Robust Beamforming via Worst-Case SINR Maximization

S.-J. Kim, A. Magnani, A. Mutapcic, S. Boyd, and Z.-Q. Luo

IEEE Transactions on Signal Processing, 56(4):1539-1547, April 2008.

- robust_bf.pdf

Minimum variance beamforming, which uses a weight vector that maximizes the signal to interference plus noise ratio (SINR), is often sensitive to estimation error and uncertainty in the parameters, steering vector, and covariance matrix. Robust beamforming attempts to systematically alleviate this sensitivity by explicitly incorporating a data uncertainty model in the optimization problem. In this paper, we consider robust beamforming via worst-case SINR maximization, that is, the problem of finding a weight vector that maximizes the worst-case SINR over the uncertainty model. We show that with a general convex uncertainty model, the worst-case SINR maximization problem can be solved by using convex optimization. For a certain type of separable uncertainty model, we show that robust beamforming can be carried out at a cost comparable to standard minimum variance beamforming. We show that several robust beamforming methods that have been proposed in the literature can be interpreted as solving a worst-case SINR maximization problem. We illustrate our method with a numerical example.