Paper ID: 17197
student

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

Author: Dr. xiaoyan yu
Fuzhou University, China, cool09@163.com

Prof. Li Chen
Fuzhou University, China, Chnle@fzu.edu.cn
Dr. Limin Xie
Fuzhou University, China, lucy_min@163.com

OBSERVER-BASED TWO TIME CONTROL OF FREE-FLYING FLEXIBLE SPACE MANIPULATOR

Abstract

High-precision measurements of base attitude and joint displacements and link coordinate are available on flexible space robot manipulators. In contrast, base angular velocity and joint velocity and link coordinate rate measurements which increase the cost are, in many cases, contaminated by noise. It is therefore economically and technically interesting to investigate the possibility of controlling flexible space robot dynamics by only using angular position measurements and flexible deformation. Firstly the dynamic model of a free-flying space manipulator with two flexible revolute joints is established by applying the Lagrange equations. Secondly singular perturbation model of the space flexible manipulator system is obtained by using two-time scale control theory , in which the system is decoupled into slow (rigid) and fast (flexible) subsystems. Then a composite controller which consists of a slow control component and a fast control component is proposed. The fast controller is designed with the estimated velocity by linear observer to damp out the vibration of the flexible link using optimal Linear Quadratic Regulator (LQR) method. A sliding observer based robust control algorithm is applied to control the slow subsystem with unknown payload parameters and bounded disturbances to track the desired trajectory. Finally the numerical simulation is carried out, which confirms the controller proposed is feasible and effective.