INTERNAL BLAST RESPONSES OF A STIFFENED COMPARTMENT: EXPERIMENTS AND SIMULATIONS

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Abstract:
Internal air blast is a major field of study for the survivability of naval platforms. The blast is confined in a compartment and predicting the damage from the explosion involves modelling many processes, including the detonation, fluid-structure interaction, complex reflections and material failure. A key feature is to simulate and predict the loading on the surrounding walls. Thus there is a need to quantify these processes so that simulations can be validated. To meet this end, experiments were conducted on a 1.5 x 1.5 x 1.5 m mild steel stiffened compartment, consisting of 6 mm welded plate walls. The compartment was subjected to a series of internal explosions, with the explosive centrally located. The internal pressure load was measured by surface mounted transducers on the walls, and the subsequent plate response was measured by suitably mounted strain gauges and accelerometers. Additionally, time-of-arrival pin probes on the wall face were used to measure the speed of the incident shock wave.

The extensive pressure and strain measurements have enabled detailed comparison between simulation and the measured loading and response of the compartment walls. Several simulation techniques are explored and a discussion is presented of the criteria needed to select the appropriate numerical techniques during each stage of these processes. These studies are a continuation of previous experiments on explosive loading on plates. Comparisons are also presented between the response of a free plate and that of the constrained internal plates (walls) of the compartments.