

SPACE POWER SYMPOSIUM (C3)
Small and Very Small Advanced Space Power Systems (4)

Author: Mr. Bryan Pawlina
University of British Columbia, Canada

Ms. Jenny Yu
University of British Columbia, Canada

ENERGY-OPTIMAL CONTROL OF DEPLOYABLE SOLAR PANELS FOR A CLASS OF
NANOSATELLITES

Abstract

Deployable solar panels offer advantages over fixed, chassis-mounted solar cells such as increased light-collecting surface area, increased room for chassis-mounted components, and independent control of panel normal vector with respect to satellite attitude. However, maneuvering the panels requires actuator effort both in the panel manipulators and rejection of the disturbance this motion imparts on the attitude stabilization system. Large, flexible arrays in particular have a non-trivial optimal control for small satellites, such as cubesats. Our analysis considers the control of solar panels and satellite attitude together as interacting parts of the energy collection system. The energy-optimal control is derived for a few example satellite architectures showing that families of solutions arise from different configurations.

The dynamics of a university competition nanosatellite are modeled and the theory applied to its deployable solar panel system in-orbit. Research is ongoing into the simulated relative improvement of the energy-optimal system with and without ignoring the solar panel dynamics for various attitude pointing requirements.