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Influences of Separation of the Boundary Layer in the Reservoir Pressure in the Shock Tube

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Abstract : The shock tube is a ground-facility widely used in aerospace and aeronautics science and technology for studies on gas dynamic and chemical-physical processes in gases at high-temperature, explosions and dynamic calibration of pressure sensors. A shock tube in its simplest form is comprised of two separate tubes of equal cross-section by a diaphragm. The diaphragm function is to separate the two reservoirs at different pressures. The reservoir containing high pressure is called the Driver, the low pressure reservoir is called Driven. When the diaphragm is broken by pressure difference, a normal shock wave and non-stationary (named Incident Shock Wave) will be formed in the same place of diaphragm and will get around toward the closed end of Driven. When this shock wave reaches the closer end of the Driven section will be completely reflected. Now, the shock wave will interact with the boundary layer that was created by the induced flow by incident shock wave passage. The interaction between boundary layer and shock wave force the separation of the boundary layer. The aim of this paper is to make an analysis of influences of separation of the boundary layer in the reservoir pressure in the shock tube. A comparison among CDF (Computational Fluids Dynamics), experiments test and analytical analysis were performed. For the analytical analysis, some routines in Python was created, in the numerical simulations (Computational Fluids Dynamics) was used the Ansys Fluent, and the experimental tests were used T1 shock tube located in IEAv (Institute of Advanced Studies).

Keywords : boundary layer separation, moving shock wave, shock tube, transient simulation
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