DUSTY BLAST WAVES

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An explosive generated blast wave is a spherical discontinuity surface. When such an event takes place in a pure gas environment, the solution is well known. However, since the earth atmosphere may contain various types of solid particles (dust), it is of interest to evaluate the effect of these solid particles on the blast wave and the post-shock flow properties.

In order to evaluate the dust effect on the considered flow, the governing equations of mass, momentum and energy conservation were formulated for a blast wave in a dusty gas and solved numerically using a FD-Scheme. the method of artificial viscosity is used for proper representation of discontinuities (e.g. shock fronts). Details regarding the development of the conservation equations and the numerical solutions are given in the paper.

The solution is conducted for the following 2 cases:
- The gaseous phase is an ideal nitrogen gas. This assumption is reasonable when the blast wave Mach Number is smaller than 5.
- The gaseous phase is a real nitrogen gas. At higher Mach number, the post-shock gas temperature is high enough to excite, at least partially, some of the gas internal degrees of freedom.

For comparison purposes each solution was conducted twice: one for a pure gas case, the second for a similar dusty case. The highlights of the obtained results are:

1. Due to the dust presence the primary bast wave is significantly delayed. (Its velocity is smaller than that obtained for a similar pure gas case).

2. In a dusty case, the blast wave is weaker (smaller pressure jump through the shock front) than a similar pure gas case.

3. Increasing the initial diaphragm radius (which in turn increases the initial energy of the exploding gas) results in an increase in the average delay of the primary shock wave for the dusty gas case.