Achievable Rates with Imperfect Transmitter Side Information Using a Broadcast Transmission Strategy

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Abstract

We investigate the performance of the broadcast approach for various fading distributions, which correspond to different models of partial transmit channel state information (CSI). The first model considered is the quantized limited feedback. In this model, the receiver can send as feedback only a finite number of bits describing the fading gain. We derive the optimal power allocation for the broadcast approach for the quantized feedback model. For a Rayleigh fading channel, numerical results here show that if the feedback word can be longer than one bit, the broadcasting gain becomes negligible, due to diminished channel uncertainty. The second partial transmit CSI model is a stochastic Gaussian model with mean and variance information, which is commonly used for modeling the channel estimation error. In a single-input single-output (SISO) channel, this model also corresponds to the Ricean fading distribution, for which we derive maximal achievable broadcasting rates. We further consider a multiple-input single-output (MISO) channel, and derive the optimal power allocation strategy in a broadcast approach. Numerical results here show that uniform power allocation is preferable over beamforming power allocation in the region where broadcasting gain over single level coding is non-negligible.

Index Terms

Broadcast approach, code layering, channel state information, quantized feedback.