HEAD-ON REFLECTION OF A NORMAL BLAST WAVE FROM A RUBBER ROD ANALYTICAL, NUMERICAL AND PARAMETRIC STUDIES

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Scientists have been attempting in the past four decades to find ways by which blast wave load on structures can be reduced.
A few years ago a joint research project was initiated by the Department of Mechanical Engineering of the Ben-Gurion University of the Negev in Israel and the Ernst Mach Institute in West Germany, in order to study the head-on collision of a normal blast wave with a flat plate supported by a rubber rod.
The governing equations of the above mentioned process were developed and solved numerically, using a finite difference scheme, to obtain the flow field properties both in the gaseous and the solid phases.
Comparison with our experimental results gave us confidence that both our analytical model and computer code are capable of accurately simulating the problem at hand.
Based on this agreement, detailed investigation on how the flow field is affected by the various parameters of the problem, was conducted. The results of this parametric investigation enables one to choose a set of pa-
rameters by which the blast wave load could be either enhanced or reduced.
A brief report of both the analytical and experimental studies will be followed by a detailed report of the parametric study which will include easy-to-use working plots.
As an example, consider figure 1 where the ratio of the pressures acting on the shock tube end wall and without a rubber protection are plotted as a function of the incident blast wave Mach number. The parameter in this case is the ratio between the cross section area of the flat plate and the rubber rod -A*. It is evident from figure 1 that for a given value A* the pressure ratio decreases as the incident blast wave Mach number increases.
Furthermore, for Ms=3, for example, the pressure acting on the end-wall of the shock tube could be enhanced by about 100% by choosing A*=0.5 or reduced by about 60% by choosing A*=4.