ANALYSIS OF PLATE AND SHELL STRUCTURES SUBJECTED TO NUCLEAR AND CONVENTIONAL EXPLOSIONS

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The analysis of a structure subjected to a nuclear or conventional explosion is of considerable interest for both military and civilian systems. This is a problem area of extreme difficulty both from the gas dynamics
and structural response points of view. These problems are not amenable to simple solutions. Thus, the present paper describes a research program with an overall objective of developing a FE code for the analysis of these problems as well as the execution of a series of small scale, well controlled experiments by which the code may be verified.

The developed FE program, in the first instance, was oriented toward the analysis of a flat plate or cylindrical shell structures. The elements developed allow non-linear strain-displacement relations, elasto-plastic linear isotropic hardening material behavior as well as strain rate and thermal effects. The formulation is valid for a full range of element thickness from very thin to moderately thick. Isotropic homogeneous materials have been assumed because of the broad range of date which is available for these materials at ambient and elevated temperatures. Time integration of the resulting discretised motion equations has been accomplished using unconditionally stable and accurate integration algorithms.
To fully demonstrate this numerical analysis capability an example of a nuclear burst/target combination, which includes all the loading and material behavior features which have been mentioned, will be presented.

Future aspects of this research program include: the extension of the code to deal with composite materials, stringer elements, and general assemblages of plates, as well, a series of blast tests an highly instrumented isotropic and fibre composite cylinders are planned. To complete the veri-fication of the code numerical comparisons to these cylinder test results will be made in addition to comparisons with panel blast trial currently underway at DRES.