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A NOVEL METHOD OF PATH PLANNING FOR SPACE ROBOT CAPTURING TUMBLING FAILED SATELLITE WITH THE BEST CONFIGURATION

Abstract

Due to component failure or fuel exhaustion, some satellites on orbit cannot keep proper functioning, some of them need to be deorbited. Space robot is an important way to do such missions. The attitude of failed satellite maybe tumble and out of control, this will make the collision force bigger during actual capture period, which cause a great disturbance to the attitude of the space robot's base. The recent research demonstrates that there is a kind of "the Best Configuration" of space robot, with which the attitude disturbance caused by collision force is minimum during capturing. "the Best Configuration" means that three special points are exact in linewhich called line L. The first point is the contact point of the end effector and the capturing pointthe second is the center of mass of the manipulators, and the third is the center of mass of the base of space robot. Besides, line L is collinear with the direction of the collision force. The realization of "the Best Configuration" depends on path planning of the manipulators before capturing. Using the inverse of the Generalized Jacobian Matrix(GJM) , We can make the end effector trail after the capture point continuously, but we can't get the robot's configuration expected. So in this paperwe proposed a novel method of path planning for a redundant robot with seven freedom. Firstly, let the end effector trail after the capture point by using the pseudo inverse of the GJM. Then based on the null-space of the GJM, a set of special angular velocities of the joints which make no influence on the motion of the end effector is introduced to amend the angular of the joint, ensure that "the Best Configuration" can be reached when capture happens. Using above novel method, we have done simulations with a seven freedom robot. Results show that the end effector can trail after the capture point continuously, and the configuration of the robot is coincidence with "the Best Configuration" expected when capture happens.