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Space Elevator as Transportation Infrastructure to Access Space (3)

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ANALYTICAL STUDY OF THE DYNAMICS OF LUNAR SPACE ELEVATOR WITH CONSIDERING THE ELLIPTICITY OF THE ORBIT

Abstract

Lunar Space Elevator (LSE) has been proposed as a new transportation system between the Moon and the Earth [1]. LSE is composed of a long tether that connects the lunar surface and the high earth orbit (about 100,000km), a counter weight that gives appropriate tension to the tether, a climber that transports the payload along the tether, and a spacecraft that transports the payload between the counterweight and the earth's ground. A normal space elevator on Earth is a system that places the center of gravity of the system in a Geosynchronous Erath Orbit, but LSE places it at the Lagrange point (L1) where the centrifugal force and the gravitational forces of the earth and the moon are balanced. LSE has advantages not only it makes the transportation cost much lower compared with that by the normal propulsion system, but also has a possibility to construct by using existing materials because the required tension is much lower than that required for Earth's space elevator. In the previous research, the construction requirements and operating method of LSE were discussed, but the discussion was conducted under the simple assumptions that the tether was a rigid body and the lunar orbit was a circular orbit. In our study, we created an analytical model in which the orbit of the moon is the real elliptical orbit and considers the elasticity of the tether in order to analyze the tether dynamics of LSE in more detail. As a result, it was found that the tether vibrated with a cycle of one month by the fluctuation of the Lagrange point with the variation of the distance between the earth and the moon when considering the elliptical orbit of real moon, and this effect made the construction difficult by using existing materials as described in the previous study. We also examined the possible control method of LSE that can be established by the existing materials based on that result. The detail analytical results will be presented at the conference.

[1] Jerome Pearson, Eugene Levin, John Oldson, Harry Wykes., Lunar Space Elevators for Cislunar Space Development Phase I technical Report, Star Technokigy and Research,inc, 2 May 2005.