

Perturbative Analysis on a Lunar Free Return Trajectory

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Abstract : In this study, starting with a predetermined Lunar free-return trajectory, an analysis of major near-Earth perturbations is carried out. Referencing to historical Apollo-13 flight, changes in the mission's resultant perimoon and perigee altitudes with each perturbative effect are evaluated. The perturbations that were considered are Earth oblateness effects, up to the 6th order, atmospheric drag, third body perturbations consisting of solar and planetary effects and solar radiation pressure effects. It is found that for a Moon mission, most of the main perturbative effects spoil the trajectory significantly while some came out to be negligible. It is seen that for apparent future request of constructing low cost, reliable and safe trajectories to the Moon, most of the orbital perturbations are crucial.

Keywords : Apollo-13 trajectory, atmospheric drag, lunar trajectories, oblateness effect, perturbative effects, solar radiation pressure, third body perturbations

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