SPACE PROPULSION SYMPOSIUM (C4)
Advanced and Combined Propulsion Systems (8)

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ORBITAL MANEUVER OF SATELLITE USING SOLAR SAIL

Abstract

Now days the problem of launching satellite comes down to geometry and energy. However energy is limited and so is cost. Meeting the operational constrains, determines the launch window. The **site latitude and orbit inclination** are two important factors affecting how much energy boosters have to supply. It's a rare case indeed to launch directly into the final orbit. Once a satellite is in its mission orbit, perturbations must be concentrated or perhaps the satellite must be moved into another orbit. **The velocity and position determines its orbit, where change in velocity changes its orbit.** Since gravity is conservative, the satellite will always return to the point where it performed the maneuver (provided it doesn't perform another maneuver before returning). The satellite maneuver depends on amount and type of propellant it carries. There are practical limits to the amount of propellant a satellite can carry. These constraints on maneuvering in space have important consequences for satellite operation. In this situation, the satellite uses electric propulsion system for orbital maneuver. Thus, **this paper looks at solar sail a form of spacecraft propellant which will be an effective replacement for orbital maneuver.**

The Solar sail use the radiation pressure (solar pressure) from stars to push large ultra-thin mirrors to high speeds. **The total force exerted on a solar sail may be around 1 newton or less, making it a low-thrust propulsion system**, similar to spacecraft propelled by electric engines. Thus, the utilisation of solar sail for orbital maneuver of satellite is examined. The maneuver within the orbital plane allows the user to change the altitude of a satellite, shape of orbit, orbital period and inclination of orbit. The satellite orbit is assumed to be at an **altitude of 0 − 35,786 km** with **eccentricity of 0 <= e <1** (circular, elliptical orbit). The Proper attitude maneuver is prescribed to utilise highest solar drag from the sun. The maneuver is realised using **a quaternion feedback algorithm.** This paper presents **the success of the continuous and abrupt orbital maneuver using solar sail as spacecraft propellant which is illustrated through orbital parameters and simulations.** The advantage of this paper shows that **electric propellants are conserved for the fight path and the efficiency of the satellite is increased in terms of longevity.**

Keywords: Solar sail, orbital parameters, low thrust propulsion System, orbital maneuver, orbital perturbations.