ON NEW FEATURES OF SUPERSONIC AXISYMMETRIC GAS FLOWS

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In the present work, qualitative features of supersonic axisymmetric gas flows are considered. The supersonic inviscid flow around the considered configurations was simulated using the Euler equations. The surface of the bow shock wave was treated explicitly. The Euler equations were integrated using the MacCormack finite-difference scheme. The viscid simulation results were obtained by means of the method based on the Reynolds-averaged Navier – Stokes (RANS) equations solving.

The peculiarities of occurrence of a minimum in the drag of power-law bodies and aerodynamic configurations with a conical stabilizer, linear character of the dependence of the drag coefficient on the cone semiapex angle C_x (θ) from the point of inflection to $\theta = 90^\circ$ are revealed.

An analysis of the total drag constituents of a cone, i.e., a wave drag and friction drag depending on the cone semiapex angle, is carried out which proves the presence of the minimum of total drag of slender cones. Fundamentally new approaches were obtained in choosing optimal parameters of wingless vehicles. An analysis of the results of the computational investigations indicates the key influence of the pressure distribution along the surface of the tail stabilizer on the total value of the wave drag coefficient for the considered aerodynamic configurations of a flying vehicle. The examined peculiarities of supersonic flow associated with the characteristics of the drag of bodies of revolution having a tail part in the form of a truncated cone made it possible to study the mechanism of occurrence of a minimum in the drag coefficient for the given class of aerodynamic configurations.

The results obtained represent a theoretical interest and have a practical importance while choosing the shapes of the components of flying vehicles.