PERFORMANCE ANALYSIS OF OCDMA IN BINARY SYMMETRIC CHANNEL

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Abstract

In this paper, performance analysis of OCDMA in Binary Symmetric Channel for eight users has been done. For parameters like Signal to Noise Ratio, Bit Error Rate, Maximum and minimum error for different users has been used plotted by developing codes through MATLAB. Binary Symmetric Channel has been used through which only binary data has been transmitted and received.

Keywords *– OCDMA system, SNR, BER, Binary Symmetry Channel (BSC)*

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I. INTRODUCTION

Optical fibers provide excess bandwidth for multiple access operations, permitting many users to simultaneously communicate over the same medium by allocating time, bandwidth etc.

There are three major multiple access schemes available namely Time Division Multiple Access (TDMA), Wavelength Division Multiple Access (WDMA) and Code Division Multiple Access (CDMA).

Usually fiber optic communication systems use either TDMA or WDMA schemes to allocate bandwidth among multiple users. In a TDMA system, time slot is allocated to the user from whole channel. In a WDMA system, each user occupies bandwidth from the total channel. In CDMA, each user is identified by different codes or addresses. The advantages of CDMA include the flexibility in the allocation of channels, the ability to operate asynchronously, enhanced privacy, multimedia support and increased capacity in bursty nature networks

In 1980's emergence of wireless CDMA with tremendous benefits gave idea to some researchers to transfer the principle and advantage of CDMA into optical communication networks. The feasibility of implementing CDMA in optical communication was demonstrated in 1986. Then **Salehi** employed CDMA techniques in optical communication and analyzed the performance.

The general OCDMA system comprises of three parts i.e. the transmitter, channel and the receiver.

