

Fuzzy Strong Tracking Unscented Kalman Filter Design for Integrated Navigation

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ABSTRACT

A navigation integration processing scheme, called the strong tracking unscented Kalman filter (STUKF), is based on the combination of unscented Kalman filter (UKF) and strong tracking filter (STF). The UKF employs a set of sigma points by deterministic sampling, such that the linearization process is not necessary, and therefore the error caused by linearization as in the traditional extended Kalman filter (EKF) can be avoided. As a type of adaptive filter, the STF is essentially a nonlinear smoother algorithm that employs suboptimal multiple fading factors, in which the softening factors are involved. In order to resolve the shortcoming in traditional approach for selecting the softening factor through personal experience or computer simulation, a novel scheme called the fuzzy strong tracking unscented Kalman filter (FSTUKF) is presented where the Fuzzy Logic Adaptive System (FLAS) is incorporated for determining the softening factor. The proposed FSTUKF algorithm shows promising results in estimation accuracy when applied to the integrated navigation system design, as compared to the EKF, UKF and STUKF approaches.

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