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

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ELECTRODYNAMIC WING FOR LEO SPACECRAFT PROPULSION

Abstract

propellantless propulsion in space is desirable for long term space missions. A new concept of electrodynamic wing of such kind is put forward in this paper. The electrodynamic wing is composed of a number of thin and long conducting wires which are kept at high positive potential by an onboard power supply. With each highly biased wires inducing thick cylindrical plasma sheath in space plasma, through which ambient electron current from space is attracted, the wing generally forms a much larger total effective plasma sheath surface surrounding the structure than its enclosed area, and efficiently enlarges the electron current attracted from the ambient plasma by the wing. Due to the electron current enhancement mechanism, the wing can produce efficient electrodynamic force by interacting with the earth magnetic field. A physical model of the electrodynamic wing is built, and the basic performance and characteristics of such a wing are analysed. A magnetic wing with ten wires two hundred meters long can generate a force of tens of mN depending on the biasing voltage and spacecraft altitude, and for one kilometer length, the propulsion approaches sub-newton level. Electrodynamic wing technology is applicable in low earth orbit space from 250km to nearly 1000km altitude. Because of its low weight and high electron current attraction efficiency, the technology probably find promising application for future low earth orbit missions, not only in altitude control or orbit attenuation offset, but also in orbit transfer, etc.