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Conceptualizing Space Elevators and Tethered Satellites (3)

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REGARDING THE EFFECT OF A CLIMBER'S MOTION ON THE TETHERED SATELLITE SYSTEM

Abstract

The design requirements of the climber attached great importance to economy and transportation efficiency, and the feasibility was examined in a report of International Academy of Astronautics (IAA) and Edward's research. However, no testing of climbers in a space environment has taken place as of yet. Through this report we aim to introduce the prototype climber for space environment testing that we have designed, and share the results of our testing as well as where we are headed.

The planned experiment of a climber in space will, utilizing a deployed microsatellite-class tethered satellite, have a climber move along the tether between the two ends. As the climber moves, the system becomes more complex as it turns into three satellites all connected by a tether, and it is unknown how it will behave or what effects each part will have on another. Furthermore, to reduce the chance of a collision with another satellite during this space experiment, there is a need for the TSS to control its motion, and for a climber that will not negatively interfere in this. For example, the motion of the climber could affect the center of gravity of the entire system, causing a change to the orbital velocity of the TSS, and it is important to make sure such things are accounted for and will not get in the way of the satellites position control. This is why we used the physical modeling language Modelica to perform an acasual model, to simulate the motion of the entire TSS as the climber moves, to investigate the effect of the climber's motion on the system. The results were used in developing the stability criterion for the entire system, which will be useful in deciding the velocities and accelerations of the climber during this in-orbit test.