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MODELING AND CONTROL OF TENTACLE LIKE MULTI-LINK MANIPULATOR FOR ACTIVE
DEBRIS REMOVAL (ADR) NANOSATELLITE MISSION

Abstract

The increase of uncontrolled objects and space debris orbiting around earth and hazard anticipated from such objects is extensively identified and examined since past decade. Grasping an uncontrolled body in space requires precise knowledge of geometry, orientation and angular velocity of object which is not possible in most cases. A bio inspired tentacle type manipulator intended for grasping debris is proposed in this paper. Manipulator consists of modular chain of multiple miniature links. Due to high number of degrees of freedom this type of manipulator can achieve intricate and highly redundant shapes mimicking as tentacle. An iterative solver developed to simulate dynamics of multi-link manipulator considering small links of equal mass, length, joint friction, and force due to gravity. Numerical computation of Jacobian and its pseudo inverse control is used to track various manipulator trajectories. Special grasping type motions are modeled and validated using numerical simulations. Results of this study provides preliminary estimates of dimension of host nanosatellite and torques that needs to be compensated by attitude control system of nanosatellite intended for active debris removal missions.