Robust adaptive beamforming based on the direct biconvex optimization modeling

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Research

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Abstract

It is well known that the performance of the minimum variance distortionless response beamformer is sensitive to steering vector mismatch, which motivates the development of robust adaptive beamforming(RAB). However, robust adaptive beamforming (RAB) is usually modeled as a nonconvex optimization problem. The most state-of-art methods solve it indirectly by approximating the nonconvex problem to the convex optimization problem, which causes the approximation errors and performance degradation. To circumvent this problem, a novel method that is against the mismatch of the signal look direction errors, which reformulates RAB as the biconvex form directly, is proposed. This method imposes ideal response constraints to guarantee the gain of the angular region in which the actual signal lies and suppresses the signals in the remaining region, and constructs a four-order problem. Then, an auxiliary variable is introduced to reformulate it as a biconvex problem without approximation process, which can be efficiently solved iteratively by the alternating direction method of multipliers (ADMM) algorithm. Simulation results show that the proposed method can obtain a better performance on the signal-to-interference-plus-noise (SINR) and flexible control of error range.

Full Text

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Figures

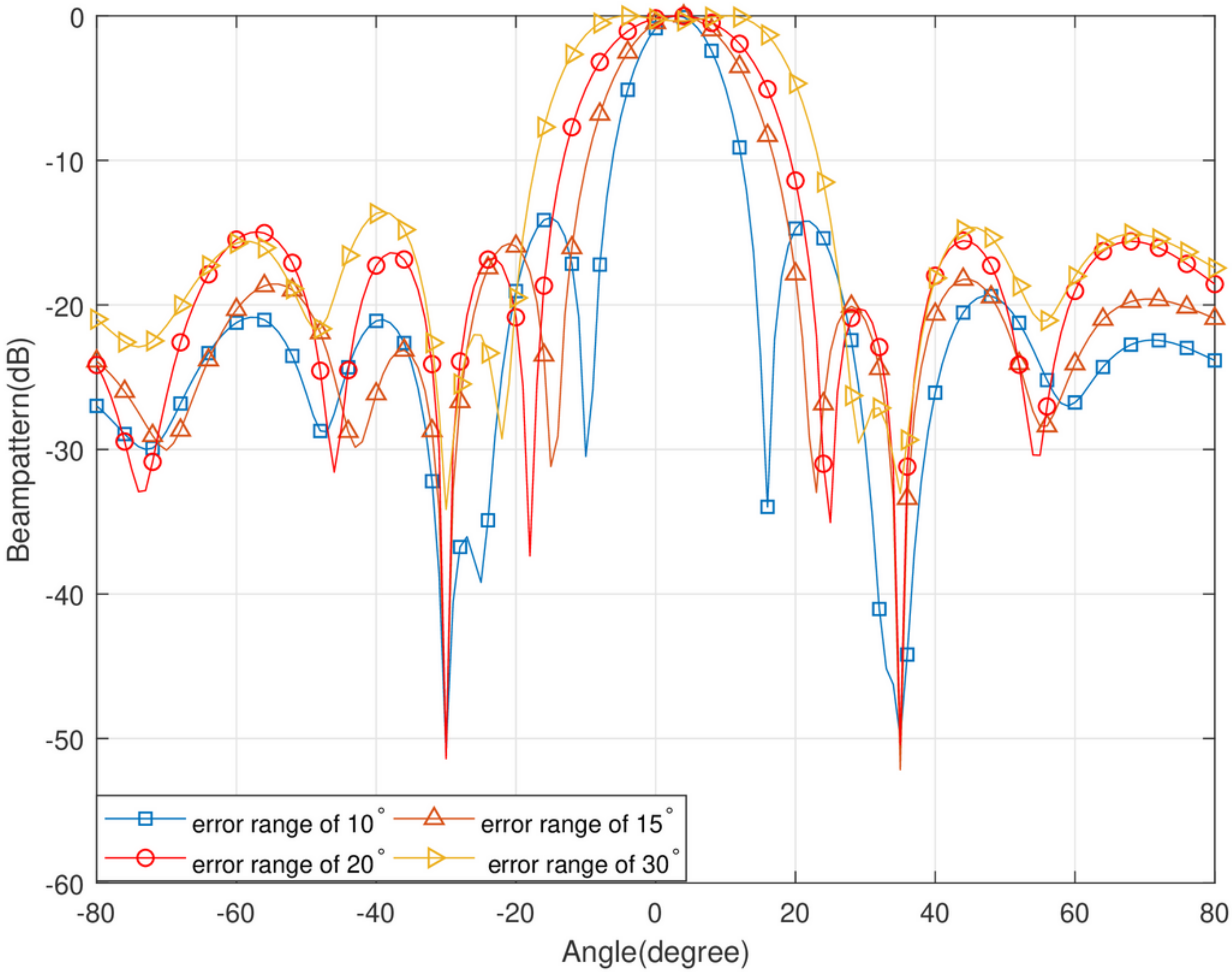

Figure 1

Beampatterns versus different signal look direction error ranges.

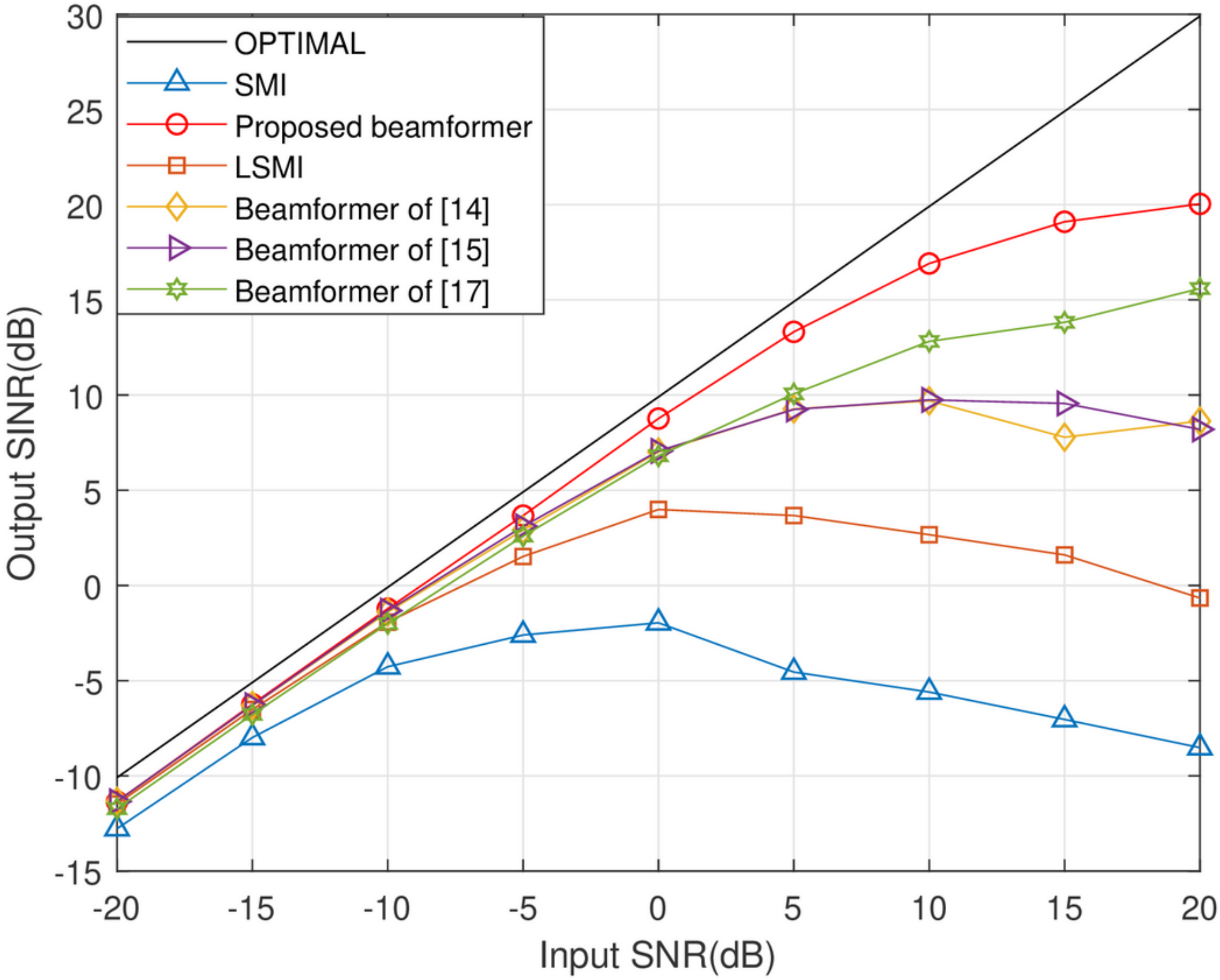

Figure 2

the output SINR verus the input SNR with K=30, INR=30dB.

