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LOW-THRUST ORBITAL TRANSFER TO GEOSTATIONARY ORBIT

Abstract

For spacecraft propulsion, Electric propulsion (EP) has been considered a well-researched and promising technology over the years. When compared with conventional chemical propulsion system, the advantages offered by the Electric Propulsion system such as low thrust and high specific impulse make it capable to deliver higher payload fractions for space missions. Future satellites destined for Geostationary Equatorial Orbit (GEO) may benefit by using both chemical propulsion as well as Electric Propulsion to strike a balance between transit time, delivered payload mass, and minimal power degradation. Initially, in order to avoid prolonged exposure to the trapped radiation in the Van Allen belts, a chemical propulsion stage can be used to place the satellite in a higher-energy elliptical orbit and the low-thrust electric stage can be used to complete the transfer to GEO. Hence, mission designers require a method to rapidly evaluate low-thrust transfers to GEO. This paper aims to develop an algorithm to quickly determine the V (velocity increment) for a low-thrust transfer from an arbitrary elliptical orbit to GEO. The algorithm required to calculate V for planar transfer to GEO is presented and variation in V at different values of orbital parameters such as semimajor axis and orbit eccentricity are discussed.