FINITE ELEMENT ANALYSIS OF A BLAST LOADED CYLINDER

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The transient response of a thin walled aluminum cylinder, representing a generic aircraft structure, loaded by an enveloping shock wave has been simulated with the ADINA FE program and the results have been found to correlate well with counterpart experimental records.

To select an appropriate modeling of the cylinder, an eigen frequency analysis was performed using the 16 noded shell and the 3 noded triangular plate elements in ADINA. The first 20 frequencies and corresponding mode shapes were found to correlate excellently with those from a Raleigh-Ritz analysis, with the 16 noded element being marginally better.

A linear analysis of the blast only test has been performed and the strain histories at most gage locations correspond very well with test results for the first 4 ms, but thereafter the strain records at some gage locations show an increasing divergence. A non linear analysis shows that dynamic buckling is the predominant cause of this divergence and that the code calculation and test results clearly agree in the number of buckling nodes, the magnitude of the deformation patterns on the cylinder do not coincide exactly due to the imperfection sensitivity of buckling phenomena. These calculations conclusively show that dynamic buckling is the predominant effect and emphasize the importance of choosing appropriate modeling techniques for such problems.