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On the Performance of MIMO Nullforming with Random Vector Quantization Limited Feedback

ABSTRACT:

This paper analyzes the performance of random vector quantization (RVQ) for limited feedback nullforming in multi-input multi-output (MIMO) communication systems with and without receiver coordination. A single-stream scenario is considered in which one or more primary receivers request nulls by providing limited feedback to the transmitter. Without receiver coordination, each primary receiver informs the transmitter of its best beamforming precoding vector. The transmitter then selects a zero-forcing precoding vector orthogonal to all of the beamforming precoding vectors. With receiver coordination, the primary receivers feed back the common precoding vector that minimizes the average interference. In both cases, secondary receivers in the network do not provide feedback and experience channels statistically equivalent to a single-antenna fading channel. Analytical results show that, for a system with K primary receivers and random codebooks with N=2^B precoding vectors, the mean received power at the primary receivers is upper bounded by N^{-1/K} = 2^{-B/K} with or without receiver coordination. Exact results are also derived for the K=1 receiver case. Numerical results verify the scaling and also show that systems with receiver coordination outperform those without receiver coordination by a constant gap for large N in terms of average interference.