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POWER OPTIMIZATION DESIGN OF EARTH OBSERVATION SATELLITE

Abstract

The main task of earth observation satellite is to deliver earth surface condition information to ground base station in accurate and valid. In order to perform this task, a satellite is equipped by attitude control system. The control system has important role especially when satellite conducts automatic image capturing for targeted earth surface. Image capturing is major operation task of earth observation satellite. Some research results shows that image capture operation consumes minimum 30% of the orbit time. In image capture operation, the camera, satellite pointing maneuver and attitude control actuator establish close-loop process. The actuator is managed by satellite main computer and the reaction wheel system. Because of its critical role, attitude control system requires stable operation and accurate target pointing in order to get best quality earth surface images. However, the limitation of power supply capacity cause the operation of attitude control system limited in time so that imaging process cannot be achieved adequately. In order to overcome power capacity limitation, in this paper a method to obtain optimal satellite design is considered. This paper focus on how to determine some dimensional satellite parameters in order to minimize power consumption. We develop a mathematical model that describes the relation between image capture operation and power consumption. Mathematically in general a quadratic objective function is constructed and optimal solution is searched in entire feasible satellite parameter domain. Optimization process is conducted using software. In order to verify the effectiveness of the method, selected design parameters of satellite are evaluated using computer simulation. The computer simulation consists of satellite attitude dynamic module and power system module which is derived from mathematical model. Numerical simulation has been conducted using real satellite structure data. The simulation results has shown that the proposed method worked well. It means that the design parameters have made the objective function minimum.

Keywords— micro satellite; attitude control system; power supply capacity; imaging; optimization; satellite configuration.