

HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)  
Long Term Scenarios for Human Moon/Mars Presence (2)

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A NEW METHOD FOR MARS PATHFINDER ENTRY OF MULTIPLE CASES

**Abstract**

Since modern aerospace vehicles mainly complete hypersonic flight in rarefied region no matter in earth's atmosphere or other celestial bodies', it is quite necessary to understand the accurate aerothermal-dynamics environment in rarefied gas flow field under different cases. The principal contribution of this paper is the development of an analysis computation program which can predict hypersonic aircrafts in rarefied thermochemical nonequilibrium flow field effectively. The DSMC computation of hypersonic flow past towed ballute is completed by using a new method of spacecraft orbiting a planet. Rarefied gas flow field of Mars Pathfinder and the corresponding towed ballute moving in the Earth's and Martian atmosphere has been calculated using the unstructured grids DSMC program we compiled. Some corresponding important data of aerothermodynamic environment has been received. Clearly this study provides a strong theoretical support for the development of the computation analysis of new method of spacecraft orbiting a planet in our country, and fills the gaps in this area. Reaction theory of 8 species 44 reaction in hypersonic high-temperature flow field in Martian atmosphere environment have been proposed. In this paper, thermochemical nonequilibrium characteristics, wall heat flux, pressure coefficient and friction coefficient, all the key parameters of hypersonic aircraft in the earth's and Martian atmosphere have been presented by the numerical simulation and analysis in 5 cases. Typical examples show that the results of this paper are in good agreement with data, which indicates that the unstructured DSMC parallel program is feasible and effective for the numerical simulation of hypersonic rarefied gas flow.