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INVESTIGATION OF AN EFFECTIVE APPROACH FOR AERODYNAMICS COMPUTATION OF MARS ENTRY VEHICLES

Abstract

To acquire aerodynamic characteristics of Mars entry vehicles accurately and quickly, an efficient estimation method using effective ratio of the specific heats γeff to account for high temperature real gas effects during Mars atmosphere hypersonic flight regime was presented. It can be used to quantify, parameterize, and illustrate real-gas effects in a simple way. Instead of the density ratio across shock wave in the nose region of vehicles, the new method proposed in this paper adopted mixed gas parameters at shock wave obtained from chemical nonequilibrium flow field to determine γeff numerically. For typical hypersonic flight conditions of Mars entry vehicles, including Mars Phoenix and Mars Science Laboratory, comparisons of the effective method and chemical nonequilibrium computations show good agreement, considering the computation time saved significantly, which means that the new method is very effective for real-gas effects simulation of Mars atmosphere.