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USE OF AN ACTIVE ELECTRODYNAMIC TETHER TO PROVIDE A VARIABLE ORBIT FOR EFFECTIVE RADIATION MODELING AT DIFFERENT ALTITUDES IN THE LOW EARTH ORBIT

Abstract

One of the most crucial factors which influence the mission life of satellites in the Low Earth Orbit is atmospheric radiation. This radiation poses a serious threat to the satellites components and to provide measures to counteract it, its measurement is a very crucial objective. However simply using a radiation detector on a satellite in a specific orbit is not sufficient as it limits the range of the detector only to that orbit and as radiation density is dynamic and changes with solar activity at different altitudes.Hence a system is required which provides a cost effect method of varying the altitude of the satellite over a period of time to effectively measure radiation at different altitudes during its orbit. This paper presents the use of an active electrodynamic tether system integrated with a Nano-satellite to achieve the same. The tether system consists of a long conducting wire which when lowered into the atmosphere provides a closed circuit with the plasma of the ionosphere for the flow of current. This current flow interacts with the magnetic field of the Earth to generate a Lorentz drag force on the satellite causing the satellite to lose altitude while simultaneous generating power which is stored in batteries. To re-boost the satellite, a current is provided to the tether in the opposite direction using the power obtained during deboosting along with power from the solar panels of the satellite, causing a lift on the satellite and hence gaining altitude. This process is carried out throughout the satellite's orbit and the radiation detector continues to collect data at different altitudes. This paper explores the use of a scintillator coupled with a photomultiplier tube and a multichannel analyzer(MCA) for the measurement of electron flux as these radiations pose the greatest threats to on-board electronics.The data obtained will be used to map out the flux density variations which will help future space missions. This paper illustrates the use of a mathematical model to simulate the rate of assent and decent of the satellite while the tether is deployed which enables us to predict the orbit change of the satellite.