

一种优化高斯粒子滤波的载波频偏估计算法

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摘要: 针对单载波频域均衡系统中载波频偏估计问题, 建立非线性状态空间模型, 提出 Unscented 高斯粒子滤波(UGPF)频偏估计算法. 在时间更新中, 利用高斯粒子滤波(GPF)对待估状态变量的状态后验及预测概率分布进行高斯近似, 压缩重采样处理环节, 能有效缓解粒子退化对滤波性能影响; 量测更新中, 引入 Unscented 卡尔曼构造重要密度函数, 融合最新观测值对粒子样本进行修正, 优化滤波算法性能. 仿真结果表明, 该算法较最大似然(ML)、标准粒子滤波(SPF)及高斯粒子滤波算法具有更高的估计精度与更快的收敛速度, 在非高斯噪声条件下仍具有较好的频偏跟踪性能.

关键词: 高斯粒子滤波; 免重采样; 重要密度函数; Unscented 卡尔曼滤波; 频偏估计

Carrier frequency Offset Estimation Algorithm Based on Improved Gaussian Particle Filtering

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Abstract: To improve the performance of carrier frequency offset estimation in SC-FDE system, a nonlinear state space model is built and a new algorithm based on Unscented Gaussian particle filtering(UGPF) is proposed. In the time update step, the algorithm approximates the filtering and predictive densities of the state variables by Gaussian distributions in a PF framework, which make the substituted distribution approximating the true posterior distribution more accurately. The UKF is introduced into the algorithm to use the latest observation for particle samples modification in the measurement update step, which avoids the particle impoverishment problem because the resampling process is not need. Simulation results are presented to corroborate that compared with the existing approaches based on ML, SPF and GPF, the new algorithm not only improves the estimation accuracy and convergence speed, but also has a good performance in non-Gaussian noise environment.

Key words: gaussian particle filter; un-resampling process; importance density function; unscented kalman filter; frequency offset estimation

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