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IAF SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

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INDUCTIVE PLASMA THRUSTER (IPT) DESIGN FOR AN ATMOSPHERE-BREATHING ELECTRIC PROPULSION SYSTEM (ABEP)

Abstract

Challenging space missions include those at very low altitudes, where the atmosphere is source of aerodynamic drag on the spacecraft, therefore an efficient propulsion system is required to extend the mission lifetime. One solution is Atmosphere-Breathing Electric Propulsion (ABEP). It collects atmospheric particles to use as propellant for an electric thruster. This would minimize the requirement of limited propellant availability. The system could be applied to any planet with atmosphere, enabling new mission at these altitude ranges for continuous orbiting. Challenging is also the presence of reactive chemical species, such as atomic oxygen in Earth orbit. Such components are erosion source of (not only) propulsion system components, i.e. acceleration grids, electrodes, and discharge channels of conventional EP systems (RIT and HET). IRS is developing within the DISCOVERER project an intake and a thruster for an ABEP system. This paper deals with the design and first operation of the inductive plasma thruster (IPT) developed at IRS. The paper describes the design, flanked by IRS heritage on inductive plasma generators (IPG) from one side, aided by numerical simulations with ADAMANT code on the other. Such a device is based on RF electrodeless discharge aided by externally applied static magnetic field. The IPT is composed by a movable injector, to variate the discharge channel length, and a movable electromagnet to variate position and intensity of the magnetic field. By changing these parameters along with various designs of the antenna, the aim is to achieve the highest efficiency for the ionization stage. The IPT is set into operation for the first time as a plasma source, and its early evaluation of the plasma discharge for various magnetic fields is shown.