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OPTIMAL ORBIT OF A TYPICAL EARTH OBSERVATION SATELLITE WITH THE PURPOSE OF PROPELLANT AND PAYLOAD MASS MINIMIZATION

Abstract

Due to costs of transferring a satellite to orbit, access to pre-defined mission characteristics for minimum satellite mass was always one of the satellite design aims. Satellite design based on a common platform has drawn many attentions for more than three decades. A set of existing subsystems in a pre-defined common platform are changeable with tight restrictions. Therefore, in order to reduce the total mass of satellite focus is on the reduction of propellant mass required for the mission as well as the mass of satellite optical payload. The mass and performance characteristics of these two are commonly dependent on the satellite orbital mission and hence, the orbital parameters are considered as the main driver of determining the performance and mass of these two parts. The required propellant of the propulsion subsystem is used for three objectives of orbit correction, attitude maneuvers and orbit transfer in deorbiting phase that are functions of orbital parameters and have the ability to get a mathematical model. Moreover, the mass and dimensions of an optimal payload to achieve a desired resolution and swath width will be changed by any change in orbital parameters. These changes are predictable by using a proper mathematical model and forming a database of optical payload. This paper aims at finding an optimal orbital parameters by searching in the design space bounded with launch vehicle, platform and mission requirements. In such optimal orbit the aggregate mass of propellant and the optical payload become minimized. Keywords: Optical payload, Platform, Propulsion subsystem, Optimization, Satellite orbit