

HUMAN SPACEFLIGHT SYMPOSIUM (B3)
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PATH PLANNING FOR FREE-FLOATING SPACE ROBOT BASED ON MPSP ALGORITHM

Abstract

Due to the nonholonomic nature of FFSR (free-floating space robot), it is unable to perform a path planning for FFSR as a fixed-base robot through inverse kinematics, and the traditional path planning methods for FFSR don't preferably consider the follow-up control torque required. Therefore, this paper proposes a path planning method based on model-prediction static programming (MPSP) for FFSR. Firstly, the kinematic model of FFSR is derived from the method of homogeneous coordinate transformation, and the dynamic model of FFSR is established by Lagrangian method. The path planning problem of FFSR is considered as the optimization problem with terminal constraints when the desired end position was set and the torque was selected as performance index. Then, the MPSP algorithm are introduced to solve the optimization problem. The control history produced by PD control is taken as the initial guess, and the relationship between the control deviation and the end position error is derived by the principle of optimal control. So the end can reach the desired position through constant modification of the control history and iteratively solution of the state equation. Finally, the numerical simulation is carried out with a planar 2-DOF FFSR as an example. The simulation results show the effectiveness of the algorithm.