

Analysis of the Restricted Three Body Problem in the Context of a Lunar Transfer Orbit

ABSTRACT

While the two-body approximation developed in class is good enough for preliminary orbit determination and propagation, it fails even at short term predictions in higher orbits due to the non-negligible gravitational forces of other celestial bodies, such as the moon. The restricted three body problem considers a small spacecraft under the influence of two larger bodies, such as the Earth and the moon. The forces exerted by the Earth and moon on each other are considered, but the spacecraft is assumed to have a negligible effect on the larger bodies.

This study will illustrate the limitations of the two-body approximation in the context of a lunar transfer orbit as well as the opportunities presented by using a restricted three body approximation, such as free-return trajectories that the Apollo missions used in the 1960s and 1970s.

In addition, MATLAB software will be developed that uses numerical integration techniques to model the orbit of a satellite considering the gravitational forces of both the Earth and moon. This software will include a graphical user interface (GUI) that will simplify its use, making it a useful tool for preliminary mission design and educational illustration of the three-body problem.

REFERENCES

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