BLAST RESPONSE OF A FLUID-FILLED ELASTIC SHELL

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ABSTRACT

The investigation of blast-induced neurotrauma requires an understanding of the processes by which stresses are imparted to the brain from exposure of the head to an external shockwave loading. Results of a combined experimental/modelling study are described investigating the blast response of a generic fluid-filled elastic spherical shell with particular interest in how the internal stress-field is affected by the model parameters including boundary conditions. Computational modelling simulations are described for the dynamic response of 50mm diameter fluid-filled spheres subjected to simulated blast-wave pressures in the range of 15-30psi. A series of coupled CFD/FEA (Chinook/LS-DYNA) simulations was performed and results compared with experimental measurements from the Advanced Blast Simulator at DRDC Suffield Research Centre showing good agreement. Key extracts are presented from a parametric computational study to determine the effect of various modelling variables (mesh resolution, cavitation, load curve, material models, hourglass control) and physical parameters (fill material, shell thickness, shell shape, apertures) on the structural vibration response and consequent fluid pressure developed inside the sphere.