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PROPOSAL OF SYSTEM EVALUATION METHOD AND REDESIGN METHOD OF CUBESAT FOR IMPROVING MISSION ACHIEVEMENT RATE

Abstract

This paper describes the method to evaluate the reliability of the system to achieve the mission and the method of a redesign method based on the evaluation results, to improve the mission achievement of CubeSat. It is mainly developed using consumer-use products, and the advantage is low cost. Therefore, in recent years, CubeSat has been in high demand as a constellation satellite, and the number of annual launches has increased about 10 times in the past 10 years. On the other hand, however, it is an issue that the degree of achievement of the mission is low, and about 50 percent of satellites have actually failed the mission. The causes include omissions of requirements, design and verification and deficient satellite health monitoring. In addition, missions may fail because there is no design to deal with the anomalies. As the complexity of the design increases, the development process increases, and defects are created. Also, CubeSat need to realize functions with limited resources (volume, mass, budget), many devices are designed without redundant systems. A design method is needed to improve the mission achievement rate while taking into account the such constraints of CubeSat. In this study, through the following steps, we aim to improve the mission achievement by considering the complexity of the system and changing to a design that can monitor satellite health and deal with abnormalities. () Implements a Composite Failure Analysis Method that has static failure analysis targeting each components and dynamic analysis targeting interaction between components to identify the possibility of satellite abnormal modes. () Based on the obtained abnormal mode, appropriate telemetry data and an appropriate countermeasure method for monitoring the satellite system are formulated. () We evaluate the reliability of the system to achieve the mission from both aspects of the improvement of the mission achievement by the redesign and the complexity of the system. Then, based on the result of the system evaluation, the optimal redesign is executed. The details of these three steps will be explained in the presentation, and a design methodology will be proposed to improve mission achievement. The proposed system evaluation method and redesign method are implemented on the 6U CubeSat "Prelude", Precursory Electric Field Observation CubeSat Demonstrator, which is currently under development, and the results are reported in the presentation.