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REACTIONLESS TIME DELAY ESTIMATION BASED ADAPTIVE FUZZY SLIDING MODE
CONTROL OF A SPACE MANIPULATOR APPROACHING A ROTATING TARGET

Abstract

Null reaction motion planning and control of a planar three-link space manipulator approaching a rotating target is studied. Firstly, the Lagrange dynamic model of the system is established, and based on the theory of Null Reaction Space the mathematical model of reactionless motion planning is derived. Then the vector norm constraint algorithm of Null Reaction Space is studied. Furthermore an adaptive fuzzy sliding mode control algorithm based on time delay estimation is proposed. This method estimates the unknown items of the system by delay estimation technology, in which accurate and complete system dynamics model is not required, and an adaptive time delay estimation is introduced to adjust the estimation value. An improved continuous non-singular fast terminal sliding mode control is proposed which guarantees the continuity of the sliding mode surface and the non-singularity of the system and improves the convergence speed in the course of approaching the sliding mode surface and the control accuracy of the system. Finally, the Matlab simulation of a planar three-bar space manipulator is carried out to verify the effectiveness of the method.