A Comparative Analysis Of All-magnetic Attitude Control Techniques For Nanosatellites Sun Acquisition

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INTRODUCTION

nanosatellites as well as more conventional spacecraft, the safe mode of the attitude control system is probably the most important one, as it must insure that the satellite receives enough power from the sun to charge its batteries, and maintains its thermal equilibrium whatever happens.

A great number of very detailed theoretical studies about magnetic control are already available in the literature. Unfortunately the methods proposed are most of the time overly complex for the problem at hand, which can hinder building a strong physical understanding of how the system works, and complicate troubleshooting and validation.

Reducing complexity is all the more important as this validation.

METHOD

AIM

• Design 3 different straightforward candidate strategies for all-magnetic attitude control of a 3U CubeSat using a magnetometer and sun sensors for attitude determination.

• Compare performances in terms of maximum depth of discharge, Convergence time, Depointing, and Robustness

RESULTS

NON-SPINNING

3-Axis Control

2-Axis with kinetic momentum monitoring (Fuzzy Hybridization)

SPINNING

Spinning

Strategy:

Strategy:

b

b

b

3-Axis

Control

SPINNING

Spin Control

Position Control

CONCLUSIONS

Outcome

• 3 approaches have been developed and tested

• Non-spinning 3-axis does not work (expected)

• Non-spinning 2-axis control is best for accuracy

• Spinning is best for convergence time and DoD

• Spinning more dependant on angular velocity measurements than non-spinning


Future work

• A proper robustness analysis should be carried out for both strategies

• With respect to uncertainties on inertia

• With respect to uncertainties of solar irradiation

• A realistic model of the sun sensor should be implemented

REFERENCES


