Paper ID: 14498
student

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures 1 - Development and Verification (Space Vehicles and Components) (1)

Author: Dr. Jie Liang
China

Prof. Li Chen
Fuzhou University, China

NONLINEAR FEEDBACK COMPOSITE CONTROL OF SPACE MANIPULATOR SYSTEM WITH BOUNDED TORQUE INPUTS AND UNCERTAIN PARAMETERS

Abstract

With the development of the robot technology and the deepening of space exploration, more and more space robots have been applied in the exploitation of space resource. As a result of the complexity of space missions and the particularity and risk of the space environment, the space robots should have the characters of light weight, high speed and efficiency, and have robustness to the external disturbance. Moreover, due to physical limitation, the actuator outputs are constantly bounded or constrained, actuator saturation is an unavoidably nonlinear factor in space robot systems, and every physical actuator has inherent constraints. When the input signals exceed such limits, the actuator saturates, causing the closed-loop performance to deteriorate and in the extreme case, to even lose stability. These practical problems have to be taken into the system controller design. This thesis discusses control problem of free-floating space robot system with bounded torque inputs and uncertain parameters is studied. The kinematics and dynamics of the system were analyzed by use of momentum conservation. Base on the results, a nonlinear feedback composite control scheme for free-floating space robot system with bounded torque inputs and uncertain parameters is developed. The proposed control scheme regulates the uncertain parameters by use of robust and adaptive control, and limits the input torques in a finite range by use of the continuous differentiable increasing functionsso the controller is more suitable for practical applications. Moreover, the control scheme can guarantee the stability of the system, regardless of whether the parameter-region is precise. That reflects the better robustness. The simulation results show the feasibility and efficiency of the control scheme. Acknowledgement This paper work is supported by the National Natural Science Foundation of China (Grant No.11072061), Fujian Provincial Natural Science Foundation (Grant No. 2010J01003).