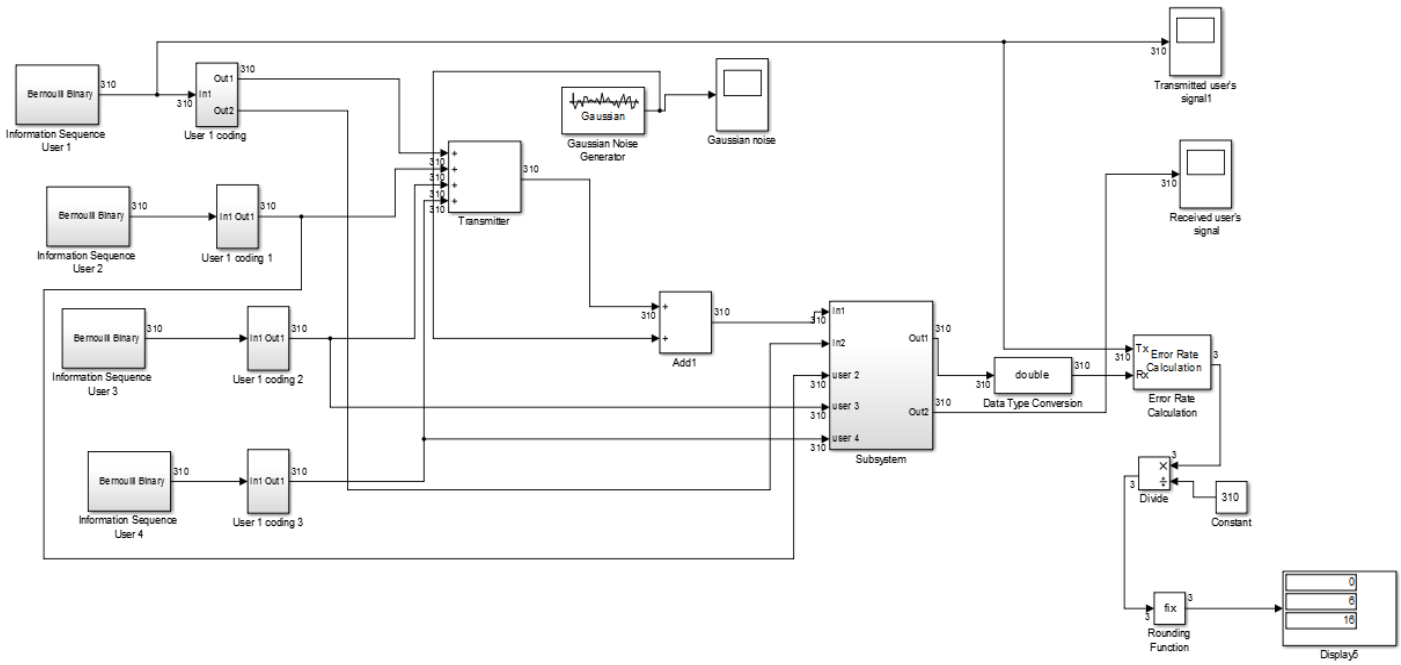

Fig: - 1- OCDMA simulink model

In **Fig:-1** the OCDMA simulink model has been shown in which transmitter comprises of the information sequence generated by Bernoulli generator. Also, the spreading of code is being done in transmitter itself. Then the channel introduces noise and at the receiver de-spreading of code is done and then the error rate calculation has been done and at display the BER has been analyzed.

The principle of OCDMA is based on spread-spectrum techniques, which have been widely used in mobile-satellite and digital-cellular communication systems. The concept is to spread the energy of the optical signal over a frequency band that is much wider than the minimum bandwidth required to send the information.

Despite of various advantages it suffers from various noises such as Phase Induced Intensity Noise (PIIN), Multiple Access Interference (MAI), thermal noise and shot noise that degrades the overall system performance. The PIIN is the main reason for performance degradation which results from phase incoherence of overlapping signal on same spectra causing fluctuations of total signal intensity.

II. PERFORMANCE ANALYSIS

In CDMA usually each user is assigned with a unique spreading code used to spread the data which is used by users to distinguish its data from the data of other users and these spreading codes are called as Optical Orthogonal Codes (OOC). In OCDMA, On-Off Keying (OOK) is used which is similar to binary unipolar encoding. An optical orthogonal code OOC (N, w ,λ_a,λ_c) can be defined as a family of (0,1) sequences with length **N** and weight **w**, where λ_a and λ_c are positive numbers and they are maximum possible level (thresholds and constraints) for autocorrelation function and cross correlation function respectively in the family of OOC.

In this paper, we have seen that how the OCDMA system works and give error. These errors have been plotted through MATLAB codes. The led and photodiode has been introduced in program itself and autocorrelation has been done between input sequence and individual user code using circular convolution properties and graph has been achieved. The graph of autocorrelation is shown by transmitted and received bits sequence. In Fig:-2 graph between autocorrelation of transmitted code 1 with received code 1 has been shown. In Fig:-3 graph between autocorrelation of transmitted code 2 with received code 2 has been shown. In Fig:-4 graph between autocorrelation of transmitted code 3 with received code 3 has been shown. In Fig:-5 graph between autocorrelation of transmitted code 4 with received code 4 has been shown. In Fig:-6 graph between autocorrelation of transmitted code 5 with received code 5 has been shown. In Fig:-7 graph between autocorrelation of transmitted code 6 with received code 6 has been shown. In Fig:-8 graph between autocorrelation of transmitted code 7 with received code 7 has been shown. In Fig:-9 graph between autocorrelation of transmitted code 8 with received code 8 has been shown. Then total error has been calculated and achieved a graph (Fig:-10) of BER with respect to SNR.

Then two more graphs has been plotted which shows the maximum error rate (Fig:-11) and minimum error rate (Fig:-12) of individual users.