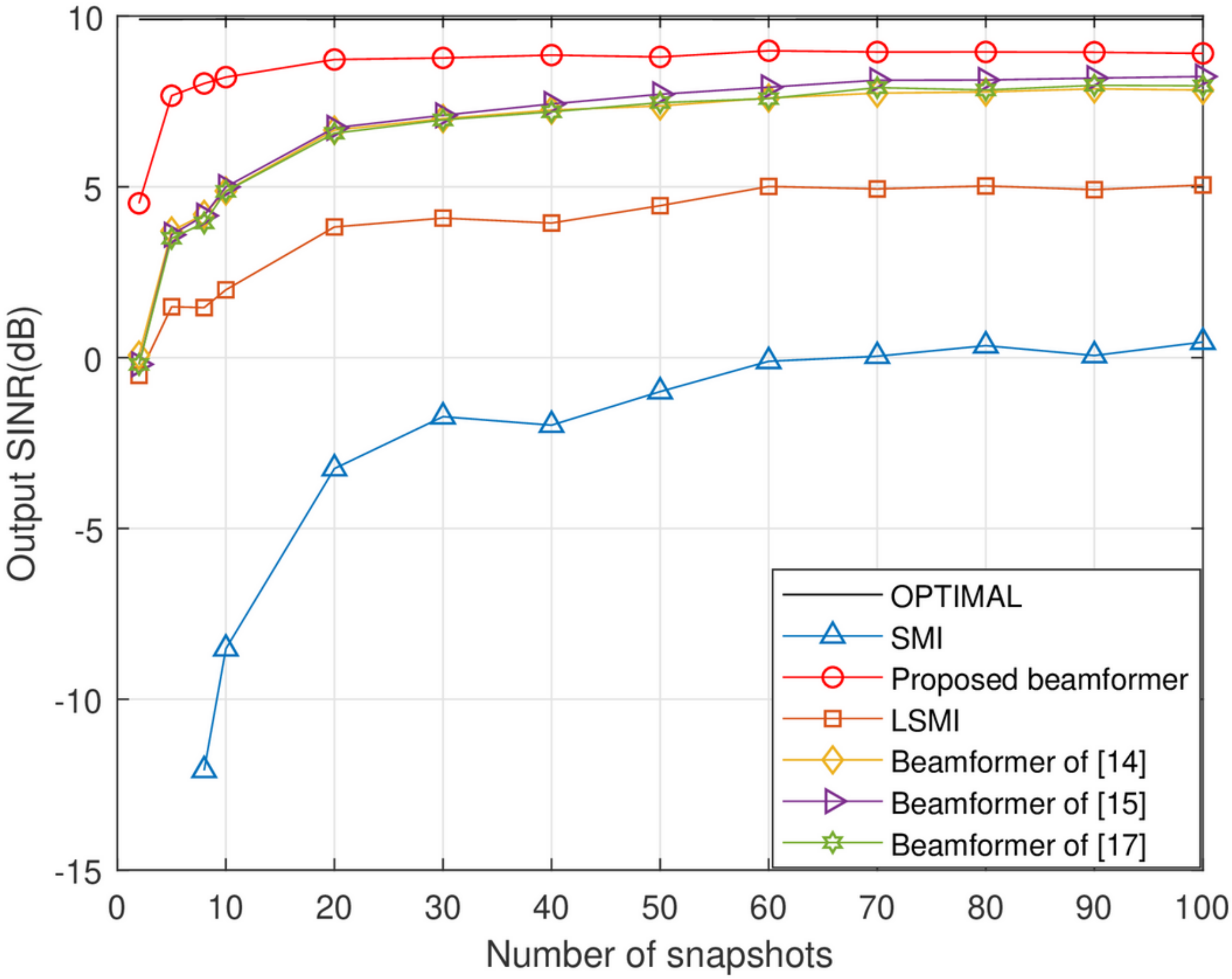

Figure 3

the output SINR versus the number of the training snapshots with SNR=0dB, INR=30dB.

