASED BLAST PROFILE GENERATOR

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Abstract: In many problems of blast vulnerability assessment and development of protective technologies, interests concern the response to standardized reference blast conditions in the mid- to far-field not requiring resolution of the detailed detonation processes within a particular explosive and its near-field fireball expansion. ConWep [1] has been an outstanding software tool in this regard in that a user can quickly extract key blast parameters for a specified charge size, type, and range based on the experimental Kingery-Bulmash (K-B) database for spherical TNT blast. ConWep remains very well suited for its intended use, however, the blast parameters from the K-B database and presented through ConWep are not sufficient for many applications. The database is gas-dynamically incomplete, presenting only static-overpressure conditions whereas additional properties such as flow velocity and density are also required for complete blast flowfield resolution. Furthermore, the negative phase and secondary shock are not included and most explosives do not scale with TNT blast.

The Pressurized Volume Constant Gamma (PVCG) blast-source model was introduced in [2] as a simplified means to resolve blast conditions generated by a wide range of explosive formulations. PVCG does not require any special detonics solvers and treats the charge as a 'balloon' of artificial high-pressure ideal gas allowing its use in any computational fluid-dynamics (CFD) code for compressible flow. The blast flow solution is physics-based and therefore fully defined and self-consistent regarding the gas-dynamic conditions (pressure, density, flow-velocity, and temperature for example) and includes the negative phase and secondary shock in the solved wave profiles. Subsequent to the successful simulation of other explosives, PVCG is used here to replicate and extends the K-B database for TNT blast to estimate complete blast-wave profiles into the negative phase, including all relevant gas-dynamic conditions. The results for the blast flow-field solution are quickly accessible by means of an Excel application based on a development by Dewey [3].

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