

控制理论与实践

基于UKF的新型北斗/SINS组合系统 直接法卡尔曼滤波

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摘要:

针对传统的间接法卡尔曼滤波在北斗/捷联惯导(serial inertial navigation system, SINS)组合导航系统中无法实现较高的定位精度且计算的冗余度大的缺点, 提出一种基于无迹卡尔曼滤波(unscented Kalman filter, UKF)的新型组合系统滤波算法。本算法以SINS输出的导航参数及平台误差角等作为系统状态, 无源北斗输出的位置速度参数作为量测, 采用改进的UKF方法进行数据融合, 并直接计算组合系统导航参数的最优估计。实验结果表明, 新算法可以降低对伪距误差模型的精确度要求, 同时避免非线性系统状态方程的线性化, 简化滤波参数的调整过程, 从而有效地缩短组合导航系统的解算时间, 提高定位精度。

关键词: 惯导系统 北斗/捷联惯导组合导航系统 扩展卡尔曼滤波 无迹卡尔曼滤波 平台误差角

Improved Kalman filtering algorithm for passive BD/SINS integrated navigation system based on UKF

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Abstract:

A passive BD/serial inertial navigation system (SINS) integrated navigation system using traditional indirect Kalman filtering method can not achieve the high positioning accuracy and costs too much calculating time. An improved filtering algorithm based on unscented Kalman filter (UKF) is proposed after comparing the advantages and disadvantages of the traditional direct filtering method, the extended Kalman filtering (EKF) method and UKF. Navigation parameters from SINS and platform error angles are chosen as the state of the system, and navigation parameters from passive BD are chosen as measurements. The final optimal estimations of navigation parameters including position and speed can be calculated directly. The experimental result indicates that the new algorithm requires no accurate error models and can effectively solve the nonlinearity problem of state equations. Besides, it can also simplify the adjustment process of filtering parameters to reduce the total calculating time. Comparing to prevalent filtering algorithms, this new one can obtain more accurate positioning result and is significantly important to the further study of the filtering algorithm for passive BD/SINS integrated navigation system.

Keywords: inertia system BD/SINS integrated navigation system extended Kalman filter (EKF) unscented Kalman filter (UKF) platform error angles

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