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THE APPLICATION OF UPF ALGORITHM IN THE GPS/INS INTEGRATED NAVIGATION

Abstract

On the state estimate of the system, the Extended Kalman Filter algorithm is conventionally adopted to improve the estimation accuracy, which is valid when the system is linear. However, applying this algorithm may result in estimation error and even leads to filter divergence because of linearization in the filtering process when the system is nonlinear. As the GPS/INS integrated navigation system is nonlinear, estimation error is inevitably introduced when the Extended Kalman Filter is employed in this system. Another fact that affects the filtering result is the noise model. The precondition of employing the Extended Kalman Filter is to assume that the noise model is Gaussian distribution, but the noise model in GPS/INS integrated navigation system is uncertain, which also produces estimation error and may result in filter divergence. Both the estimation error and filter divergence decrease the navigation accuracy. The Unscented Particle Filter is introduced to estimate the system state in this paper. This algorithm is based on Particle Filter and Unscented Kalman Filter, which makes use of the Particle Filter's applicability in non-Gaussian systems and the Unscented Kalman Filter's applicability in nonlinear systems, so theoretically the Unscented Particle Filter algorithm can produce more precise estimated results in the state estimate. To validate the Unscented Particle Filter algorithm's availability in navigation system, the simulation results of the Filter algorithm in GPS/INS integrated navigation system is given in this paper which shows that the estimation error the Unscented Particle Filter produced is much less than the Extended Kalman Filter algorithm, and therefore the navigation precision is obviously improved.