Abstract

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Enhancing the Efficiency of Pulse Shaping in Satellite Communication systems using Multirate Filters

In this paper, a novel pulse shaping technique for satellite communication system is proposed. Instead of conventional raised cosine (RC) square root raised cosine (SRRC) analog filters, digital multirate (MR) filters are used for pulse shaping. An MR filter is simply realized using a low complexity polyphase finite impulse response (FIR) digital filter. MR pulse shaping can be considered as partial response (PR) signaling that overcomes the drawbacks of correlative level coding (CLC) duobinary and modified duobinary techniques. A matrix is used to describe the MR filter, transforming input blocks of length (k-1) to output blocks of length k, thus changing the symbol rate by a factor of k/(k-1). The matrix is designed to shape the spectrum of the output blocks, in order to have Nyquist spectral nulls. Wagner decoding is used at the receiver to enhance the bit error rate (BER) and increase power efficiency. The BER of MR pulse shaping with different block lengths k, is investigated for different modulation techniques described in satellite communication standards, over additive white Gaussian noise (AWGN) channel. The tradeoff between bandwidth and power efficiency is considered for different values of k. It is found that for BPSK, MR pulse shaping with k=10 has a 12.5% increased bandwidth efficiency over raised cosine with roll-off factor of 0.25, used in DVB-S2 standards. In addition, an accurate calculation of the probability of error after Wagner decoding is presented.