Exploration of Other Destination (6)
Exploration of Other Destination (1)

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TRAJECTORY DESIGN OF EARTH TO MERCURY GRAVITY ASSIST MISSION USING ITERATIVE PSEUDOSTATE TECHNIQUE

Abstract

An iterative pseudostate technique is used to design the trajectory of an Earth to Mercury gravity assist mission via Venus. The superiority of the iterative pseudostate technique over other analytical techniques is demonstrated in this paper. The iterative pseudostate technique (1) includes the gravity of the Sun and the planet within the pseudosphere of the planet and iterates upon the pseudostate to generate the excess velocity vector. An analytical tuning strategy (2) is used to obtain a hyperbola that contains the desired excess velocity vector at the pseudosphere. The proposed analytical method incorporates the aspherical gravity model of the departure planet, that is, Earth and generates the design. This design is very close to the numerical design and requires minimal fine tuning to achieve the target parameters under full force model. The use of iterative pseudostate technique as a mission design and analysis tool is demonstrated in the current work. As the proposed design is very close to the numerical design, the analytical design charts show the trend of numerical designs for the wide range of mission scenarios. This provides in-depth insight into the various mission scenarios. Similar charts are not possible with other analytical techniques and the numerical technique requires enormous computation time and effort.

References

[1]. SP Parvathi and RV Ramanan, "An Iterative Pseudostate Method for Transfer Trajectory Design of Interplanetary Orbiter Missions", Journal of Guidance, Control, and Dynamics, (2016), accessed November 24, 2016, doi: http://arc.aiaa.org/doi/abs/10.2514/1.G002072.

[2]. R.V. Ramanan and V. Adimurthy, "Nonimpact Lunar Transfer Trajectories Using the Pseudostate Technique", Journal of Guidance, Control and Dynamics, Vol.28, No.2, March-April, 2005. doi: 10.2514/1.7607.

[3]. S.W. Wilson, Jr., "A Pseudostate Theory for the Approximation of Three-Body Trajectories." AIAA Paper No. 70-1061, AAS/AIAA Astrodynamics Conference, Santa Barbara, California, Aug. 19-21, 1970.