Paper ID: 34391
student

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Space Transportation Solutions for Deep Space Missions (8-A5.4)

Author: Prof. Xiaohui Wang
Beihang University, China, xhwang@buaa.edu.cn

Mr. Liheng Mao
Beihang University, China, maoliheng2@163.com
Mr. Jianwen Zhao
Beihang University (BUAA), China, zjw19920128@126.com
Mr. Renjie Li
Beihang University, China, lirenjie142@163.com
Prof.Dr. Renwei Xia
Beihang University, China, Lamotte73@163.com

MOON-TO-EARTH TRANSFER ARCHITECTURE RESEARCH BASED ON LUNAR SPACE ELEVATOR

Abstract

This paper proposes a new moon-to-earth transfer architecture based on lunar space elevator, focuses on researching energy consumption problem of this new transfer architecture. The following processes are often adopted in traditional moon-to-earth transfer architecture: the ascent stage of lunar lander transfers the payload to lunar orbit where the payload and propelling module dock, the propelling module then returns the payload to earth. Traditional architecture requires a lot of fuel and the cost is high. If the lunar space elevator was built in the future, there will be a new economic moon-to-earth transfer architecture based on lunar space elevator: use the climber of elevator to ascent payload from lunar surface to altitude h where the payload and propelling module dock, the propelling module then provides trans-earth injection (TEI) delta-$\mathbf{v}$ to send the payload to earth. In this paper, optimization method is used to find a most energy-saving transfer architecture which is based on lunar space elevator. The design variables in this optimization problem include payload-to-climber mass ratio n, launch altitude h, and TEI delta-$\mathbf{v}$ that contains size and direction. Furtherly, considering the carrying capacity and the height of elevator are limited in the reality, optimal architecture may not be able to perform, this paper explores the general regularity, which requires less energy expended than traditional moon-to-earth transfer architecture, between payload-to-climber mass ratio n and launch altitude h.