Paper ID: 15443
poster
student

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Vehicles – Mechanical/Thermal/Fluidic Systems (7)

Author: Mr. Guo-hao DING
National University of Defense Technology, China, dingguohao@hotmail.com

Prof. Hua Li
National University of Defense Technology, China, lihuakd@tom.com

NUMERICAL SIMULATION OF AERODYNAMIC HEATING ON HYPERSONIC SLIP FLOW

Abstract

Hypersonic vehicles experience different flow regimes during flight due to changes in atmospheric density, and the slip flow regime is between the rarefied regime and continuum regime. In this regime, the traditional computational fluid dynamics method is not physically accurate. Moreover, the direct simulation Monte Carlo method, although physically accurate for all flow regimes, is relatively computationally expensive. For the purpose of accurate simulation with small cost, the velocity-slip and temperature-jump boundary conditions are added in computational fluid dynamics. The current study investigates a case of a cylinder in Mach-10 flow of argon gas for validation. The total drag and peak heat transfer predictions by computational fluid dynamics with velocity-slip and temperature-jump boundary conditions are comparative with the result by Monte Carlo method, and the precision is acceptable in the field of engineering application.