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AUGMENTED ADAPTIVE MOTION CONTROL AND VIBRATION OPTIMAL CONTROL FOR FREE-FLOATING FLEXIBLE SPACE MANIPULATORS WITH AN ELASTIC BASE

Abstract

Augmented adaptive motion control and vibration optimal control is addressed for free-floating flexible space manipulator with an elastic base. Firstly the dynamic model of a free-floating space manipulator with n flexible links and an elastic base was established by the Lagrange equations. Secondly the interactions of rigid and flexible motions and the interactions of flexible motions were decoupled, the singular perturbation model was derived, this singular perturbation model involved a slow subsystem and a flexible fast subsystem. Then the augmented adaptive slow subsystem controller and the flexible fast subsystem optimal controller were designed. And a composite controller was combined with the two subsystem controllers to control the motion, the flexible link and base vibrations simultaneously. Finally numerical simulations by undertaking a computer simulation of a two-flexible-link space manipulator with elastic base showed that the link and the base vibrations had been stabilized effectively with good tracking performance.