Paper ID: 68281
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IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

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TIME DELAY ESTIMATION BASED NEURAL NETWORK CONTROL OF A FREE-FLOATING SPACE MANIPULATOR WITH BOUNDED CONTROL TORQUES

Abstract

Generally, it is assumed that the actuators can provide any large enough torques needed in most of the current control algorithms of space manipulators. However, in practice, the torques, which the actuators can provide, are limit. This will lead to obvious declination of control qualities and precision. Therefore, a time delay estimation based neural network control of a free-floating space manipulator with bounded control torques and model uncertainty. First, the Lagrange dynamic model of the manipulator was established by the momentum conservation. Second, by the time-delay estimation technology the errors caused by model uncertainty are converted into the errors of the motion states. And then the errors of the motion states are compensated by RBF neural network method, whose approximation abilities to nonlinear terms are perfect. Afterwards, smooth saturation functions are introduced to the RBF controller, which can reduce the amplitudes of the input torques effectively. Finally, Numerical simulation demonstrates the proposed control algorithm's efficiency.