عنوان مقاله:

Expansion Wave Propagation into a Cavity

محل انتشار:

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خلاصه مقاله:

The flow field which results from an expansion wave entering a cavity from an upstream tube, and the focusing effect which occurs, is investigated. Different cavity geometries, different expansion wave pressure ratios and different expansion wave widths are explored. As the expansion wave propagates into the cavity it induces flow in the opposite direction and back down the walls. The flow experiences compression as it flows out back into the tube because of the concave surface of the cavity it encounters. This can result in the formation of shock waves which can propagate back up into the cavity. Very low pressure and temperature regions can develop because of the focusing action of the expansion. A convenient way of generating an expansion wave numerically and/or experimentally is in a shock tube. This consists of a tube divided into two compartments, one at high pressure and one at low pressure separated by a frangible diaphragm. On bursting the diaphragm, a shock wave travels in one direction and an expansion in the other towards the cavity. Whilst ideal boundary conditions can be imposed in numerical simulation laboratory experiments are complicated by the diaphragm being curved and having a finite opening time. The effect of an initially curved diaphragm is briefly considered. The expansion wave pressure ratio was altered by changing the initial pressure ratio across the diaphragm. For an initially high pressure ratio, supersonic flow can occur behind the trailing edge of the expansion wave which has a marked influence on the flow. The width of the wave is dependent on the distance of the diaphragm from the cavity and also has a significant influence on the flow. As the width of the wave increases and the density gradient decreases, focusing effects becomes significantly weaker. Correspondence between experiment and simulation is examined.

کلمات کلیدی:

Compressible flow, Unsteady flow, Wave focusing