SPACE SYSTEMS SYMPOSIUM (D1)
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BACKUP PLAN FOR REACTION WHEEL FAILURE OF FORMOSAT-2 SATELLITE

Abstract

FORMOSAT-2 satellite was launched in 2004 on a Sun-synchronous orbit of 14 rev/day. It has taken the first images and continuously monitoring after large disasters over the world to support the aftermath relief and precaution of secondary disasters. The daily repeat of FORMOSAT-2 simplifies operations, scheduling, and processing, and the users are easy to request images for urgent needs. With the higher altitude of 888 km and larger field of regard of 45 deg, the satellite can even take images up to the geographic poles. This demonstrates that FORMOSAT-2 is the only one high-resolution imaging satellite which can daily cover the worldwide areas. Also due to the higher altitude, it has been conducted only 7 orbit maintenances during its mission time. Good agility is to guarantee the large-area imaging or multiple tasking.

During the 11-year satellite operations, one of the reaction wheels was failed in 2012. The satellite attitude maneuver was then performed with the other three reaction wheels. The agility of the satellite is reduced with 50 percent longer than that of 4 reaction wheels. The primary telecommand interface of another reaction wheel was found anomalous in 2014, so that the satellite is now operated using the redundant one. We are facing the failure of two reaction wheels, and investigating how to control the satellite to stay in the safe mode. Simulations of the attitude control using two reaction wheels and three magnetic torquers show that the attitude can be stabilized to nadir pointing to satisfy the basic power consumption. Furthermore, if the attitude control is compensated with the thrusters, the satellite can take images with duty cycle in one percent.