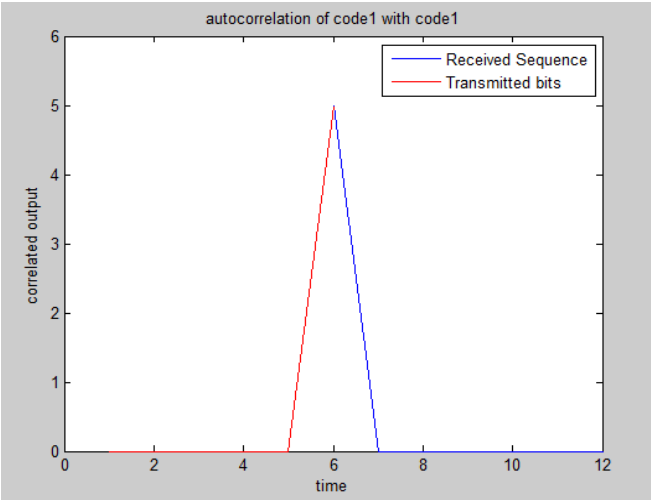

Fig:-2-Graph between autocorrelation of transmitted code 1 with received code 1

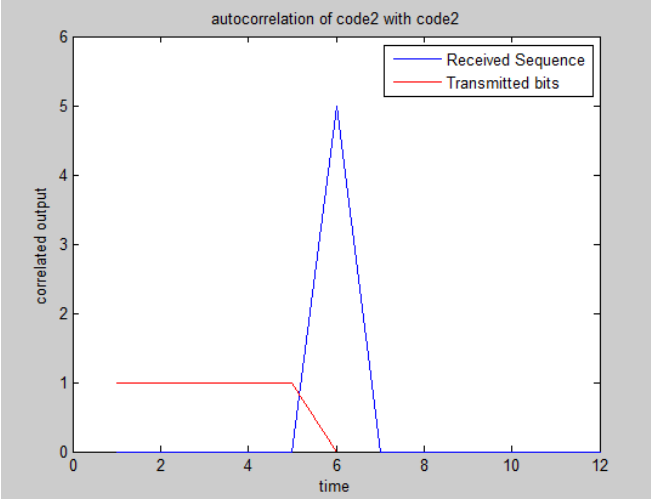

Fig:-3-Graph between autocorrelation of transmitted code 2 with received code 2

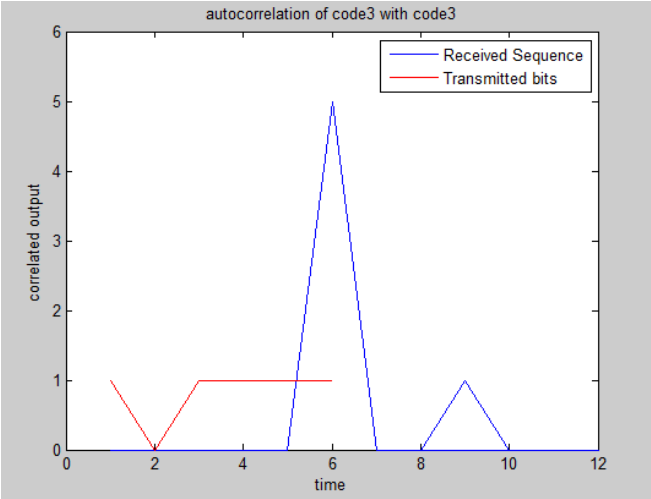

Fig:-4-Graph between autocorrelation of transmitted code 3 with received code 3

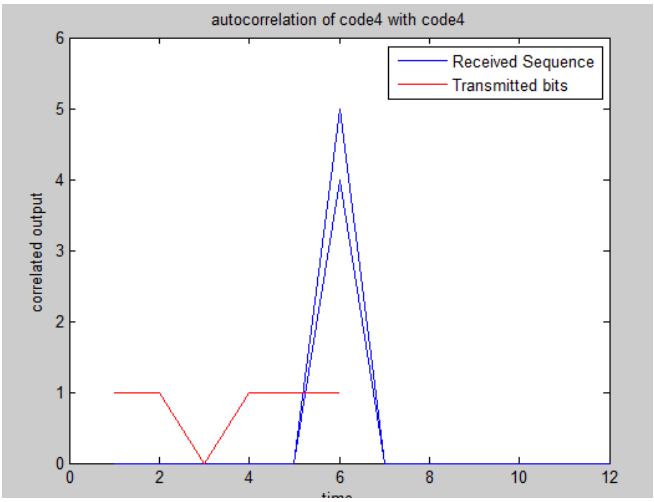

Fig:-5-Graph between autocorrelation of transmitted code 4 with received code 4

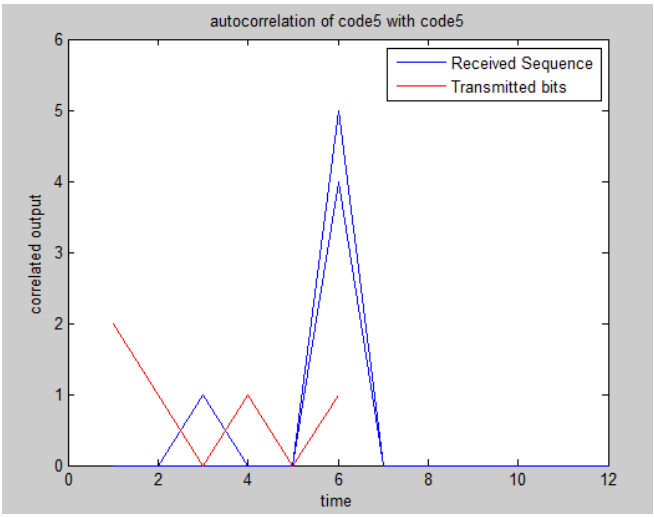

Fig:-6-Graph between autocorrelation of transmitted code 5 with received code 5

