Abstract

Yo-yo control is a nonlinear approach to tethered satellite libration control that damps in-plane and out-of-plane libration by deploying and retracting the tether at appropriate times. Based on the assumption that the tether is massless and rigid, the algorithm computes tether length changes and a limit on the rate of change of reel rate (length acceleration) that maintain positive tether tension while actively damping libration. The research published to date has studied yo-yo control using the same approximations used to formulate the control law. In this work, a simulation that models tether mass and flexibility reveals that tether stretch dynamics cause rapid loss of tether tension, and subsequent loss of control. A one dimensional tether stretch model is developed and used to compute an upper limit for tether length acceleration. The tethered satellite simulation demonstrates that the modified yo-yo control law maintains positive tension and effectively controls libration.

Citation

"Effects of Tether Stretch Dynamics on a Tethered Satellite Yo-Yo Control Law," with James Dabney, et. al. ProQuest Dissertations Publishing, 1993.