ASTRODYNAMICS SYMPOSIUM (C1)
Attitude Dynamics (1) (3)

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NEW ONE-AXIS MAGNETIC ATTITUDE CONTROL IN ABSENCE OF MAGNETOMETER READINGS

Abstract

Active magnetic control synthesis and analysis for attitude guidance of "Chibis-M" microsatellite are considered. Completely new magnetic control scheme based on the well-know "Bdot" reasoning is proposed. Satellite achieves one-axis inertial space attitude and maintains spinning around this axis. Control scheme utilizes Sun sensors or other possible sensors readings and orbital position data, magnetometer is not used or is unavailable. This control can therefore be used a backup system in case magnetometer fails.

Averaging technique is used to assess equilibrium positions stability. The behavior of a system with respect to initial conditions and orbit parameters is studied. Evolutionary equations of motion for the axisymmetrical satellite are obtained, full set of autonomous first integrals is present. These integrals bring terminal spinning value. Equilibrium positions are found that bring inertial attitude. Slightly non-symmetrical satellite evolutionary equations are obtained also, stable equilibrium positions depending on the inertia tensor are shown. As a result simple formulae allow fast assessment on satellite attitude and spinning rate.

Algorithm functioning onboard "Chibis-M" satellite is used to verify analytical results. The algorithm ensures solar panels attitude with respect to the Sun. Different stable attitude configurations are achieved in-flight.

The work was supported by RFBR grants 12-01-33045, 13-01-00665, 14-01-31313.