Paper ID: 33610
student

SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations (IP)

Author: Dr. FENG FEI
The Academy of Equipment, China

Prof. Yasheng Zhang
China
Mr. Zhang Anli
China
Dr. Wenhua Cheng
The Academy of Equipment, China

IMPROVED MULTI-CONIC METHOD IN TRAJECTORY DESIGN AND EMERGENCY MANEUVER STRATEGY OF THE LUNAR SOUTH POLE RETURN MISSION

Abstract

The South Pole Region of the Moon has been highlighted as a potential landing site by European Space Agency and NASA because of favorable illumination conditions and other scientific factors. This paper concentrates mainly on the method of window searching of return injection from the Lunar South Pole, the trans-earth trajectory design and an emergency maneuver strategy from main landing site to a backup landing site of earth.

First, according to the South Pole Region illumination, communication and reentry restricted conditions, this paper presents a Three-Stages window searching method in multi-constraints for the trajectory injection. Subsequently, an improved Multi-Conic method that combines the lunar oblateness correction in the propagation of trans-earth trajectories is then proposed. Furthermore, a long period of trajectory from lunar or other interplanetary destination generally means an unpredictability of landing site of earth. To enhance the safety during reentry process and avoid adverse weather conditions which may appear on the main landing site, an impulse maneuver strategy in trajectory is put forward and optimized, which particularly aims at some emergency situations happen in main landing site after trans-earth injection and have to land in backup landing site.

Simulations show that the Three-Stages window searching method combining with the improved Multi-Conic method can achieve a valid injection window from the South Pole Region in multi-constraints and enhance the terminal accuracy significantly. Additionally, the optimized impulse maneuver strategy provide a practicable solution in increasing safety of vehicle with low fuel consumption. The method proposed can not only be applied to orbital missions of lunar exploration, but also can provide references for other future interplanetary explorations.