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OPTIMIZATION OF THE CABIN THERMAL ENVIRONMENT CONTROL IN A SPACECRAFT ON THE GROUND PREPARATION STAGE BEFORE LAUNCH

Abstract

Spacecraft mission cycle includes the ground preparation stage before launch, active flight period and orbit stage, etc. During the different stages of flight, the emphasis point of the spacecraft's cabin thermal environment control is different. On the ground preparation stage before launch, the main source of aircraft thermal loads includes convection heat transfer with ambient air and the heat consumption of instruments and equipment, etc. For some spacecraft, its orbit time is very short, the cabin thermal environment control before launch plays a great impact on the thermal control design for the later stages. Therefore, in order to meet the whole task cycle of aircraft cabin thermal environment control, and make the spacecraft thermal control design as simple and economy as possible, the cabin thermal environment control of the ground preparation stage before launch has become one of the important problems to be solved in the analysis of spacecraft thermal control. Based on a short in-orbit spacecraft as an example, through the simulation calculation analysis method, optimal control of ambient air temperature, inlet air flow velocity and the supply direction, carried out the analysis of cabin thermal environment control in detail during the ground stage, given the vehicle airflow distribution, as well as the temperature distribution of equipment under the influence of convection and radiation heat exchange. The simulation results can be used as input for cabin thermal environment control of subsequent stages, optimize the entire task cycle spacecraft thermal control design