

论文与技术报告

基于四阶混合累积量的CP-GTD模型参数估计方法

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摘要:

二维相干极化GTD (CP-GTD) 模型能够精确描述高频区雷达目标的电磁散射机理。基于此模型, 针对二维ESPRIT方法在色噪声情况下估计精度不高的问题, 提出了一种新的二维散射中心参数估计方法。根据二维四阶混合累积量的特点和性质, 用其代替观测数据实现色噪声背景下二维CP-GTD模型的位置参数估计, 然后通过MUSIC谱峰搜索方法估计散射中心的类型参数, 通过最小二乘法估计散射中心的相干极化散射矩阵。该方法能够实现全极化雷达目标的超分辨成像和二维CP-GTD模型参数的正确估计, 与现有的二维MUSIC和二维ESPRIT方法相比, 改善了估计性能, 对色噪声具有较强的稳健性, 同时克服了在长观测样本情况下计算量过大的缺陷。仿真和暗室测量数据实验验证了上述结论的正确性。

关键词: 相干极化GTD模型; 参数估计; 四阶混合累积量; 色噪声

Parameter estimation method of CP-GTD model based on FOMC

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Abstract:

The electromagnetic scattering mechanism of radar target in high frequency domain can be characterized exactly by the two-dimensional (2D) coherent polarization GTD (CP-GTD) model. Considering the problem of 2D-ESPRIT method that has low estimation precision under the circo of colored noises, a new scattering center parameter estimation algorithm for CP-GTD model based on 2D fourth-order mixed cumulants (FOMC) is proposed, named as 2D-FOMCESPRIT. In light of the characteristics of 2D FOMC, the measured data's FOMC is used to estimate position parameters firstly, then the scattering types and polarimetric scattering matrices are estimated via MUSIC spectrum peak search method and the least square method respectively. The proposed method can realize super-resolution imaging of fully polarized radar target and accurate parameter estimation of 2D CP-GTD model. Compared with existing 2D-MUSIC and 2D-ESPRIT method, 2D-FOMCESPRIT algorithm provides great improvement on the estimation performance, possesses more robustness under the condition of colored noises and better computation efficiency with respect to large measured data. Experimental results from simulated data and real data verify the validity of above conclusions.

Keywords: Coherent polarization GTD model Parameter estimation Fourth order mixed cumulants Colored noise

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