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DEPLOYMENT DYNAMICS OF SPACE ELEVATOR RIBBON

Abstract

The Space Elevator is a futuristic and advanced application of tethers in space. The essential idea is to connect the Earth and the space with 100,000 KM long tether. This tether will be anchored on Earth and balanced with a counter-mass on other end. The space elevator, if constructed successfully, would provide cheap and continuous access to space as compared to conventional rocket engines. Of the considerable challenges involved in its construction, such as material strength, stability of the system, etc., one of the most intriguing challenges is how to successfully deploy the system from space. The current and the most accepted model of the space elevator, as described in current space elevator literature, calls for deployment from GEO (about 35,000 km). A careful study needs to be done to understand the dynamics of the SE ribbon during the deployment phase, however, since some initial studies have shown that the deployment process is highly unstable and that the entire system can fall out of orbit soon after the deployment begins. This paper presents a deployment model of the system which considers the mass and the flexibility of the system. For simplicity, only planar motion is considered. The rate of deployment is governed by the thruster forces in the deployer mechanism. The system is simulated and the instability present in demonstrated. Further, a simple control mechanism is developed to eliminate the instability and it is shown that this control mechanism can successfully deploy the entire ribbon while maintaining the entire system in orbit.