Paper ID: 65698
student

IAF ASTRODYNAMICS SYMPOSIUM (C1)
Guidance, Navigation and Control (1) (1)

Author: Mr. Aniket Bire
University of Arizona, United States, Aniketbire@email.arizona.edu

CALIBRATED AND DECALIBRATED APPROXIMATIONS OF SATELLITE RELATIVE MOTION IN A RESTRICTED 3-BODY REGIME OF EARTH-MOON SYSTEM

Abstract

NASA's efforts to explore the moon in the Artemis program will offer unique challenges to design sustainable lunar outpost around the moon. This demands an advancement in satellite relative motion techniques to handle dynamically complex regimes in the Earth-Moon system. In response to this demand, this paper investigates the satellite relative motion in the calibrated circular and calibrated elliptical restricted 3-body problem in a local-vertical-local-horizontal (LVLH) frame. This calibrated linearized approximation of the nonlinear satellite relative motion in a restricted 3-body problem is obtained by developing an equivalence of the linearized equations of motion that are related through linearized transformations. In developing this equivalence, this paper exploits the advantage of utilizing linearized solutions for coordinates with lower nonlinearity indices to develop calibrated linearized solutions for coordinates with higher nonlinearity indices and in turn, improves the accuracy of the conventional linearized solution. These calibrated solutions are also compared against the conventional and calibrated Euler-Hill (HCW) model and the Linear Equations of Relative Motion (LERM) model in this paper. Furthermore, these calibrated relative motion models are employed to study relative motion applications such as rendezvous and space loitering in the Earth-Moon system. Finally, more accurate decalibrated solutions are obtained by inverting the calibration process.