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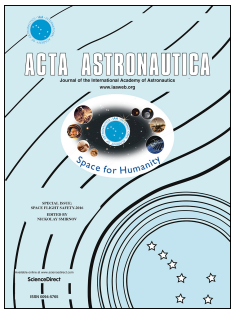

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PII: S0094-5765(16)30043-1

DOI: 10.1016/j.actaastro.2017.10.001

Reference: AA 6490

To appear in: *Acta Astronautica*

Received Date: 16 January 2016

Revised Date: 3 April 2017

Accepted Date: 1 October 2017

Please cite this article as: G.E. Chamitoff, A. Saenz-Otero, J.G. Katz, S. Ulrich, B.J. Morrell, P.W. Gibbens, Real-time maneuver optimization of space-based robots in a dynamic environment: Theory and on-orbit experiments, *Acta Astronautica* (2017), doi: 10.1016/j.actaastro.2017.10.001.

Real-time Maneuver Optimization of Space-Based Robots in a Dynamic Environment: Theory and On-Orbit Experiments

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Abstract

This paper presents the development of a real-time path-planning optimization approach to controlling the motion of space-based robots. The algorithm is capable of planning three dimensional trajectories for a robot to navigate within complex surroundings that include numerous static and dynamic obstacles, path constraints and performance limitations. The methodology employs a unique transformation that enables rapid generation of feasible solutions for complex geometries, making it suitable for application to real-time operations and dynamic environments. This strategy was implemented on the Synchronized Position Hold Engage Reorient Experimental Satellite (SPHERES) test-bed on the International Space Station (ISS), and experimental testing was conducted onboard the ISS during Expedition 17 by the first author. Lessons learned from the on-orbit tests were used to further refine the algorithm for future implementations.

Keywords: Space Robotics, Trajectory Optimization, Obstacle Avoidance,

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