Paper ID: 37210
student

Poster Session (P)
Poster Lunch (1)

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# PATH PLANNING AND ANALYSIS FOR SPACE ROBOT TO APPROACH A TUMBLING SATELLITE

**Abstract**

Space robot is expected to play an increasingly important role in space exploration and on-orbit service. In order to capture and rescue an uncontrolled tumbling satellite, the space robot is required to plan an appropriate path to approach the target satellite in limited time and avoid collisions in the approaching path. This paper focuses on the path planning and capability analysis for the space robot to approach a tumbling target satellite. First, the attitude motion of the tumbling target satellite is analyzed and limited with reasonable assumptions. The relative kinematic equations of the space robot and the target satellite are derived as the theory basis of the approaching path planning. Then, a new approaching strategy is developed, in which the space robot is planned to approach the target satellite in its spin axis orientation in order to avoid the collisions with the revolving appendages of the target satellite. The approaching paths in different phases of the strategy are planned in detail. Furthermore, the effects of the target satellite's motion states and the space robot's control abilities on the capability of the approaching strategy are analyzed through numerical simulations. The results illustrate that the approaching strategy proposed in this paper is effective for the space robot to approach the tumbling target satellite. The maximum spin angular velocity of the target satellite that can be approached by the space robot in this strategy is less than 25 degree/s. Finally, the advantages and disadvantages of the approaching strategy are summarized as conclusions. The results of this paper can provide references to the development of the technologies of space robot and on-orbit service.