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IN-ORBIT ESTIMATION OF MAGNETOMETER BIASES AND SCALE FACTORS VIA NONLINEAR TWO-STAGE KALMAN FILTER

Abstract

The scale factor and bias of the magnetometer must be determined in order to appropriately estimate satellite dynamics and control orientation. The magnetometer scale factor and bias are not constant due to temperature variation and thermal distortion of the structure, which causes a relatively large magnitude error, and these effects must be eliminated to meet the requirements of the mission. This study proposes a method based on a nonlinear two-stage Kalman filter for in-orbit calibration of a magnetometer. The magnetometer bias and scale factor error are combined to form the equivalent non-steady bias noise, which is removed from the magnetometer measurements as bias noise. Each iteration of the estimation process has two stages: the first stage uses the Kalman filter to estimate equivalent magnetometer biases as well as three state parameters; the second stage uses a newly suggested modification to the Kalman filter to estimate three scale factors.