

控制理论与实践

FLAKF在无陀螺惯性测量组合中的应用

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摘要:

在无陀螺惯性测量组合 (non gyro inertial measurement unit, NGIMU) 导航计算中, 由于加速度计输出动态噪声的存在, 造成误差随时间迅速累积。采用传统卡尔曼滤波方法进行NGIMU/GPS组合导航系统设计时, 又由于观测噪声的复杂性, 造成滤波结果不明显。针对上述噪声统计特性不易确定的问题, 基于NGIMU九加速度计配置方案, 提出利用模糊逻辑自适应卡尔曼滤波(fuzzy logic adaptive Kalman filter, FLAKF)方法进行NGIMU/GPS组合导航系统设计。该FLAKF方法通过对噪声方差进行修正, 将卡尔曼滤波器调整到最优状态。同时进行了系统位移、速度、角速度仿真, 仿真结果验证了FLAKF方法的可行性。

关键词: 惯性导航 无陀螺 NGIMU/GPS 模糊逻辑自适应卡尔曼滤波器

Application of fuzzy logic adaptive Kalman filter in NGIMU/GPS integrated navigation

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Abstract:

In a non gyro inertial measurement unit (NGIMU) system, an inevitable accumulation error of navigation parameters is produced due to the dynamic noise of the accelerometer output. During designing an integrated navigation system, which is based on a nine configuration NGIMU and a single antenna global positioning system (GPS) by using the conventional Kalman filter (CKF), the filtering results are divergent because of the complicity of the system measurement noise. So a fuzzy logic adaptive Kalman filter (FLAKF) is applied in the design of the NGIMU/GPS. The FLAKF optimizes the Kalman filter by modifying the noise covariance. A simulation case for estimating the position, velocity and angle rate is investigated with this approach. Results verify the feasibility of the FLAKF.

Keywords: inertial navigation non gyro NGIMU/GPS fuzzy logic adaptive Kalman filter

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