Research on the Aero-Heating Prediction Based on Hybrid Meshes and Hybrid Schemes

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Abstract: Accurate prediction of external flowfield and aero-heating at the wall of hypersonic vehicle is very crucial for the design of aircrafts. Unstructured/hybrid meshes have more powerful advantages than structured meshes in terms of preprocessing, parallel computing and mesh adaptation, so it is imperative to develop high-resolution numerical methods for the calculation of aerothermal environment on unstructured/hybrid meshes. The inviscid flux scheme is one of the most important factors affecting the accuracy of unstructured/hybrid mesh heat flux calculation. Here, a new hybrid flux scheme is developed and the approach of interface type selection is proposed: i.e. 1) using the exact Riemann scheme solution to calculate the flux on the faces parallel to the wall; 2) employing Sterger-Warming (S-W) scheme to improve the stability of the numerical scheme in other interfaces. The results of the heat flux fit the one observed experimentally and have little dependence on grids, which show great application prospect in unstructured/hybrid mesh.

Keywords: aero-heating prediction, computational fluid dynamics, hybrid meshes, hybrid schemes

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