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ACTIVE MOTION/VIBRATION CONTROL OF FLEXIBLE JOINT MANIPULATOR WITH STEWART PLATFORM ACTIVE MOUNT AND ADRC-IS CONTROLLER

Abstract

During manipulation, large manipulators on-board spacecraft always suffer from undesirable structural vibration due to joint flexibility. In this paper, to improve the accuracy and stability of the manipulator's end-effector, active vibration suppression of the flexible joint manipulator (FJM) is implemented with Stewart Platform Active Mount (SPAM) which connecting the FJM's root and spacecraft. According to the real FJM's mechanical parameters, an integrated dynamic model of FJM and SPAM is derived with energy method, and the normal mode analysis, transient response analysis and frequency response analysis are carried out. Based on the characteristics of the integrated dynamic model, an FJM vibration controller with Active Disturbance Rejection Control (ADRC) method is designed. Further, a FJM motion/vibration controller is designed by means of the combination of ADRC method and Input Shaping (IS). Finally, the numerical simulation of FJM motion/vibration control is conducted. The simulation results are quite good in the case of external disturbance as well as FJM manipulation. The feasibility of FJM vibration suppression by SPAM is proved, and the effectiveness of motion/vibration controller with ADRC method and IS is verified.