Effect of Wall Curvature on the Reflected Impulse Produced by an Explosion in Air

Y. Kivity, H. Lenselink, C. Florie, A. Venis
MSC.Software (E.D.C) B.V.
Groningenweg 6, 2803PV Gouda, The Netherlands

Abstract

This paper is concerned with the impulse on a curved wall resulting from the reflection of the spherical blast wave of a nearby explosion in air. Our aim is to extend the existing manual data for reflected impulse, which is currently limited to planar walls, to walls with curvature. Four cases of curved walls are considered, in addition to the standard plane wall, which are listed here in descending order of the mean curvature:

- Explosion inside a sphere with radius R – mean wall curvature =+1/R
- Explosion inside a long cylinder with radius R – mean wall curvature =+1/2R
- Explosion at a distance R from a plane wall – mean wall curvature = 0
- Explosion outside a cylinder with radius R – mean wall curvature =–1/2R
- Explosion outside a sphere with radius R – mean wall curvature =–1/R

The work is based on calculations with the MSC.Dytran hydro-code, employing a 3D, 2^{nd} order accurate solver. A series of calculations was carried out for a TNT charge of 2 kg. The cylinder or sphere radius R was chosen as 1 m. For the external explosions, the distance between the charge and the surface was chosen equal to the radius R, in order to obtain a consistent set of results. It was found that, as expected, the reflected impulse is a monotonic function of the wall mean curvature, increasing about 44% from the plane wall value to the internal spherical explosion. Similarly, a decrease of about 12% was found from the plane wall to the external spherical explosion.