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Space Elevator as Transportation Infrastructure to Access Space (3)

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STUDY ON ORBIT CONTROL OF ORBITAL ELEVATORS BY PROPULSION SYSTEM AND
VARIABLE LENGTH TETHER**Abstract**

Full-sized of space elevator has a problem that cannot be constructed without breakthrough of new material technology such as carbon nano-tube. On the other hand, orbital space elevator which is a partial space elevator that doesn't connect to the ground can be realized with convention materials other than CNT. Other merits are that it does not pass through the part near the ground where the influence of gravity and atmosphere is large. Such system also will be the initial stage of the final full-sized space elevator. In the previous studies about orbital elevator, analysis of vibrations caused by climber operation on orbital elevator [1] and the required energy using an orbital elevator [2] was carried out. However, they didn't consider the shift of orbit of orbital elevator by climber operation. In this study, we consider the change in the orbital center caused by the climber operation and examine the method of suppressing the change of the orbital center. In the study, we first show the changes the orbit caused by the climber operation, and then analyze the propulsive force and propellant mass required to maintain the orbital center when it is assumed that the propulsion system is attached to the geostationary orbit station. We also examined the appropriate method of the climber operation that can reduce the required propellant. Result shows that a very large propulsive force and a large amount of propellant mass are required for each pattern when orbit control is performed using a propulsion system. So, we consider a control method that does not use a propulsion system as next step and propose a method of orbit control using a variable length tether. The detail of the analytical results will be shown in the conference.

[1] Li Gangqiang, Z.H.Zhu,"On libration suppression of partial space elevator with a moving climber",Nonlinear Dynamics-July 2019 [2]Pamela Woo, Arun K Misra,"Energy considerations in the partial space elevator",Acta Astronautica99(2014)78-84