Paper ID: 31194
student

13th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Innovative Concepts and Technologies (1)

Author: Mr. Changchun Bao
Tsinghua University School of Aerospace, China, imut007@163.com

Mr. Jingyang Li
China, lijingyang10@mails.tsinghua.edu.cn
Mr. Hongwei YANG
Tsinghua University, China, Yang.HW.THU@gmail.com
Dr. Hexi Baoyin
Tsinghua University, China, baoyin@tsinghua.edu.cn

NEAR EARTH ASTEROIDS CAPTURE TO LUNAR ORBIT BASED ON THE RESONANT GRAVITY ASSISTS THEORY

Abstract

Near Earth asteroids (NEAs) exploration has attracted great attentions recently. NEAs witness the formation of planets in the early solar system, and perhaps settle debates on the origin of water on Earth. Also, a feasible reference plan for future asteroid defense mission can be obtained by studying the inertial structure and components of asteroids. A captured asteroid may be used against a possible Earth-impacting object. Meanwhile, with the growing number of detected NEAs, it will be found that some of them can be mined for expensive rare resources of certain need. Researches on the composition of the asteroids indicate that many materials, which are useful for propulsion, construction, life support, agriculture, metallurgy, semiconductors, and precious and strategic metals, could be extracted and processed from NEAs. In this paper, a trajectory design method for capturing NEAs to a lunar orbit is presented. There are no NEAs that can be captured by moon naturally because of the Moon's weak gravitational field. Therefore, the first step of capturing NEAs is to transfer them from the Heliocentric orbit to the Geocentric orbit. The transfer is calculated in the Sun-NEA two-body model where an impulse is executed on the NEAs to make them approach the Moon for gravity assist. The calculation of the magnitude of the impulse is similar to the midcourse correction maneuver of an interplanetary mission. A differential correction process is used to obtain the velocity increment while the lunar flyby is designed to decrease the orbital energy relative to the Earth. The second step is the capture by the Moon with resonant gravity assist where an impulse is applied at the apogee of the asteroid to decrease the velocity relative to the Moon. The final step is to insert the NEAs into the orbit of the Moon by executing braking maneuver. In this paper, a numerical example is provided to demonstrate the above-described method. Candidate asteroids that can be captured are first selected and then velocity increments that are necessarily needed for the final capture are calculated.