

## **COMPARISON OF THE VELOCITY DISTRIBUTIONS AT THE CONICAL AND CONTOURED NOZZLES OF HYPERSONIC WIND TUNNEL AT-303**

**L.G. Vasenev, V.I. Zvegintsev, A.M. Kharitonov, A.N. Shpiyuk, S.I. Shpak**

***Khrstianovich Institute of Theoretical and Applied Mechanics, Siberian  
Branch, Russian Academy of Sciences, 630090, Novosibirsk, Russia***

This work refers to the wind tunnels of high supersonic and hypersonic velocities. It is devoted to the comparison of velocity fields in the working part of the hypersonic wind tunnel AT-303 ITAM SB RAS when it was equipped by nozzles of various design.

This wind tunnel was designed to operate over a wide range of Mach and Reynolds numbers, At the moment of commissioning in 2000 it was equipped with a cheap multi-mode conical nozzle, designed for a hypersonic flow with a range of Mach numbers from 8 to 20.

To improve the performances of the wind tunnel AT-303 and its capacity computational design technology and optimization of multi-modal shaped nozzles was developed to ensure good quality of the generated flow. With the new technology two shaped nozzle designed for a range of Mach numbers from 8 to 14 and from 14 to 20 were fabricated and adapted to the wind tunnel AT-303.

The characteristics of the flow in contoured nozzles in 16 different regimes of wind tunnel operation were obtained. These results were compared with similar data from conical nozzle (27 regimes). It was found that the non-uniformity of the Mach number in the transverse and longitudinal directions of flow of less than 1% and 0.4% in the contoured nozzles. For the conical nozzle these characteristics were 3% and 10%, respectively.

The present results are of interest to professionals involved in the design and development of new hypersonic wind tunnels, and for professionals experimenters conducting aerodynamic research in ground facilities.

Keywords: hypersonic wind tunnel, conical and contoured nozzle, flow field non-uniformity.