EXPERIMENTAL AND THEORETICAL STUDY OF SHOCK WAVE PROPAGATION THROUGH DUCTS WITH ABRUPT CHANGES IN THE FLOW DIRECTION

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The complex flow and wave pattern following an initially planar shock wave transmitted through ducts having abrupt changes in direction is studied experimentally and theoretically/numerically. Several different duct geometries are investigated in order to assess their effects on the accompanying flow and shock wave attenuation while passing through these ducts. The effect of the duct's wall roughness on the shock wave attenuation is also studied. The main flow diagnostic used in the experimental part is either an interferometeric study or an alternating shadowchlieren diagnostics. The obtained photos provide detailed description of the flow -volution inside the investigated ducts. Pressure measurements were also taken in some of the experiments. In the theoretical/numerical part the conservation equations for an inviscid, perfect gas were solved numerically. It is shown that the proposed physical model (Euler equations) which is solved using a second-order-accurate, highresolution scheme can simulate such a complex, time-dependent process very accurately. Specifically, all wave patterns are numerically simulated throughout the entire interaction process. Excellent agreement is found between the numerical simulation and the experimental results. The efficiency of a double-bend duct in providing shock wave attenuation is clearly demonstrated.