METHOD FOR CONTROLLING ATTITUDE IN SURVIVAL MODE FOR A SATELLITE CARRYING AN INSTRUMENT SENSITIVE TO SOLAR RADIATIONS

Technological advantages

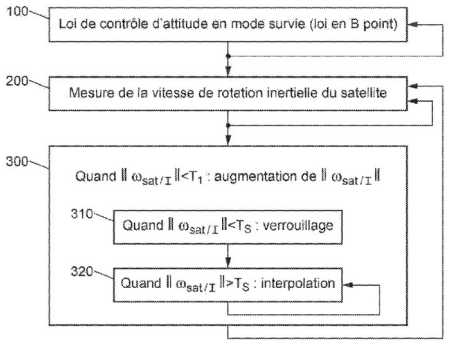
- Autonomous protection: secures sensitive instruments without needing to know the Sun's exact position.
- High responsiveness: use of gyroscopes to achieve very short response times (under 100 ms).
- Adaptive correction: velocity increment proportional to the need, ensuring smooth and continuous acceleration.
- Control stability: Maintains the satellite's natural rotation.
- Algorithmic safety: Incorporates safety thresholds to prevent calculation errors at near-zero speeds.

Invention synthesis

This invention relates to an attitude control process for Low Earth Orbit (LEO) satellites in "survival mode," a critical phase designed to ensure electrical autonomy following an incident or launcher separation. The primary challenge is that standard control laws can slow the satellite's rotation; if an optical instrument faces the Sun at low speed, it faces a risk of irreversible thermal damage. The invention solves this by monitoring the inertial rotation speed and activating actuators (reaction wheels) to boost the satellite's spin whenever it drops below a predefined threshold. By guaranteeing a minimum rotation speed, the instrument's exposure to solar radiation is kept brief enough to be harmless, ensuring hardware survival without requiring complex sun-pointing algorithms.

Potential applications

- Earth observation satellites: protecting high-resolution cameras and opto-electronic sensors.
- Space telescopes: safeguarding mirrors and sensitive detectors during loss-of-control phases.
- LEO missions: enhancing the safety of compact platforms utilizing magnetorquers.
- Deployment phase: securing instruments after launcher separation before nominal commissioning.



Description of the control system

(100) Attitude control: magnetic torquers commanded to limit variations in the Earth's magnetic field, internal angular momentum commanded along a determined axis.

(200) Measurement of the satellite's inertial rotation speed.

(300) Command of inertial actuators adapted to form internal angular momentum.

Commercial benefits

- Mission risk mitigation: reduces the probability of total loss of instrumentation during safe mode phases.
- Software simplification: eliminates the need for complex survival modes based on sun sensors.
- Increased reliability: extends operational lifespan, prevents thermal shocks.
- Versatility: software solution can be implemented on various satellite without major hardware changes.

Patented invention - under license.

For more information :

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