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论文

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非线性滤波方法及其在飞行状态及参数估计中的应用

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A NEW NONLINEAR FILTER AND ITS APPLICATION TO FLIGHT STATE AND PARAMETER ESTIMATION OF AIRCRAFT

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摘要

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摘要 基于非线性系统高阶近似的思想,提出一种比推广卡尔曼滤波(EKF)更接近非线性系统本质的近似滤波方法,并应用于飞行状态的参数估计(或称为飞行轨迹重构)问题。仿真和实际飞行数据计算结果表明:提出的非线性近似滤波方法比EKF有更高的估计精度和更好的鲁棒性,对飞机机动形状、数据长度要求不高,滤波收敛速度快。利用飞行状态估计数学模型的具体特点,使计算量和存储量大幅度减少。该方法应用于非线性较强的飞行状态及参数估计问题。可得到比EKF更好的结果。

关键词: 非线性滤波近似 卡尔曼滤波器 飞行条件 参数辨识 飞行试验

Abstract: new nonlinear approximate conditional mean filter is presented and applied to the flight state and parameter estimation of aircraft. The results of simulated and actual flight test data computations show that the new filter proposed here can give much more accurate estimates of flight state than extended Kalman filter(EKF) for different initial values and noise statistics. Moreover, the new method has fewer requirements for the maneuvering shapes, noise levels, data length and better convergency than that of EKF. The computational and storage requirements for one-step filtering updates of the new filter have been reduced greatly by exploiting some special features of system and measurement models and this makes it possible for the nonlinear filtering algorithm to be on-line realized on IBM-personal computer. It is proved that the new filter will be suitable for state and parameter of flight region at high angles of attack and can give good results even for low sample rate flight test data.

Keywords: nonlinear filters-approximation Kalman filters flight conditions-parameter identification flight tests

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