

论文与报告

基于极大后验估计和指数加权的自适应UKF滤波算法

赵琳, 王小旭, 孙明, 丁继成, 闫超

1. 哈尔滨工程大学自动化学院 哈尔滨 150001

收稿日期 2009-5-31 修回日期 2009-10-30 网络版发布日期 接受日期

摘要

针对传统Unscented卡尔曼滤波器(Unscented Kalman filter, 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(Maximum a posterior, 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

Adaptive UKF Filtering Algorithm Based on Maximum a Posterior Estimation and Exponential Weighting

ZHAO Lin, WANG Xiao-Xu, SUN Ming, DING Ji-Cheng, YAN Chao

1. College of Automation, Harbin Engineering University, Harbin 150001

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 unscented Kalman filtering \(UKF\) algorithm](#) [constant noise statistic estimator](#) [time-varying noise statistic estimator](#) [maximum a posterior \(MAP\) estimation](#) [exponential weighting](#)

DOI: 10.3724/SP.J.1004.2010.01007

通讯作者 王小旭 woyaofly1982@163.com

作者个人主页 赵琳; 王小旭; 孙明; 丁继成; 闫超

扩展功能

本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(1288KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献\[PDF\]](#)
- ▶ [参考文献](#)

服务与反馈

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [复制索引](#)

▶ [Email Alert](#)

相关信息

- ▶ [本刊中 包含“非线性”的 相关文章](#)
- ▶ 本文作者相关文章

- [赵琳](#)
- [王小旭](#)
- [孙明](#)
- [丁继成](#)
- [闫超](#)