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# AUGMENTED FAULT-TOLERANT DYNAMIC SLIDING MODE CONTROL OF FLEXIBLE-JOINT SPACE MANIPULATORS

**Abstract**

Adaptive fault-tolerant control based on dynamic sliding mode and active suppression control of flexible-joint elastic vibration are designed for flexible-joint space manipulator system with actuator faults. Combined with Lagrange equations and the conservation of momentum and moment, the dynamic equations of the system are established. In order to track the trajectory of the space robot and suppress the elastic vibration caused by joint flexibility, the system is decomposed into a slow subsystem and a fast subsystem by singular perturbation theory. A fault-tolerant controller is proposed for slow subsystem. According to the dynamic sliding mode, a new sliding mode surface is designed on the basis of the traditional sliding mode surface, and an adaptive fault-tolerant controller is presented. The adaptive term in the control method can adjust the fault estimation adaptively, so as to compensate for the influence caused by the fault and make the controller fault-tolerant. For the fast subsystem, the velocity difference feedback controller is used to suppress the elastic vibration caused by joint flexibility. Finally, numerical simulations are carried out to verify the effectiveness of the presented control method.