

16th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)  
Conceptualizing Space Elevators and Tethered Satellites (3)

Author: Prof. Yoshiki Yamagiwa  
Shizuoka University, Japan

Mr. Shoji Sato  
Shizuoka University, Japan

Mr. Tatsuro Sato  
Shizuoka University, Japan

Dr. Shoko Arita  
Shizuoka University, Japan

Mr. Kiyotoshi Otsuka  
Obayashi Corporation, Japan

Dr. Yoji Ishikawa  
Obayashi Corporation, Japan

OPTIMUM CONTROL OF CABLE DEPLOYMENT OF SPACE ELEVATOR FROM GEO STATION  
IN TWO DIRECTIONS**Abstract**

Understanding of cable dynamics at the construction of a space elevator is one of the most important issues to design a space elevator. Several studies have been made about the cable dynamics at the construction of a space elevator until now, however, it is assumed in these studies that the cable deployment is done with rising the space station to the orbit higher than GEO keeping the center of the orbit being stayed in GEO. Such method has a disadvantage that a large propellant is required to rise the space station to the higher orbit. We proposed a new method to construct the space elevator in which cables are simultaneously deployed both upward and downward from GEO space station with keeping it in GEO under the momentum balances between the upward- and downward- moving cables. Our preceding analytical study [1] showed that this proposed cable deployment method was able to reduce the total required propellant mass for controlling cable tips and GEO station by about one-third of that in the cable deployment method with rising the space station, but the required propellant mass was still large compared with the assumed cable tip masses and GEO station mass. In this study, we improved the analytical model as such that the time variation of propellant mass during cable deployment was reflected more accurately, and examined the optimum control conditions of cable deployment. From the results, we found that the dramatic reduction of propellant mass for controlling the cable tips was possible by finely controlling the cable deployment speed. The detail of the analytical results will be presented at the conference.

[1] Tao, K, Yamagiwa, Y., Ishikawa, Y. and Otsuka, K., Study about the Simultaneous Deployment Performance of the Cables from GEO Station at the Space Elevator Construction, *Acta Astronautica*, Vol.138, pp.590-595, 2017.