

ABSTRACT

In this work, we investigate the performance of multi-rate quasi-synchronous optical CDMA network of the Multi-Code and Variable Sequence Length using balanced Walsh code. The main advantage of using the balanced Walsh code is the cross-correlation of the address sequence and the undesired sequences at zero time shift is zero. We investigate the performance of multi-rate optical CDMA in quasi-synchronous network where the cross-correlation at delay time shift can decrease the simultaneous users in the network. The optical encoder and decoder are designed based on the parallel delay line which has the inner serial structure to reduce the optical loss. In addition, a large number of simultaneous users can access the transmission channel with different bandwidth while maintaining a good BER performance and the network can have a large number of simultaneous users due to the large number of available code sequences. We present the algorithm for generating the balanced Walsh codes for two multi-rate schemes and design computer programs to generate the codes, to calculate the cross-correlation function and the probability distribution of the cross-correlation, and to evaluate the BER performance. We also found that multi-rate optical CDMA networks using the Variable Sequence Length scheme can support a larger number of simultaneous users at a required BER of 10^{-9} than the Multi-Code scheme and also can achieve the better optical power utilization.