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DEVELOPMENT OF A SOLAR ARRAY DRIVE MECHANISM FOR THE USE ON MICRO-SATELLITE PLATFORMS

Abstract

Photovoltaic solar array (PVSA) systems are the most widely used method for spacecraft power generation. However, in many satellite missions the optimum orientation of the PVSA system is not always compatible with that of the payload orientation. Many methods, have been examined in the past to overcome this problem. Up to date, the most widely used active method for large costly satellites is the solar array drive mechanism (SADM). The SADM serves as the interface between the satellite body and the PVSA enabling the decoupling of their spatial orientation. Non the less, there exists a research and development gap for such systems regarding low cost micro-satellites.

The first step of this research individual orbital parameters of various micro-satellites have been extracted, and have been compared to the rotational freedom of the corresponding SADMs used. The findings demonstrated that the implemented SADMs are over designed. It is therefore concluded that these components are not tailored made for each spacecraft mission individually, but rather, exhibit a generic design to fulfill a majority of mission profiles and requirements.

Motivated by the above analysis, the cardinal objective of the current reaserch is to develop a low cost mechanism that will be precisely tailored for the use of a LEO micro-satellite platform orbiting in altitudes of $500 - 1000Km$. The design of the mechanism may vary from the existing miniaturized SADMs. For example, the preliminary analysis of the current research suggests, that the conventional use of the slip ring system as the electronic transfer unit can be replaced by a seMI Orientation Unit (MIOU).

Systems engineering tools for concept generation and selection have been used. In addition, simulation and mathematical modelling have been implemented on component and system level, to accurately predict the behavior of the system under various modes of operation. The production and system testing of the prototype has taken place and it has verified that the development of such a system, will aid the power generation of the solar arrays, while having a positive impact on the cost reduction of such satellites. In the presentation the final results and conclusion are presented.

This ongoing project is the result of the collaboration between the Faculty of Aerospace Engineering of TU Delft and LuxSpace Sarl. The overall goal of this research is to lay the foundations and fill the gap between research and design, for the development of SADMs for low cost micro-satellites in LEO.