SHOCK PROPAGATION THROUGH GAS WITH DENSITY INHOMOGENEITIES

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ABSTRACT: Propagation of a plane shock through non-uniform inviscid gas is numerically investigated. Several types of inhomogeneities – quarter-plane, thin layer or elliptic bubble filled with high- or low-density gas – are considered. Different, regular and irregular, flow structures are observed and analyzed. New quantitative features of shock-inhomogeneity interactions, such as formation of high-enthalpy wave-structured stream and lamellar vortex are found (fig. 1, left). Semi-analytical main flow parameters assessment method is proposed. Nearly self-similar growth of well-known "precursor", for interaction of a shock with thin heated layer, is found to be disturbed at late times due to internal "flow choking" process. The effect of secondary shocks cumulation is revealed for interaction of a shock with both light- (fig. 1, right) and heavy-gas elliptic bubbles. Dependant on bubble geometry and shock properties, different regimes of cumulation – external, internal and transitional – are found. The quantitative dependence of cumulating gas parameters on bubble geometry is investigated.

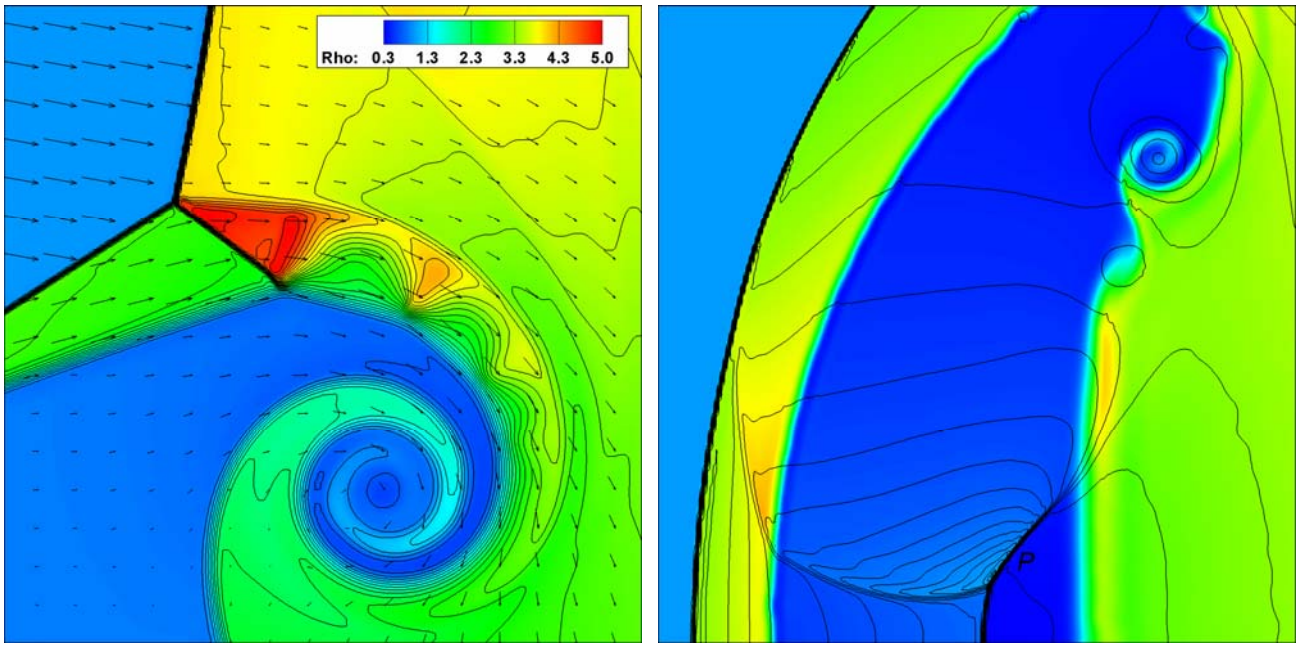

Fig. 1 Part of density field for non-stationary interaction of a shock wave with quarter-plane filled with high-temperature gas, high-enthalpy stream structure (left), and cumulative shock P, formed by shock propagation through light-gas bubble (right).

References

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