Expected Distortion with Fading Channel and Side Information Quality

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Abstract

We study the joint source-channel coding problem of sending a Gaussian source over a fading channel when the decoder has additional correlated side information whose quality is also time-varying. We assume a block fading model for both the channel and the side information, in which the instantaneous channel and side information states are known only at the receiver. We consider the minimum mean square error and its high SNR slope, called the distortion exponent as the performance measures. We consider joint source-channel transmission scheme based on joint decoding at the receiver. We then extend the technique to hybrid and multilayer schemes. Finally, we consider a robust coding scheme which naturally combines the features of digital and analog transmissions. We optimize these schemes numerically in the finite SNR regime and derive closed form results for the corresponding distortion exponents in the high SNR regime. We also provide a comparison with an informed transmitter upper bound, which is not tight in general, as opposed to the setup without side information.