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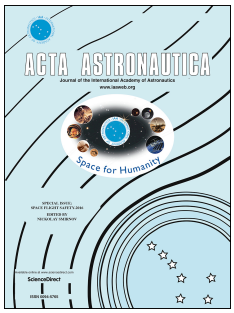

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Detumbling Control for Kinematically Redundant Space Manipulator Post-Grasping a Rotational Satellite

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Abstract

The objective of this paper is to establish a detumbling strategy and a coordination control scheme for a kinematically redundant space manipulator post-grasping a rotational satellite. First, the dynamics of the kinematically redundant space robot after grasping the target is presented, which lays the foundation for the coordination controller design. Subsequently, optimal detumbling and motion planning strategy for the post-capture phase is proposed based on the quartic Bézier curves and adaptive differential evolution (DE) algorithm subject to the specific constraints. Both detumbling time and control torques are taken into account for the generation of the optimal detumbling strategy. Furthermore, a coordination control scheme is presented to track the designed reference path while regulating the attitude of the chaser to a desired value, which successfully dumps the initial angular velocity of the rotational satellite and controls the base attitude synchronously. Simulation results are presented for detumbling a target with rotational motion using a 7 degree-of-freedom (DOF) redundant space manipulator, which demonstrates the effectiveness of the proposed method.

Keywords: Detumbling strategy, Coordination control, Post-grasping

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