ON OPTIMAL CONFIGURATION OF LIFTING BODIES TAKING INTO CONSIDERATION THE CONVECTIVE HEAT FLUX

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The problem about the configuration of a body with maximal lift-to-drag ratio at high supersonic speeds taking into consideration the convective heat flux towards this body is examined.

It follows from the analysis of the distribution of specific heat flow rate (q_w) over the surface of delta wings with blunted edges that in the vicinity of bluntness q_w value does not practically depend on the distance along the edge and it corresponds to two-dimensional flow. Cumulative heat flux towards the wing surface depends weakly on the angle of attack, and the ratio of Stanton number to friction coefficient is constant along the wing chord, except the vicinity of the blunted nose tip. These peculiarities of q_w variation over the wing surface permits to reduce the minimization problem of cumulative heat flux to finding the shape of the leading edge bluntness and shape of the side surface.

With known optimal shape of the leading edge [1] the problem on the shape of the side surface is reduced to the minimization problem of the friction drag coefficient. Therefore, having the problem statement for the configuration of the body with maximal lift-to-drag ratio, in addition to isoperimetric conditions for constant volume, bluntness radius of the edges, etc., it is necessary to set the condition for limited surface area of the body. As result, in the problem statement for the configuration of the body with maximal lift-to-drag ratio the condition on limited heat flux is reduced to variation of the friction coefficient at a certain value μ in the functional to be optimized.

It was found through computations that optimal body configuration depends weakly on μ value with variation of this value in the wide range.

The influence of Mach number, friction coefficient, planform on parameters of the optimal configuration is analyzed.

The work is supported financially by Russian Foundation for Basic Researches

(project 12-01-00626-a).

REFERENCE

[1] V.A.Ivanov, S.V.Peigin, S.V.Timchenko. Numerical analysis of supersonic viscous gas flow past axisymmetric blunted bodies // Fluid Dynamics, 1999, vol.34, issue 1, pp91-99