EVOLVING TECHNOLOGY: MULTI-PHASE, MULTI-MATERIAL, ALE APPROACH AND TOOL DEVELOPMENT FOR BURIED BLAST SIMULATION

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ABSTRACT

Modeling the response of structures subjected to blast from shallow buried explosives poses a challenge, primarily due to the inherent coupled interaction. The response of the structure affects the surrounding blast pressure field, which in turn, affects the loading on the structure; therefore the problem is coupled in nature. The problem is complicated due to the difference in time scales associated with the blast loading and structural damage. Damage mechanisms such as structural collapse generally occur later compared to the duration of the blast since the duration of the failure event is much longer. In this presentation, an evolving methodology, combining the effects of early coupled interaction and later structural damage, Fluid-Structure Interaction (FSI) effect using multi-material and multi-phase Arbitrary Lagrangian Eulerian (ALE) formulation is described.

The utility of the methodology is demonstrated through a newly developed toolset for LS-DYNA ALE based simulation and an example involving blast loading on a high-fidelity plate structure supported through Vertical Impulse Measurement Fixture [VIMF]. Data from the experiment is compared with the LS-DYNA ALE simulation to investigate the efficacy of the methodology. Results reveal that this new analysis tool yields accurate results that will be useful in predicting vehicle response and provide a means of quickly iterating on proposed structural solutions.

KEY WORDS

Fluid Structure Interaction, Lagrangian, Eulerian, ALE, Multi-phase, Multimaterial, LS-DYNA