IMPULSE OF GLOW DISCHARGE IN SUPERSONIC BOUNDARY LAYER ON FLAT PLATE

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Experimental investigations of mechanisms of the origin turbulence in shear flows are carried out both in natural and in controlled conditions. The method of controlled disturbances is more preferred, because in this case it is possible to compare experimental results with numerical calculations quantitatively.

This paper is devoted to description of the first our experience of the introduction of finite in time and space disturbances into the supersonic boundary layer. The goal this work was a development of a method of introducing controlled single wave packets in a supersonic boundary layer and studying of them evolution to downstream into a compressible shear layer.

The experiments were made in T-325 low noise supersonic wind tunnel of ITAM SB RAS at Mach 2. Experiments were carried out on models of a flat plate with a sharp leading edge with different sources of controlled disturbances. One is a point glow discharge, circuit of which is well known. Another is surface glow discharge, which consists of two copper electrodes placed parallel to the flow, and a dielectric between them. The scheme of the discharge ignition is based on a break of the primary circuit of a spark coil. The break is carried out by the transistor switch. Probe of the constant-temperature hot-wire anemometer was used to measure in synchronization mode.

It was obtained, that the direction breakdown of surface discharge only influences on the amplitude of the introduced disturbances. The duration in time and amplitude of the wave packet grow with increasing of the power supplied to the discharge. Wave packet spreads in transverse direction, and significantly is modified downstream. Estimates of the propagation velocity of disturbances were made. So the method of introducing a solitary wave packet in supersonic boundary layer is developed and tested.

Key words: supersonic boundary layer, laminar-turbulent transition, wave packet, artificial disturbances.