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Robust Adaptive Beamforming Via a Novel Subspace Method for Interference Covariance Matrix Reconstruction

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Abstract

In this paper, a novel subspace method is proposed to reconstruct the interference-plus-noise covariance matrix (IPNCM) according to its definition, which can fundamentally eliminate the signal of interest (SOI) component from the sample covariance matrix (SCM). The central ideal is that each interference steering vector (SV) is estimated by the vector lying within the intersection of two subspaces while its power obtained by using the Capon spectral estimator. The first subspace is the interference subspace and it is obtained from each interference covariance matrix term calculated by integrating over each interference angular sector. The second one is the signal-interference subspace got from the SCM. Then a more precise IPNCM is reconstructed based on these accurate estimations. Meanwhile the signal covariance matrix is calculated by integrating over the SOI angular sector so that a new SV estimation of SOI can be obtained from its prime eigenvector. Finally, based on the new IPNCM and the SV of SOI, a novel robust beamformer is formulated to improve the robustness against array model mismatches. Simulation results demonstrate that the proposed beamformer outperforms other existing reconstruction-based beamformers and almost attains the optimal performance in both low and high input signal-to-noise ratio (SNR) cases.

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