Paper ID: 26459
poster
student

44th STUDENT CONFERENCE (E2)
Student Conference – Part 2 (2)

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A NON-COOPERATIVE SATELLITE HOLDING SYSTEM WHICH HAS A HIGH DEGREE OF FREEDOM MECHANISM

Abstract

Active debris removal in LEO is now urgently required. JAXA is developing the Electrodynamic Tether (EDT) which is a debris deorbit device using the geomagnetic Lorentz force. Connecting EDT to the debris is dangerous operation, so that it should be done by robots. However the way of approaching and connecting it to debris like non-cooperative satellites is not established. Some of the reasons are lack of the mechanical interface to be captured on the debris, the rotation of the debris or operation at close range with risk of collision. This paper describes a novel mechanism for capturing and holding of an upper stage of a rocket which is a big part of the debris. This mechanism is composed with a tether part which is very flexible and a fixation mechanism part which has rigidity. The fixation mechanism part is like a belt and has many hinges and joints with torsion springs and passively expands when it bumps to the debris and twines around the body of the rocket. The end part is very light and simple, but exhibits great ability to keep holding because of friction between the target and the surface of the hinges. Active debris removal with EDT is expected to take one year to complete deorbiting. Impact tension occurs when EDT finishes to expanding its tether and static tension loading continues until the finish of the deorbit. This paper shows the result of experiments about the ability of tension loading endurance of the mechanism in a microgravity using a small bread-board model of the capture mechanism and a rocket model.