Mars Exploration (3)
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EXOMARS SCHIAPARELLI: NUMERICAL INTERPRETATION OF CONVECTIVE AND RADIATIVE HEATING FLIGHT DATA

Abstract

One of the main tasks of each Mars exploration science projects is the delivery of scientific equipment to the surface of planet. During the descent in the Martian atmosphere dense layers, space vehicle is subjected to the significant thermal loads. The main component of the Martian atmosphere is the carbon dioxide, which has a considerable radiation emissivity at the high temperatures. It makes necessary to take into account not only convective, but also radiative heat transfer (especially for the leeward surface). Each of Martian mission is very important in view of unique experimental data obtaining. However, similar experiments are expensive and complicated which explains the significant role of numerical simulation in the fundamental investigations. Thus, it is necessary to develop the computer codes for the following main problems joint solution: gas dynamics, chemical kinetics, vibrational relaxation, equilibrium and non-equilibrium dissociation and ionization, radiative heat transfer, turbulence effects. NERAT computer codes was developed in Laboratory of Radiative Gas Dynamics of Institute for Problems in Mechanics of the Russian Academy of Sciences (IPMech RAS) within the framework of the international science projects of Mars exploration. These codes are designed to solve radiative aerothermodynamics problems in two- and three-dimensional cases. There is a significant background of NERAT verification and validation for different Martian descent space vehicles test cases. The current efforts are focused on the Martian spacecraft leeward side convective and radiative heat fluxes estimation. The parameters are calculated for Exomars Schiaparelli real trajectory points within the framework of science collaboration between IPMech RAS and CNES Consortium. The detailed investigations of the Schiaparelli backside heating have been performed accounting actual information about sensors positions. The data obtained are of interest in terms of future Martian science mission's preparation.