

航天电子技术

基于空时频分析的多分量跳频信号DOA估计

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摘要:

提出了一种基于空时频分析的多跳频信号波达方向(direction of arrival, DOA)估计方法。该方法能够在欠定条件下(传感器数目小于信号数目)实现多个信号的测向。首先将信号的短时傅里叶变换(short time Fourier transform, STFT)与平滑伪魏格纳-威利分布(smoothed pseudo Wigner-Ville distribution, SPWVD)组合, 利用STFT的无交叉项和SPWVD的时频聚焦性性能, 得到了一种切实可行、时频图清晰稳健的分布; 然后在时频域提取有效跳(hop), 并建立该hop的空时频矩阵, 最后分别运用线性空时频、二次空时频和root-MUSIC共三种方法估计每hop信号的DOA。仿真结果验证了方法的有效性。

关键词: 跳频 空时频分析 时频聚焦性 交叉项干扰 DOA估计

Directions of arrival estimation for multicomponent frequency-hopping signals based on spatial time-frequency analysis

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Abstract:

An algorithm of directions of arrival estimation for multicomponent frequency-hopping signals based on spatial time-frequency analysis is proposed, which can realize direction-of-arrival (DOA) estimation in underdetermined condition. First, a clear time-frequency representation is gained by short-time-Fourier-transform (STFT) and smoothed-pseudo-Wigner-Ville distribution (SPWVD) synthesis method, which can obtain robust results with good time-frequency concentration and suppression cross-term interference performance. Then, effective hops are selected from the time-frequency distribution, and every hop's spatial time-frequency matrix is built. Finally, every hop's DOA is estimated by three methods: linear spatial time-frequency method, bilinear spatial time-frequency method, and root-MUSIC. The simulation results demonstrate that the estimation algorithm is effective.

Keywords: frequency-hopping (FH) spatial time-frequency analysis time-frequency concentration-cross-term interference DOA estimation

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