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ON THE STUDY OF INTERNATIONAL SPACE STATION ORBIT KEEPING USING VARIABLE SPECIFIC IMPULSE MAGNETOPLASMA PROPULSION

Abstract

Most spacecraft use chemical propulsion while the satellites rely on chemical thrusters or resisto-jet rockets for orbit station keeping and attitude control. Even though electric propulsion such as ion thrusters and Hall effect thrusters have been used for station keeping and orbit raising of the satellites, chemical propellants are preferred more. Currently, the most advanced Propulsion system for this purpose is the Nuclear Variable Specific Impulse Magneto-Plasma Engine; the VASIMR engine. The peculiarity of VASIMR to work in two modes namely, low thrust high specific impulse and high thrust low specific impulse make it ideal for operations like orbit Raising maneuvers, satellite repositioning, drag compensation, etc. Various such studies have already been conducted and the system proves to be efficient. In this paper, we focus on using VASIMR for the orientation of the International Space Station. Currently, the different functions like altitude maintenance, debris avoidance, and attitude control are carried out by the Russian modules Zvezda and Progress, and European ATV for Which the International space station requires on an average 7,000 kg of chemical propellant every year. The Conventional methods aren't very reliable, issues like constant refueling and hazardous leaks during propellant transfers from tanks are unavoidable. To avoid such issues and perform all the operations efficiently, VASIMR proves to be promising.

We conducted a comparative study between the conventional chemical propellant and nuclear electric VASIMR using NASA's GMAT software, to evaluate the feasibility of VASIMR as a advanced propulsion System on the International Space Station (ISS). The method adopted for this study was designing of trajectories with constant orbit parameters and varying propulsion parameters and evaluating them on the basis of performance. We arrived at a conclusion that VASIMR is more efficient to perform orbit controls of the ISS as compared to conventional systems.

Keywords: Electric propulsion, VASIMR, International space Station, GMAT.