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# ROBUST NEURAL NETWORK CONTROL OF SPACE ROBOT SYSTEM WITH FLEXIBLE JOINTS

**Abstract**

Space robot systems can accomplish lots of dangerous space missions in place of astronauts, such as retrieving broken satellites, adding fuel for spacecrafts, capturing space debris, etc. Their kinematics and dynamics control problems have been the hot topic of researchers all around the world. To reduce launching costs, future space robot systems will become lighter and lighter, which means that their structural flexibilities can not be ignored any more during the design of controllers. Similar to the ground-based ones, the structural flexibilities of space-based robot systems are mainly composed of the link flexibility and the joint flexibility. It is pointed out that, for some kinds of space robot systems in the practical applications, the joint flexibility are much stronger than the link flexibility. Therefore, attentions should be paid to the study of flexible-joint space-based robot systems. In this paper, a robust neural network control scheme for parametric uncertain space-based robot system with joint flexibility is proposed. Firstly, With the linear and angular momentum conservation of the system , the full-actuated dynamic model of space robot system is derived by using of the Lagrange method. Secondly, With the joint flexibility compensator and the singular perturbation approach, the fast and slow subsystems of robot after the flexibility compensation are given. And then, a robust neural network control scheme for the slow subsystem of flexible-joint space robot to track the desired trajectory in joint space was proposed on the premise that the stability of the fast subsystem was guaranteed well. Finally, a simulation example is carried out, and its simulation results show that the proposed control scheme can overcome the shortage of singular perturbation approach that can only be utilized in the control of robots with weak joint flexibility, and effectively remove the negative effects of uncertain parameters on the space robot system.