

算法研究

基于阵列单通道的机动目标DOA跟踪方法

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摘要:

针对现有利用阵列单通道系统对机动目标跟踪精度不高,实时性差等不足,提出了一种新的基于改进粒子滤波算法的阵列单通道机动目标波达方向(direction of arrival, DOA)跟踪方法。该方法首先在利用接收机轮流采样建立数学模型的基础上,建立跟踪模型。然后,利用粒子群优化算法对马尔科夫链蒙特卡罗(Markov Chain Monte Carlo, MCMC)粒子滤波算法的重采样环节进行优化处理,给出了一种交互MCMC粒子滤波算法,该算法克服了传统粒子滤波算法粒子退化及样本贫化的固有缺陷。最后利用该算法求解跟踪方程,实现了实时DOA估计。理论分析与仿真结果表明,本文方法可实现基于阵列单通道的DOA跟踪与波束形成一体化,且能够处理相干信号,与标准粒子滤波和子空间类算法相比,收敛速度快,跟踪精度高。

关键词: 阵列信号处理; 波达方向跟踪; 阵列单通道; 粒子滤波; 粒子群算法

DOA tracking of maneuvering target based on single channel array

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Abstract:

The traditional maneuvering target tracking with single channel array system has low precision and bad real-time performance. In order to address these problems, a new method of maneuvering target direction of arrival (DOA) tracking for single channel array system is proposed in this paper. Firstly, we established a new frequency domain spatial-spectrum estimation modeling via controlling receive channel by radio frequency shift, this model only requires the array outputs to be sampled one at a time by a single receive channel. Based on this model, we build the tracking modeling. Then, by introducing particle swarm optimization algorithm into resample-move of Markov Chain Monte Carlo (MCMC) particle filter, we proposed Interacting Markov Chain Monte Carlo particle filter(PF) algorithm which can deal with both particle degeneration problem and sample impoverishment. Finally the time varying direction of arrival is estimated on time based on this algorithm. Theoretics analyse and simulation results show that method presented in this paper can realize joint direction of arrival tracking and beamforming for single channel array system. Besides, it can deal with coherent signals. Compared to Markov Chain Monte Carlo particle filter and subspace tracking methods, the proposed method in this paper has higher precision and speed of convergence.

Keywords: array signal processing; direction of arrival tracking; single channel array; particle filter; particle swarm algorithm

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