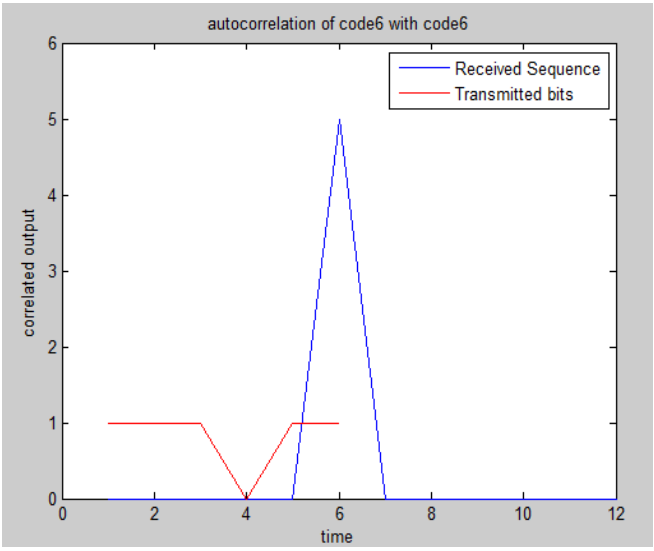

Fig:-7-Graph between autocorrelation of transmitted code 6 with received code 6

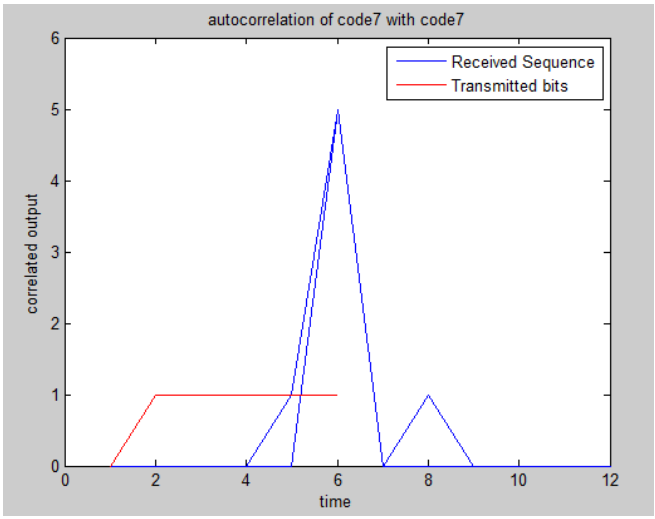

Fig:-8-Graph between autocorrelation of transmitted code 7 with received code 7

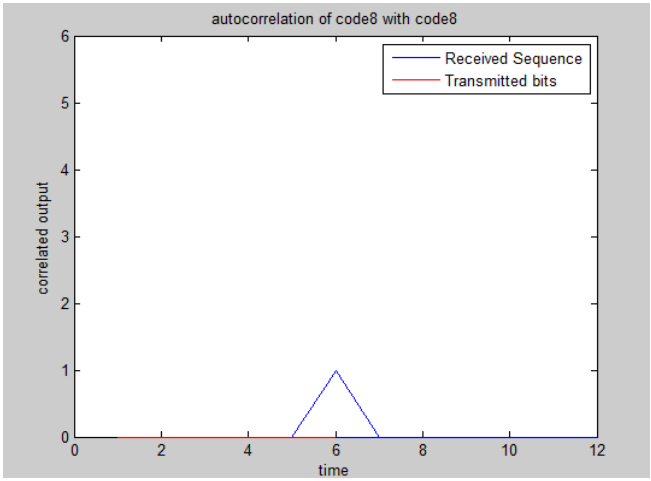

Fig:-9-Graph between autocorrelation of transmitted code 8 with received code 8

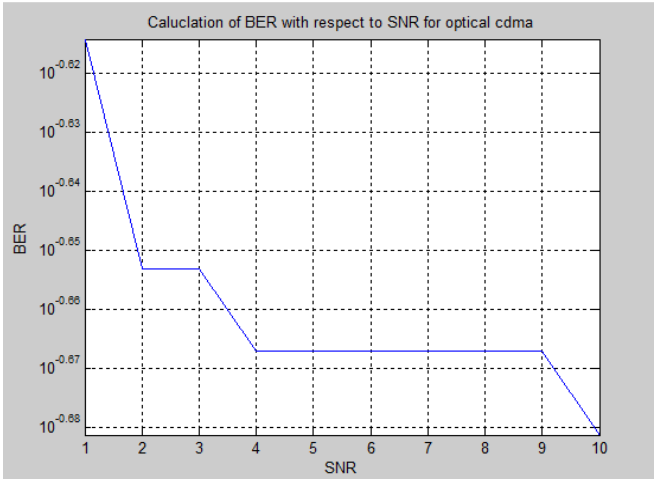

Fig:-10- Graph between BER and SNR

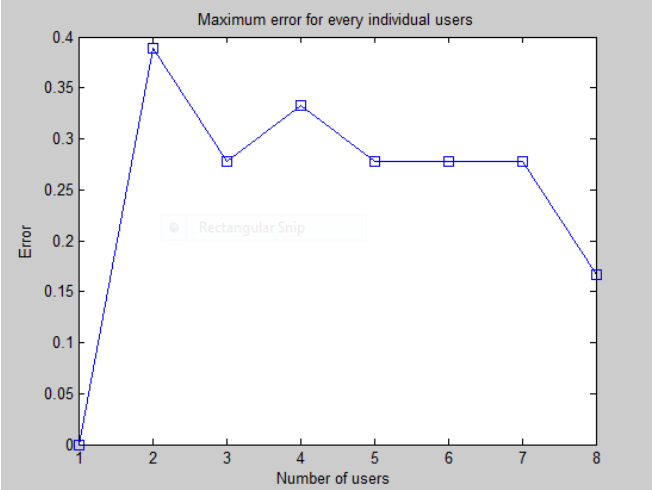

Fig:-11- Graph of maximum error for every individual user

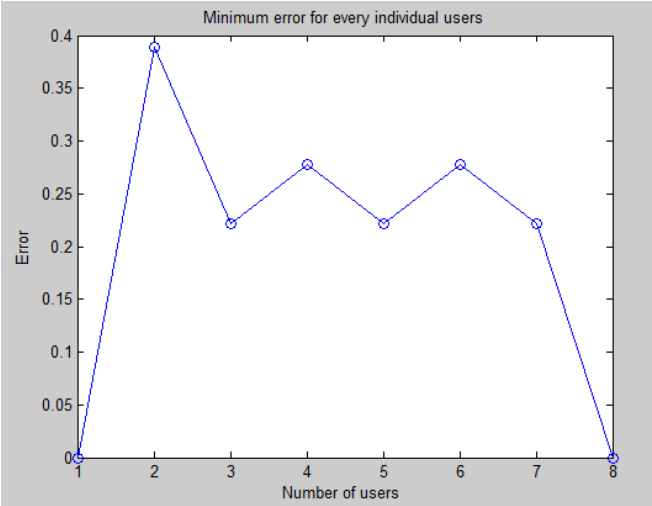

Fig:-12- Graph of minimum error for every individual user

III. CONCLUSION

In this paper, initially the auto-correlation graph for individual user has been achieved. Then analysis came out with graphs plotted between BER and SNR of different users. Through graph we can conclude that SNR is inversely proportional to BER as it has been realized through plot that with the increase in value of SNR, the value of BER decreases significantly. Also, we have achieved the graphs of maximum and minimum value of error for different users.

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