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A COMMAND SEQUENCING ASSISTANT TOOL FOR SPACECRAFT RENDEZVOUS AND DOCKING PLAN DESIGN

Abstract

Sequence of commands is the base of spacecraft flight control. It is actually a kind of detailed work plan of spacecraft. Whether the sequence of commands is executed with or without human interaction, it must be designed by planners. Spacecraft rendezvous and docking (RVD) is a key operational technology for complicated space mission. Due to the complicated time-order relationship between different RVD activities, it would be laborious for planers to design sequence of commands without professional tools. The purpose of this research is to develop a command sequencing assistant tool for spacecraft rendezvous and docking plan design, which can facilitate the design process of sequence of commands. The software tool is composed of three major modules: event database module, support module and sequencing module. The event database module saves commands in a hierarchical manner. The support module interacts with other systems and performs some basic calculations. The sequencing module is designed on base of the other two modules. First, an interactive sequencing environment with graphical timeline is designed. The orbital revolution numbers, TTC time windows and orbital day-night transition intervals are shown along with the timeline. A design base unit, which could be an action, a command chain or an event, is added to the environment by handily querying event database, can be moved and modified along timeline by keyboard or mouse conveniently. Second, a table style interactive environment is also designed for browsing and modifying time-ordered commands from another angle of view. The operations of this environment are similar to the common table software, but some measures are designed to prevent clerical errors. Third, command checking measures are designed to reduce errors, such as time-order checking for least sending interval requirement or commands with special sending requirements, TTC condition checking at the sending time of commands and so on. Finally, the command updating function is designed using hierarchical relationship network. The developed assistant software has been applied to the command sequencing process of Chinese RVD mission design, and it effectively improved the work efficiency of the planers.