Paper ID: 58759
oral
student

18th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Entering the Space Elevator Era (3)

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A ROD MODEL FOR THE EXTENSION ANALYSIS OF CONVEX TETHERS

Abstract

Tethers are structural elements that have the advantages of high storability, long length, and the ability to deploy and coil. Various applications have been proposed which utilize these advantages in space. These are called Space Tether Systems, and space elevators are one of them. Recently, it has been proposed to use CubeSats for in-orbit demonstrations of space elevators. In this case, due to the small size of the satellite, the tether length that can be stored is more limited than before. Therefore, it is difficult to stabilize the attitude of the satellite by the gravitational gradient force. Hence, the exchange for a convex tether is considered. It has higher bending stiffness than a flat tether of the equal width, and higher torsional stiffness than a round tether of the equal sectional-area. This paper proposes to use a rod model for the extension analysis of convex tethers. This model is designed to describe the in-plane changes of the cross-section shape of convex tethers. The purpose is to reduce computational time in tethers extension analysis. This proposed model is validated through comparisons with the experimental results of bending and dynamic deployment.