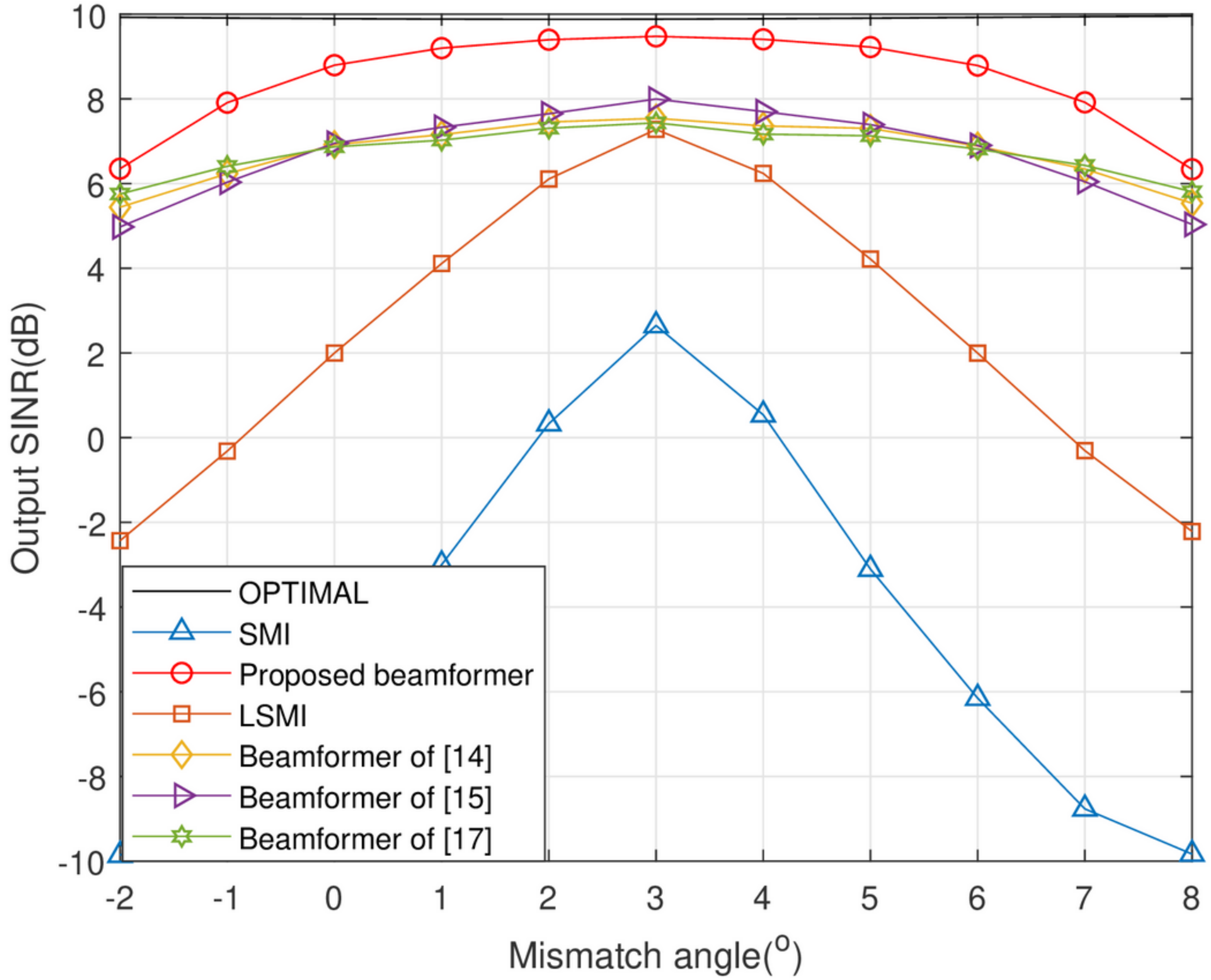

Figure 4

Output SINR versus mismatch angle with INR=30dB,SNR=0dB,K=30.

