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# Robust Processing of Antenna Array Signals under Local Scattering Environments

**Authors :** Ju-Hong Lee, Ching-Wei Liao

**Abstract :** An adaptive array beamformer is designed for automatically preserving the desired signals while cancelling interference and noise. Providing robustness against model mismatches and tracking possible environment changes calls for robust adaptive beamforming techniques. The design criterion yields the well-known generalized sidelobe canceller (GSC) beamformer. In practice, the knowledge of the desired steering vector can be imprecise, which often occurs due to estimation errors in the DOA of the desired signal or imperfect array calibration. In these situations, the SOI is considered as interference, and the performance of the GSC beamformer is known to degrade. This undesired behavior results in a reduction of the array output signal-to-interference plus-noise-ratio (SINR). Therefore, it is worth developing robust techniques to deal with the problem due to local scattering environments. As to the implementation of adaptive beamforming, the required computational complexity is enormous when the array beamformer is equipped with massive antenna array sensors. To alleviate this difficulty, a generalized sidelobe canceller (GSC) with partially adaptivity for less adaptive degrees of freedom and faster adaptive response has been proposed in the literature. Unfortunately, it has been shown that the conventional GSC-based adaptive beamformers are usually very sensitive to the mismatch problems due to local scattering situations. In this paper, we present an effective GSC-based beamformer against the mismatch problems mentioned above. The proposed GSC-based array beamformer adaptively estimates the actual direction of the desired signal by using the presumed steering vector and the received array data snapshots. We utilize the predefined steering vector and a presumed angle tolerance range to carry out the required estimation for obtaining an appropriate steering vector. A matrix associated with the direction vector of signal sources is first created. Then projection matrices related to the matrix are generated and are utilized to iteratively estimate the actual direction vector of the desired signal. As a result, the quiescent weight vector and the required signal blocking matrix required for performing adaptive beamforming can be easily found. By utilizing the proposed GSC-based beamformer, we find that the performance degradation due to the considered local scattering environments can be effectively mitigated. To further enhance the beamforming performance, a signal subspace projection matrix is also introduced into the proposed GSC-based beamformer. Several computer simulation examples show that the proposed GSC-based beamformer outperforms the existing robust techniques.

**Keywords :** adaptive antenna beamforming, local scattering, signal blocking, steering mismatch
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