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NANOSATELLITE ATTITUDE ESTIMATION WITH UNCERTAIN PROCESS AND MEASUREMENT NOISE USING NONTRADITIONAL FILTERING

Abstract

The Extended Kalman Filter (EKF) and Singular Value Decomposition (SVD) methods are integrated in the nontraditional attitude filtering algorithm to estimate a nanosatellite's attitude. The SVD approach determines the attitude of the nanosatellite and provides one estimate at a single frame utilizing measurements from the magnetometer and Sun sensor. These attitude terms are subsequently fed into the EKF with their error covariances, which makes the filter robust to measurement noise change. The Q (process noise covariance) adaption approach with multiple scale factors is suggested. This study shows that, the process noise bias and process noise increment type system changes will change the statistics of the EKF innovation. The theoretical basics of the Q-adaptive SVD-aided EKF with uncertain process noise mean and covariance are developed. Simulations are compared using the adaptive and non-adaptive versions of the nontraditional attitude filter in the presence of uncertain process and measurement noise.