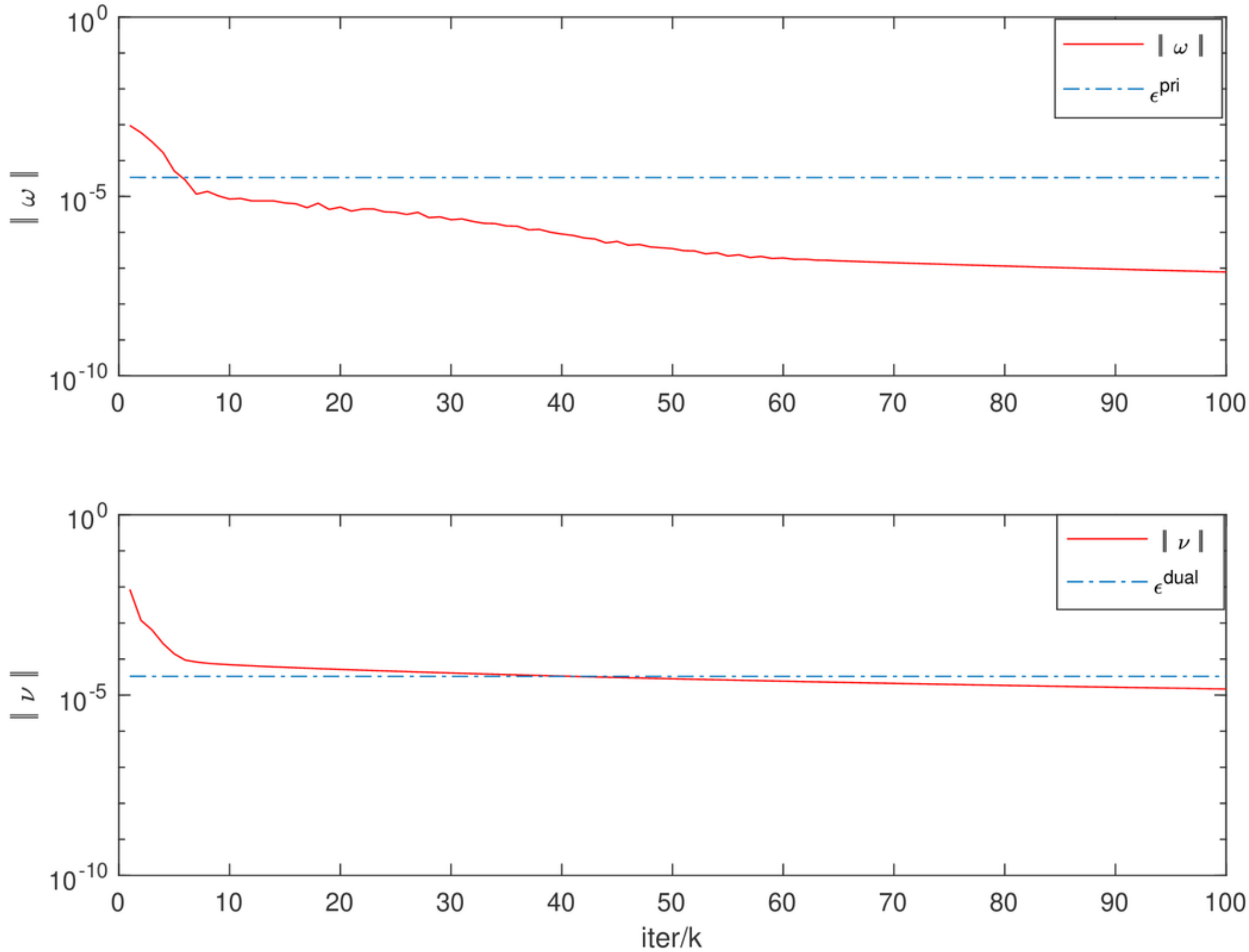

Figure 5

Norms of primal residual and dual residual versus the iteration number with INR=30dB, SNR=-10dB, K=30.