自适应混合滤波算法在微型飞行器姿态估计中的应用

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基金项目：国家自然科学基金

摘　要：

针对低成本惯性测量单元（IMU）存在漂移和噪声干扰等问题，本文提出了一种具有自适应参数调节的混合滤波算法。采用四元数法进行系统模型的描述，用梯度下降法对加速度计测得的数据进行处理，再通过互补滤波器将其与陀螺仪测量值进行融合，形成混合滤波算法。同时，考虑到飞行姿态的复杂性，进行参数 的自适应调节，因而改进后的混合滤波算法，能保证各种飞行姿态变化情况下实时姿态的最优估算。实际系统在线实时性能测试表明，本文提出的算法简单，估计精度高，易于在嵌入式系统中实现，具有较高推广应用价值。

关键词：姿态估计；四元数；梯度下降法；互补滤波；自适应混合滤波算法

Application of adaptive hybrid filter algorithm in the estimation of the micro air vehicle attitude

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Abstract:

Concerning the low cost inertial measurement unit drift and noise interference, a hybrid filtering algorithm with adaptive adjustment of parameters was proposed in this paper. With the quaternion for describing the attitudes, the accelerometer data is processed using gradient descent algorithm. And then the results are fused with Gyro measurements through the complementary filter, which is called the mixed filter algorithm. At the same time, considering the complexity of flight attitude, the parameters can be adaptively adjusted. So the improved hybrid filter algorithm can guarantee the real time optimal attitude estimation for various flight attitudes. The actual performance of the real-time system online show that, the propsed algorithm is simple, has high estimation accuracy, and is suitable for implementation on embedded hardware, so it has high application value.

Keywords: Attitude estimation; Quaternion; Gradient descent algorithm; Complementary filter; Adaptive hybrid filter algorithm

投稿时间：**2014-02-18**

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