

SIMULATION OF A BLAST WAVE WITH A CONSTANT-AREA SHOCK TUBE CONTAINING PERFORATED PLATES IN THE DRIVER

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A simple method of converting a conventional, constant-area shock tube into a blast wave simulator is to install a set of perforated plates in the shock tube driver. The function of the perforated plates is to control the air flow rate from the driver into the channel, such that the air flow produces a simulated blast wave with the correct overpressure and flow-velocity signatures in the channel. The main goal in the present numerical study is to evaluate the effectiveness of this method and, therefore, predict the performance of such a blast wave simulator. The quality of the blast wave simulator, based on the signature shape including smoothness, is shown to be strongly dependent on the number of perforated plates used in the driver, their relative spacing, and the flow constriction of each perforated plate. Glimm and Chorin's random-choice method with Sod's operator-splitting technique is employed to solve numerically the quasi-one-dimensional, unsteady, hydrodynamic equations for wave motion in a duct containing gradual area changes, in order to obtain the solution for the unsteady flow in the driver and channel of the blast wave simulator. For this solution each perforated plate is modelled as a fairly short, smooth, convergent-divergent nozzle.