Paper ID: 7547
student

SPACE OPERATIONS SYMPOSIUM (B6)
Human Spaceflight Operations Concepts (1)

Author: Mr. Lin Kunpeng
National University of Defense Technology, China, linkunpeng@126.com

Dr. Ya-Zhong Luo
National University of Defense Technology, China, yzluo@sohu.com
Prof. Guojin Tang
National University of Defense Technology, China, tanggj@nudt.edu.cn
Mr. Yi Zhang
China, chaihua321912@163.com
Prof. tang guojian
China, gjtang@263.net

SPACE STATION MULTI-INCREMENT ORBITAL MISSION DESIGN USING DYNAMIC PROGRAMMING

Abstract

As the space station's long operational time, its operation management is executed as multi-level framework based on dividing the whole lifetime into a lot of mission increments. For example, the International Space Station mission planning is being performed in several distinct steps - Strategic, Tactical and Execution Planning - with distinct planning products covering different time intervals ranging from several years to just a few days. And one increment is defined from the launch of a vehicle rotating ISS crew-members to the undocking of the return vehicle for that crew, and is composed by several mission phases including orbital maintenance, scientific experiment, rendezvous and docking, external operations, etc.The multi-increment orbital mission design is one important content of Strategic and Tactical Planning. It includes on-duty orbital height, orbital maneuver strategy, rendezvous and docking launch window and trajectory, etc for each increment, with considering the restrictions and requirements in each mission phase, and also taking into account the interaction relationship between one phase and the next, also between one increment and the next. Apparently, this design problem is a very complex multi-process decision problem.Although a lot of studies have been done on space station mission planning, seldom work involves space station multi-increment orbital mission design method. The goal of this study is to propose an effective approach for space station multi-increment orbital mission design by employing the method of operational research.With the background of China future space station design, the multi-increment orbital mission design problem is firstly described. Secondly, the dynamic programming model for this problem is formulated, and the state variables, decision variables, performance functions are respectively defined. Then the state transfer equations and recursion equations of the performance function are deduced. Finally, an example is given to validate the dynamic programming approach of space station multi-increment orbital mission design.