

算法研究

基于后向平滑容积卡尔曼滤波的单站无源定位算法

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摘要:

单站无源定位跟踪是一个典型的非线性滤波问题, 由于测量精度不高、初始误差较大等原因容易导致滤波算法定位精度低、收敛速度慢。本文将一种新型的滤波算法——容积卡尔曼滤波(cubature Kalman filter, CKF)应用于单站无源定位领域, 并将后向平滑滤波思想与CKF算法相结合, 提出了一种后向平滑容积卡尔曼滤波算法(backward-smoothing CKF, BSCKF)。该算法使用容积数值积分原则直接计算非线性随机函数的均值和方差, 并采用后向平滑值进行递归滤波, 具有更优非线性估计性能。仿真实验表明, 与EKF、UKF和CKF算法相比, BSCKF算法定位精度更高、收敛速度更快。

关键词: 单站无源定位跟踪; 滤波算法; 容积原则; 后向平滑; 容积卡尔曼滤波

A Single Observer Passive Location Algorithm Based on Backward-Smoothing Cubature Kalman Filter

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Abstract:

Single observer passive location and tracking is a typical nonlinear filtering problem, while it may have low precision estimation and slow convergence speed for the sake of low measurement precision and great initial error etc. A new filtering algorithm——cubature Kalman filter (CKF) is applied to single observer passive location and tracking in this paper, and a backward-smoothing CKF (BSCKF) is proposed, which combines backward-smoothing with the cubature Kalman filter. In the BSCKF algorithm which is of better nonlinear approximation properties, the cubature rule based numerical integration method is directly used to calculate the mean and covariance of the nonlinear random function and backward-smoothing result is used to the recursive filtering. Computer simulation shows that the locating performance of the BSCKF is apparently better than that of EKF, UKF and CKF, which has higher convergence precision and faster convergence speed.

Keywords: single observer passive location and tracking; filtering algorithm; cubature rule; backward smoothing; cubature Kalman filter

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