

AN EFFICIENT ANALYTICAL CODE TO COMPUTE THE PRESSURE LOADING OF STRUCTURES EXPOSED TO HIGH EXPLOSIVE DETONATIONS DEVELOPMENT AND VALIDATION

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Numerical studies of structure response to external high explosive detonations require calculation of structure loading and calculation of structural response. The loading depends on Detonation characteristics (explosive charge mass, shape, distance from the structure) and on structure itself (geometry). If the geometry is complex, hydrocodes can be used to compute the shock wave diffraction process, so to get the pressure loading.

However, if the vulnerability of a system to external detonations must be predicted, whatever the relative location of the charge is, time and price of hydrocode computations began too high. Indeed, such a study can require hundreds or thousands of calculations.

To solve this difficulty, CEG has developed a code which calculates very fast loading of several generic structures, to external detonations. The paper describes this code and different validation tests.

At the current development step, the code is able to calculate the loading of flat surfaces or the loading of cylindrical structures. The next step must include parallelepipedic shapes in free field or on the ground.

The main calculation steps are as follows. The structure skin is discretised in elements, as small as the user wants. For each element, the distance to the charge center and the incidence angle between the surface and the shock are calculated. Then the static overpressure amplitude of the incident shock wave is calculated from empirical data. The amplitude of the loading overpressure is calculated versus the incident overpressure and the incident angle. The decaying profile can be triangle, based on equivalent pressure impulse, or exponential, based on comparisons with results of 3D computations using the SHARC hydrocode. For a cylindrical structure, an analytical formula has been developed to compute the overpressure versus time.