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冲击杂波下的MIMO雷达DOA估计方法

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DOA Estimation in Impulsive Clutter for MIMO Radars

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摘要

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摘要 研究了对称 α 稳定分布(S α S)冲击杂波下的多输入多输出(MIMO)雷达目标波达方向(DOA)估计问题,分别提出基于分数低阶最小方差无畸变响应(FrMVDR)的MIMO雷达DOA估计算法和无穷范数归一化最小方差无畸变响应(Inf-MVDR)算法。FrMVDR算法,首先进行冲击杂波特征指数的估计,然后使MIMO雷达接收阵列的分数低阶输出功率最小,实现MIMO雷达的DOA估计。为了避免FrMVDR算法对杂波特征指数估计,提出Inf-MVDR算法,首先用无穷范数对接收信号进行归一化处理,使归一化后的阵列输出功率有界,继而采用传统MVDR算法进行DOA估计。计算机仿真验证了上述两种算法的有效性;同时仿真结果还表明在冲击杂波下,MIMO雷达的空间分集特性可显著提高DOA估计的精度。

关键词: 冲击杂波 MIMO雷达 波达方向估计 分数低阶统计量 无穷范数归一化

Abstract: This article investigates the issue of direction of arrival (DOA) estimation for multi-input multi-output (MIMO) radar in symmetric α stable (SaS) clutter. Two algorithms are proposed, i.e., a fractional lower order minimum variance distortionless response (FrMVDR) DOA estimation algorithm and an infinity-norm normalization MVDR (Inf-MVDR) DOA estimation algorithm. For the FrMVDR algorithm, the characteristic exponent value of the SaS clutter is first estimated, and then the fractional lower order output power of MIMO radar is minimized to realize DOA estimation. To avoid characteristic exponent estimation, another Inf-MVDR algorithm is developed, which first transforms the SaS clutter into a clutter with bounded output power through infinity-norm normalization, then uses the conventional MVDR algorithm to estimate DOA. Computer simulations verify the effectiveness of the two proposed algorithms. The results also show that spatial diversity of MIMO radar can significantly improve the precision of DOA estimation in impulsive clutter.

Keywords: impulsive clutter MIMO radar direction of arrival estimation fractional lower order statistics infinity-norm normalization

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