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FEASIBILITY STUDY OF ORBIT CONTROL METHODS IN CUBESATS WITH ELECTRIC PROPULSION FOR AN INTERPLANETARY MISSION

Abstract

With ESA Science Programme Voyage 2050, there is a need for technology developments in terms of more efficient power and propulsion systems for future space missions. With regards to this, many science missions have been proposed for solar system exploration, sample return, search for extra-terrestrial life, exoplanets search and understanding of the early universe. However, all such missions need an efficient and reliable satellite or a constellation of satellites. Efficient propulsion and control methods can contribute in designing a satellite which is reliable and can serve in achieving ambitious science objectives. In order

to design such a satellite, different orbit control mechanisms and electric propulsion systems have to be evaluated and adapted to the mission requirements. Thus, this paper discusses the feasibility of electric propulsion technologies along with orbit control methods in CubeSats for an interplanetary mission. With growing interest in small scale satellites, the demand for propulsion systems with moderate power levels (between 1 to 20kW) has also increased. In line with the demand of such a propulsion system, a hybrid propulsion model with electric propulsion and solar sails is investigated in this study. This paper presents a particular case of a CubeSat orbiting Jupiter's polar orbit which can contribute in achieving various science goals such as understanding Jupiter's magnetosphere and studying the mass and energy flows in the Io-Jupiter system. A high-level phase 0/A, mission analysis and feasibility study, of such an electric propulsion centric mission is conducted. Furthermore, the study exhibits a trade-off analysis of spacecraft power requirement vis-à-vis mass and thruster, trajectory design and manoeuvring, orbit determination and flight path control mechanisms which can lead to an efficient mission to the Jovian system.