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Space Elevator as Transportation Infrastructure to Access Space (3)

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DESIGN OF TAPE-SPRING EXTENSION MECHANISM FOR SPACE TETHERED SYSTEMS

Abstract

Space tethered systems are a long space structure using tethers, which are lightweight and flexible structural elements, and various applications have been proposed. Numerous demonstrations of these in orbit have been carried out, and in recent years the number of cases using CubeSats has been increasing. However, due to the limited tether length that can be stored, it difficult to gravity gradient stabilization, which has been done with conventional tethered satellite systems. Therefore, in CubeSat STARS-Me, tape-spring that higher bending rigidity than the usual tether was used, and the extension method that gradually extends it by a motor was adopted. In this study, three design variables are given to a prototype of a motorized tape-spring extension mechanism, and the effects of these on the extension of the tape-spring are investigated. As a result, it is found that the conditions for the stable extension of the tape-spring are the largest spool diameter that can be carried on the satellite; sufficient pressing force to flatten the cross-section of the tape; and opposite-sense coiling that can extend the tape with less resistance.