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稳定平台中陀螺漂移自适应实时估计算法

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Adaptive Real-time Estimation Algorithm for Gyro-stabilized Platform Drift

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摘要 针对陀螺稳定平台的漂移问题,建立了陀螺稳定跟踪装置在不同工作模式下陀螺漂移的数学模型,指出稳定模式下包含常值漂移和相关漂移的陀螺低频噪声是影响稳定精度的主要原因。提出一种自适应实时估计算法,采用卡尔曼滤波框架和滤波器收敛判据,结合Sage-Husa滤波和加权Sage-Husa滤波算法,利用跟踪器跟踪静止目标时输出的脱靶量信号对陀螺常值漂移和相关漂移进行估计。实验结果表明:该算法能够在系统模型和噪声特性均不准确的情况下使用,收敛时间小于3 s,估计均方差小于0.02 (°)/s,具有良好的鲁棒性和自适应能力。

关键词: 陀螺稳定平台　陀螺漂移　卡尔曼滤波　Sage-Husa滤波　自适应滤波

Abstract: An adaptive real-time estimate algorithm is proposed to address the problem of gyro-stabilized platform drift. First, the major work mode of the gyro-stabilized and tracking equipment is analyzed. Then, a gyro drift model under the stabilization mode and the track mode is established, which indicates that the gyro low frequency noise composed of the constant bias and related bias is the main cause of stabilization error. The algorithm adopts the Kalman filter framework and employs filter convergence criterion combining Sage-Husa filter and weighted Sage-Husa filter to estimate the constant and related drifts of gyros. Experiment results show that the convergence time is less than 3 s and the estimation standard deviation is less than 0.02 (?)/s under the condition of non-exact system model and noise characteristics, which demonstrates the robustness and adaptive ability of the algorithm.

Keywords: gyro-stabilized platform　gyro drift　Kalman filter　Sage-Husa filter　adaptive filter

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