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超高斯加载的稳健自适应波束形成及性能分析

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Robust Adaptive Beamforming Based on Super-Gaussian Loading and Its Performance Analysis

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摘要 该文提出了一种超高斯加载的稳健自适应波束形成方法，解决由于导向矢量和样本方差矩阵失配误差所导致的波束形成器性能下降的问题，利用p-范数来对两种误差不确定性进行总体修正，克服了2-范数不能同时兼顾两者实现最优修正的缺点。采用遗传算法求得最优范数p，验证了在不同实验设置下，当使用最优范数时，都比2-范数约束具有更好的性能。超高斯加载方法把复杂的不确定性建模问题转化为范数p的寻优问题，从而获得比对角加载方法更优异的性能。

关键词： 自适应波束形成　对角加载　超高斯加载　凸优化　遗传算法　l_p范数

Abstract： In order to solve the problem of beamformer's performance degradation caused by signal steering vector and sample covariance matrix mismatch errors, a robust adaptive beamforming algorithm based on Super-Gaussian Loading (SGL) is put forward in this paper. By correcting these two error uncertainties together through l_p norm, the proposed algorithm overcomes the drawback in l_2 norm issue that cannot optimally calibrate the two errors at the same time. The optimalis obtained through genetic algorithm, and the better output performance can be got comparing with l_p norm approach in different experiment conditions. The Super-Gaussian Loading algorithm transforms the complex modeling for two uncertainties into norm p optimization problem, and thus gets better result than standard diagonal loading method.

Keywords： Adaptive beamforming　Diagonal loading　Super-Gaussian Loading (SGL)　Convex programming　Genetic algorithm　l_p norm

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