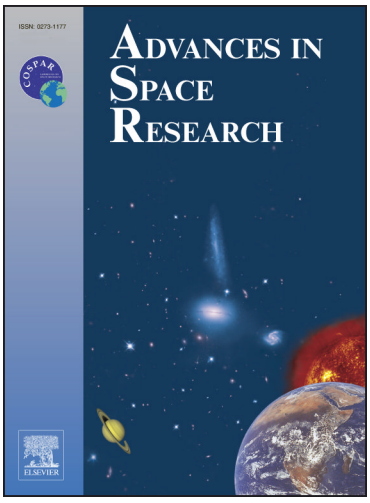

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Real-Time Sensor Fault Detection and Isolation for LEO Satellite Attitude Estimation through Magnetometer Data

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Abstract

Attitude estimation is a critical component of the Attitude Determination and Control System (ADCS) of any satellite. It is used to convert the sensor observation data to an estimated attitude using filtering algorithms. However, in the presence of sensor faults, the ADCS fails to achieve the desired attitude accuracy. In this paper, the Fault Tolerant Extended Kalman Filter (FTEKF) is proposed to handle this imperfection. In accordance, various filtering steps are included in the FTEKF design to enhance both attitude estimation and sensor fault detection. The developed algorithm can detect and isolate any unexpected sensor faults in real time, which provides a reliable attitude estimation. A comparative study with the classical and robust Kalman filters is performed through numerical simulations in order to validate the effectiveness of the adopted filter in case of magnetometer fault data.

Keywords: Satellite; Magnetometer; Fault tolerant extended Kalman filter; Attitude estimation; Sensor fault; Likelihood ratio

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