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ROBUST MOTION CONTROL AND VIBRATION OPTIMAL CONTROL FOR A FREE-FLYING FLEXIBLE SPACE MANIPULATOR WITH ELASTIC BASE

Abstract

A robust motion control and vibration optimal control is addressed for a free-flying two-flexible-link space manipulator with elastic base. In this system there are unknown but bounded external disturbances and parameters. Firstly the dynamic model of a free-flying space manipulator with two flexible links and elastic base is established by the momentum conservation and the Lagrange equations. Secondly based on singular perturbation approach and choosing appropriate local coordinate frame, the interactions of rigid and flexible motion and the interactions of flexible motions are decoupled, and a slow subsystem and a flexible fast subsystem are obtained. Then the corresponding controllers are proposed for the two subsystems, which are the robust slow subsystem controller and the flexible fast subsystem optimal controller. And a composite controller is combined with the two subsystem controllers to control the motion, the flexible link and base vibrations simultaneously. Finally Numerical simulation demonstrates the proposed control algorithm's efficiency. The virtue of this control scheme is that the linear position, linear velocity, linear acceleration of the base needn't be measured directly.