CALCULATION OF PRESSURE FIELD IN THE PROBLEM OF SONIC BOOM FROM VARIOUS THIN AXISYMMETRIC BODIES

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This work represents the results of pressure field calculations in the problem of sonic boom from various thin axisymmetric bodies. The Mach number of the free stream was set equal to 2. The calculations are done with an improved combined method. The numerical calculations of the near and far fields were accomplished using the model of viscous heat-conducting gas and the model of nonviscous ideal gas. The models of viscous and nonviscous gas were used for calculating the flow parameters in the near field. The far field was calculated by the method of ”phantom bodies”. The method of ”phantom bodies” supposes consequential calculations of the near and far flow fields. The work shows the possibility to apply the method of ”phantom bodies” for calculating the parameters of shock waves at long distances from a body. High accuracy of ”phantom bodies” method was shown by the comparisons calculation results done by other methods. It is shown that the gas viscosity can be neglected in sonic boom calculations, because viscosity influence becomes apparent only in calculations of tail shock wave intensity in the near field. The calculations of the far field allowed to find out the body shape influence and the state of atmosphere near the body on the sonic boom parameters. The result about minimal sonic boom for thin bodies with minimal wave drag coefficient obtained by the other authors was confirmed. It is shown that for nonhomogeneous gas in case of energy supply to the external flow one can obtain increasing of the sonic boom at lowering the wave drag coefficient.

Keywords: Shock waves, sonic boom, thin body, heating the flow, ”phantom bodies” method