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APPLICATION OF RANS/LES IN COMPUTING HYPERSONIC TURBULENT BASE HEATING

Abstract

A computing method is developed to predict aerothermal environment of turbulent near wake flow concluding complex mixing phenomenon like shock, free shear layer and vertex. As base heating is not as high as nose, it is always to use larger computation uncertainty to solve the base thermal protection problem than the nose. However, because of increasing weight limitation of vehicle base structures, current base heating computing method need to be improved. In the present work, the three dimensional symmetry slender cone in ideal gas was considered to verify the computing method. The paper will also discuss several different influences in base heating like Reynolds number, Mach number, attack angle and blunt ratio. This research was carried out in two different parts: numerical computation and engineering methodology. In the first part, RANS/LES(Hybrid Reynolds averaged Naiver-Stokes and Large Eddy Simulation) computing method is developed to predict base heating, based on the theory of turbulent heat transfer and separated flow mechanics. The second part, engineering methodology, which was based on the former heat experimental correlation, will be corrected to better satisfy different base flow condition. For the Bulmer's surface heat-transfer correlation used non-dimensional base pressure was limited to a few cone geometry, in the paper, new influence factors will be added to the correlation. Computed base pressure and heat flux will be compared with experimental and numerical data from several references.