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短文与研究通讯

低信噪比下周期平稳信号的稳健检测算法

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摘要：

本文提出了一种新的对周期平稳信号进行检测以及对二阶周期循环频率进行估计的算法。该算法利用信号的递归性质构造高阶自相关矩阵，并通过利用周期平稳信号与自相关矩阵特征值和特征向量的关系，对其进行检测以及对循环频率进行估计。传统检测周期平稳信号的算法是通过计算其循环自相关函数或循环谱实现，相比传统算法而言，本算法由于利用到了信号更多的先验信息，因而在较低信噪比以及较低快拍数下对周期平稳信号均能有较好的检测性能。文中仿真实验表明，本文所提算法估计出的伪循环谱相比传统方法估计出的循环谱更为平滑，在相同快拍和信噪比条件下，检测概率均高于传统方法，特别在低信噪比下对检测概率的改善更为明显。

关键词： 信号检测；周期平稳；循环频率

Robust cyclostationary signal detection algorithm under low SNR

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Abstract:

This paper proposes a new method to detect cyclostationary signal and estimate cyclic frequency. The proposed method exploits cyclostationary signal's recursive property to construct fourth-order autocorrelation matrix, and uses the relationship between the matrix's eigenvector and eigenvalue to achieve signal detection and cyclic frequency estimation. Classical methods realize the detection of cyclostationary signal through the estimation of cyclic autocorrelation function or cyclic spectrum. Compared with the classical methods, the proposed method exploits more prior information of cyclostationary signal, so it has a better performance of detection under low signal to noise ratio and low snapshots. The simulation results demonstrate that the pseudo cycle spectrum estimated by the proposed method is smoother than the cycle spectrum estimated by classical method, and under the same signal to noise ratio and snapshots, its detection probability of cyclostationary signal is always higher than classical method, the improvement is more obvious under low signal to noise ratio.

Keywords: Signal detection cyclostationary cyclic frequency

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