ORBIT TRANSFER USING A LASER-SUSTAINED SOLID PROPELLANT COMBUSTION MICROTHRUSTER

EunJi Jun[1], Sang-Young Park[1], Woong-Sup Yoon[2], and Kyu-Hong Choi[1]
[1]Dep. Astronomy and Space Science, Yonsei University
[2]Dep. Mechanical Engineering, Yonsei University

In this research, laser sustained combustion was proposed in order to develop a high-efficiency micro-thruster. The proposed thruster has combustion controllable solid propellant called "non self combustible solid propellant (NSCSP)." A 1-20W class diode laser(LD) and HTPB/AP/Addictives (propellants) are used. NSCSP is controlled with the power of laser irradiation, mixture ratio and additives. In order to demonstrate the ignition characteristics, NSCSP is irradiated with laser in ambient pressure. Ignition characteristic is one of the most important parameters that requires establishment in solid propellant for the purposes of rocket motor design, propellant selection, and development because simulation for the prediction of ignition is not possible. Current researches analyze and provide the characteristics of the laser-assisted Ignition thruster for a small satellite. The orbit rising maneuver near the Earth is also simulated by using a laser thruster. If light, compact and high power laser is available, laser-sustained solid propellant combustion mictrothruster can be used in orbit control. The characteristics of NSCSP are applied to micro-thruster which is used for orbit rising maneuver and orbit transfer. Orbit rising maneuver is the process that maintains the satellite in a specific region of space during the lifetime of the satellite. The optimization for orbit rising maneuver is performed to maximize satellite's final mass (or minimize fuel expenditure). The mass fraction obtained with variable thrust is compared with that obtained with constant thrust. Drag and J2 perturbation are considered as the largest non-gravitational force that affect a spacecraft. The advantages of laser thruster for orbital control are also discussed.