An Analytical Method for Low-Thrust and High-Thrust Orbital Transfers

Sang-Young Park

Yonsei University

Analytical formulae are presented to approximate the evolution of the semi major axis, the maneuver time, and the final mass fraction for low thrust orbital transfers with circular initial orbit, circular target orbit, and constant thrust directed either always along or always opposite the velocity vector. For comparison, the associated results for high-thrust transfers, i.e. the two-impulse Hohmann transfer, are summarized. All results are implemented in a computer code designed to analyze planar planetary and interplanetary space missions. This implementation yields fast and reasonably accurate approximations to trajectory performance boundaries. Consequently, the approach can provide trajectory analysis for each spacecraft configuration during the conceptual space mission design phase. As an example, a mission from Low-Earth Orbit (LEO) to Jupiter's moon Europa is analyzed.