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Author: Mr. Bikash Adhikari
University of L'Aquila, Italy, bikash.adhikari@mathmods.eu

Mr. Pavan kumar Asur vijaya kumar
University of L'Aquila, Italy, pavan-kumar.Asur@mathmods.eu

NUMERICAL SIMULATION OF THERMAL AND POWER ORBITS OF NANO SATELLITES

Abstract

Thermal control plays a major role in satellite development due to the harsh temperature conditions it is subjected to, in space. It has to be considered in order to have the smooth functioning of the satellite. This research describes the thermal environment and orbital analysis for a Nano Satellite. This work also describes the power generation and the shadow analysis of the Nano Satellite. When the satellite is in the orbit the guiding differential equations becomes complicated when accommodating Keplerian orbital parameters. This requires a numerical solution to determine the position and orbital properties, hence paving way for numerical algorithm. Since the orbital position and the properties that are to be determined for a particular day in a year depends on earth's position around the sun and the angle at which satellite is oriented towards the earth, an eclectic analysis has to be done in order to create the relation between sun, earth and satellite in terms of orbits.

Preliminarily, the relation between sun and the satellite orbits has been drawn using other Keplerian elements and beta angle. On the other hand, depending on the position of the earth around the sun, a thermal heat flux has been calculated for a period of one year assuming no solar flares and eruptions. A relation has been created to combine beta angle and thermal heat over a year to draw conclusions on worst possible hot case and cold case .Furthermore, the orbital position around the earth of the worst cases has been programmed and later generalized for a given day in a year. This primarily programmed code can be used to draw conclusions on incoming heat, power generations which again leads to the conclusion upon possible deployment in the solar panel, placement of sun sensors and shadow analysis(the effect of movement of satellite on the solar panels). Integrating primary code with the secondary is a bit arduous and has been achieved by the mathematical ingenious of orthogonal transformations which gives the complete information about the orbit numerically for a year. Also, from the above results thermal cycling effects for Al-6061-T6 has been estimated for the radiation effects using a commercial FEA package.