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PATH PLANNING OF EXPERIMENTAL MODULE TRANSFER FOR MINIMIZING ATTITUDE DISTURBANCE OF SPACE STATION

Abstract

Experimental Module is generally required to transfer from the docking to a berthing port by the on-board manipulator system after rendezvous and docking, and the module transfer mission is often performed at the space station assembly phase as well. Due to the micro-gravity environment, the module transfer process will cause space station attitude to drift and bring some obstacles to attitude control. Considerable studies have been done on methods for the path planning of transfer mission. However, few of them focus on minimizing attitude disturbance by using environment torques for the transfer process. This paper presents a proper and effective path planning method of module transfer to minimize the disturbance by fully making use of environment torques, and the presented method could be applied to validate and evaluate the module transfer mission and other similarly relative motion path planning problems. The paper is compiled in four parts. Firstly, considering with the gravity gradient and atmospheric drag torques, the dynamical equations of space station absolute motion and experimental module relative motion are proposed. Secondly, the path planning model of module transfer is established, which takes the commanded force and torque of the carrier as control variables. Besides, the docking and berthing conditions are employed as initial and terminal constraints. The objective is to minimize the index function, viz., space station attitude difference relative to orbit coordinate system when module transfer mission completed. Thirdly, the planned path is obtained by a programming strategy based on Gauss pseudo-spectral method. Finally, an example is given to validate the presented path planning method.