

[2009-0420] 基于极大后验估计和指数加权的自适应UKF滤波算法

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摘要

针对传统Unscented卡尔曼滤波器(UKF)在噪声先验统计未知时变情况下非线性滤波精度下降甚至发散的问题,

设计了一种带噪声统计估计器的自适应UKF滤波算法.

首先根据极大后验(MAP)估计原理,

推导出一种次优无偏MAP常值噪声统计估计器;接着在此基础上,

采用指数加权的方法,给出了时变噪声统计估计器的递推公式;

最后对自适应UKF算法进行了性能分析.相比于传统UKF,

该自适应UKF算法在噪声统计未知时变情况下不仅滤波依然收敛,

滤波精度及稳定性显著提高,而且其具有应对噪声变化的自适应能力.

仿真实例验证了其有效性.

关键词 [非线性](#) [自适应UKF滤波算法](#) [常值噪声统计估计器](#) [时变噪声统计估计器](#) [极大后验估计](#) [指数加权](#)

分类号

[2009-0420] Adaptive UKF Filtering Algorithm Based on Maximum a Posterior Estimation and Exponential Weighting

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Abstract

An adaptive unscented Kalman filtering (UKF) algorithm with noise statistic estimator is designed to solve the problem that the conventional UKF declines in accuracy and further diverges when the prior noise statistic is unknown and time-varying. Firstly, a constant noise statistic estimator which is suboptimal and unbiased is deduced based on maximum a posterior (MAP) estimation. Then, the recursive equations of time-varying noise statistic estimator are given through exponential weighting of the constant noise statistic estimator. Finally, performance analysis of the adaptive UKF algorithm is done. Under the condition of unknown and time-varying noise statistic, the proposed adaptive UKF algorithm still converges, moreover its filtering precision and stability are better than those of the conventional UKF. And an adaptive capability to deal with variable noise statistic is performed by the presented UKF. The simulation examples show its effectiveness.

Key words [nonlinear](#) [adaptive UKF filtering algorithm](#) [constant noise statistic estimator](#) [time-varying noise statistic estimator](#) [maximum a posterior estimation](#) [weighting](#)

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