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ADVANCED ELECTRODELESS PLASMA THRUSTER CONCEPTS FOR SMALL SATELLITES

Abstract

Nowadays the development of Low Earth Orbit (LEO) Small Spacecraft (SSC) is of particular interest. Such devices are planned to be used for effective telecommunication systems and advanced Earth observation research. When developing space missions of such LEO SSC, designers and operators encounter a number of technical problems. One problem is the inability to use a single propulsion system for all flight operations, such as transfer from a parking orbit to the target one, maneuvers between orbits, altitude control, orbit maintenance, attitude control, and de-orbiting. Another challenge is the limited lifetime and high energy consumption of the conventional (Hall and Ion type) Electric Propulsion Systems (EP) in LEO. To overcome these problems and others, it had been proposed to use electrodeless plasma thrusters. Such propulsion systems utilize radiofrequency, high-frequency electromagnetic fields, or microwaves to create a plasma and accelerate it by means of magnetic nozzles. By using such electrodeless propulsion systems, it becomes possible to create multiple thrust vectors by only one thruster. As a consequence, all of the flight operations required for a SSC can be performed by one EP system. In addition, they can survive and keep operating over relatively long periods of time. Furthermore, they have low energy consumption and they are compact in size which allows their implementation onboard most SSC platforms. This paper describes several promising advanced plasma thruster concepts with focus on six different new concepts of electrodeless EP systems.