THE INFLUENCE ON TARGET LOADING OF NUMERICAL WAVE REFLECTIONS FROM TRANSMISSIVE COMPUTATIONAL BOUNDARIES

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This paper quantifies the changes in the loading on a target caused by the arrival of artificial, numerically induced reflections of waves from the transmissive boundaries of a computational grid. Several computations were performed, using the 2D Cartesian co-ordinates mode of the Ballistic Research Laboratory's version of the air blast code HULL. HULL uses a 2 step, explicit differencing method to solve the inviscid, unsteady Euler equations. A target is simulated in the computational grid by generating aggregates of rigid, immobile, and impermeable flow field cells. The simple transmissive boundaries in HULL simulate a zero gradient condition across the boundary for both the pressure and the normal component of the velocity. Simple tranmissive boundaries such as these will partially reflect, in kind, waves that strike them, including shock, compression, and expansion waves. The strength of these reflected waves is directly related to the strength of the incident waves. These reflected waves then travel back into the computational grid, modifying the flow field conditions in the regions through which they pass, and thereby ending the simulation of free field conditions. The usual procedure is to locate the transmissive boundaries far enough away from the target so that these artificial waves do not arrive at the target during the time of interest. However, limitations due to available computer storage, cost, speed, or any combination thereof, may necessitate a computational grid design such that some disturbances at the target from the transmissive boundaries are probable.

Hence it is necessary to estimate the effects of these disturbances on the computed loading of the target. The analysis of the computations performed here provides insight into the nature of the disturbances and a means for estimating the deviation from free-field results._