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MULTI-ROBOT KINODYNAMIC MOTION PLANNING FOR FULL-COVERAGE INSPECTION OF COMPLEX LARGE SPACE STRUCTURES

Abstract

This paper presents a novel multi-robot inspection planning scheme for 3-dimensional full coverage of any complex large space structure hovering in Deep Space environment. An asymptotically optimal sampling-based path planner called RRT* is combined with a Linear Quadratic Minimum Time (LQMT) controller along with a new coverage planning scheme in order to create our Kinodynamic inspection path planner, which generates an optimal 3D inspection trajectory that fully observes any points constituting the boundary of the complex space structures. Our planner develops the inspection trajectory while at the same time satisfies both kinematic and dynamic constraints of the environment and the inspector robots, such as collision-avoidance, geometrical and differential constraints. A Multi-robot scheme is considered instead of a single robot to increase the reliability of the system and significantly decrease the total inspection time, which are of the crucial requirements for inspection tasks during in-space servicing missions and proximity operations. Simulation results are presented as proof of the ability and effectiveness of our planner.