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RESEARCH ON MOTION PLANNING OF SPACE ROBOT BASED ON SYNCHRONOUS OPTIMIZATION METHOD

Abstract

Space robots are indispensable for complex space tasks. Most space robots need to plan their trajectory in advance before performing tasks. Under the existing framework, the motion planning of space robot is generally divided into two parts. One is to plan a series of kinematically feasible path points, the other is to generate the trajectory based on these path points by curve interpolation or optimization. Although the random sampling method is mostly used in the planning of path points of space robot, it will lead to the large randomness of the planned path points, thus affecting the final trajectory quality, making it unable to achieve the optimization. Therefore, how to get a better trajectory of space robot has become the key of motion planning. To solve this problem, this paper proposes a synchronous optimization method, in which the path points and trajectory are synchronously optimized after obtaining the initial path point to improve the trajectory quality. Firstly, the initial path of obstacle avoidance is obtained by RRT method; Then the synchronous optimization model is established, and the cubic spline function parameters are introduced into the synchronous optimization model. Through the cubic spline function parameters, the path points and the angular velocity of the space robot joint on the path are connected, and the kinematics information of discrete path points is established at the same time; The convex optimization method is used to solve the above synchronous optimization problem to get the optimal results of both path planning and trajectory planning. Finally, in the same task environment, the results of the method proposed in this paper are compared with the results of motion planning through traditional RRT method and GB-RRT method. The results show that the final trajectory planned by the synchronous optimization method proposed in this paper is better, and the quality of trajectory planning considering dynamics is also significantly improved.