

Expected Distortion for Gaussian Source with a Broadcast Transmission Strategy over a Fading Channel

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Abstract

We consider the problem of transmitting a Gaussian source on a slowly fading Gaussian channel, subject to the mean squared error distortion measure. The channel state information is known only at the receiver but not at the transmitter. The source is assumed to be encoded in a successive refinement manner, and then transmitted over the channel using the broadcast strategy. In order to minimize the expected distortion at the receiver, optimal power allocation is essential. We propose an efficient algorithm to compute the optimal solution in linear time $O(M)$, when the total number of possible discrete fading states is M . Moreover, we provide a derivation of the optimal power allocation when the fading state is a continuum, using the classical variational method. The proposed algorithm as well as the continuous solution is based on an alternative representation of the capacity region of the Gaussian broadcast channel.