Weighted Code Transmission in Optical CMDA

Pooja Yadav, Ravindra Prakash Gupta

Abstract— ***In this Paper, the comparative analysis of a fibre optics CDMA system with or without weighted code is presented using Matlab simulation. By changing various parameters of the systems, we compare two systems in terms of BER. As the number of active users increases the BER increases. It is found that the system using weighted code is better.***

Index Terms— ***CDMA, BER, Weighted Code***

I. INTRODUCTION

Optical code-division-multiple-access (CDMA) technology combines the large bandwidth of fibre media with the flexibility of CDMA technology to provide high speed connectivity to end users. It allows users to share the same bandwidth simultaneously at low cost. Optical CDMA systems are better than TDMA and FDMA systems in terms of the system throughput and the BER performance since the whole channel bandwidth is available to each user for the whole of the time and the codes applied have better auto and cross-correlation properties. Because of this, the BER performance degrades gradually when the number of simultaneous users increases above the normal traffic.

In OCDMA, different users whose signals may be overlapped both in time and frequency share a common communication medium, multiple access is achieved by assigning unlike minimally interfering code sequence to different transmitter to avoid multiple access interference.(MAI). These codes are orthogonal with each other.

The broadband signal from the light source is ON-OFF keying (OOK) modulated[1] with the binary data , the transmitter sends a pulse with spectral distribution varying with time if the data bit value is “1”; otherwise no power is transmitted. The encoder is a fast TOF controlled with an electrical signal that represents the Functional code. Signals transmitted from all synchronized users will be mixed up in the network before received by all users. At the receiver end of the FO-CDMA, the optical pulse sequence will be compared to a stored replica of itself (correlation process) and to a threshold level at the comparator for the data recovery.

The probability of error is given by

$$\mathrm{BER}(K) = \frac{1}{2}\, erfc\left(\sqrt{\frac{SNR(K)}{2}}\right)$$

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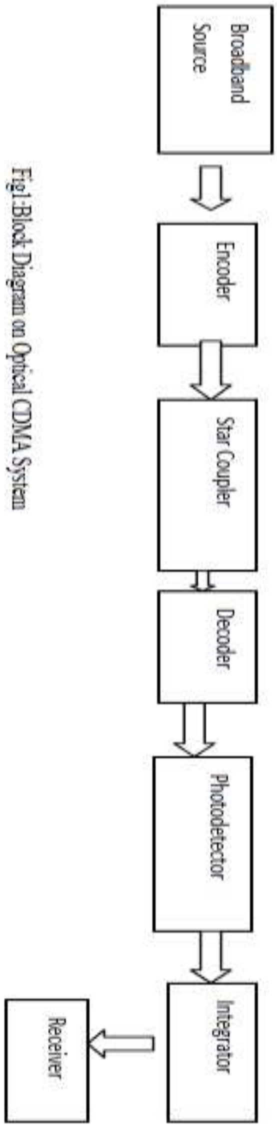
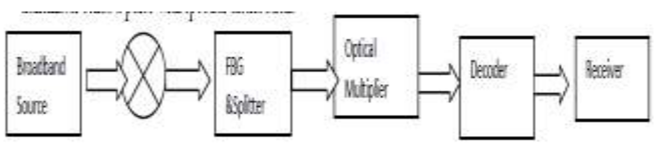


Fig1:Block Diagram on Optical CDMA System

II. PROPOSED SYSTEM

The broad band signal from the light source is ON-OFF keying (OOK) modulated with the binary data. The transmitter sends a pulse with spectral distribution



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Therefore, the electronic data are converted to broadband optical pulses then, these optical pulses are delivered to splitter for encoding. The spectral coding and the spatial encoding[2] are performed by using the two sets of FBGs and splitters, respectively. When the optical pulse is inputted into FBG1, the spectral components matched to "1s" of the spectral code sequence are reflected back and the others are filtered out. However, the matched spectral components are reflected by different gratings. It causes the round trip delays of the matched spectral components to be different. After spectral encoding, the optical pulses are passed to the splitter for spatial encoding.

The splitter equally splits each optical pulse and sends these split portions according to the spatial code sequence. The spectral and spatial codes are modulated by the Functional codes [3] using Optical Multiplier. Signals receiver, the composite signal is decoded by the decoder. The output of the decoder is therefore the signal that has the same phase shift.

An optical multiplier has been used for modulation of the spectral and spatial code sequences by functional codes. The BER of the proposed system can well be approximated as :

$$BER(K) = \frac{1}{2}\, erfc\left(\sqrt{\frac{SNR(K)}{8}}\right) * \frac{1}{2}\, erfc\left(\sqrt{\frac{SNR(K)}{2}}\right)$$

III. PARAMETER USED FOR SIMULATION

PD quantum efficiency =0.6, Spectral width of broadband light source= $\Delta\lambda$=30nm, Electrical Bandwidth=320 MHz, Receiver load resistor= R_L=1030 Ω,k1= 3,k2=.6,number of active users=1000.

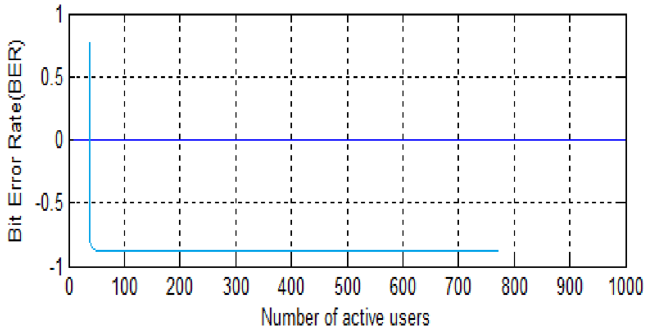

Fig3:Normalised System

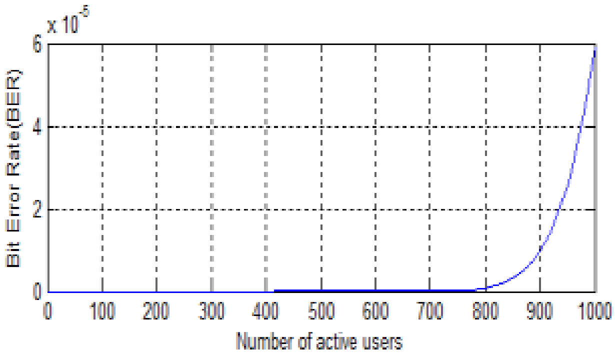

Fig4: Proposed System

IV. CONCLUSION

As it can be seen from the simulation results that in the system without weighted code transmission the bit error rate first decreases and than it remains constsnt(2.5 *10^{-4})for further users.And for the weighted code system the bit error rate is almost zero for the first 800 users than it starts increasing .We can increase the values of weighted code to increase the number of users but to a certain extent as it increases the shot noise This system is better for 1000 users only.

REFERENCES

[1] Chao -Chin Yang and Jen-Fa Huang, "Two Dimensional M-matrices coding in Spatial/Frequency Optical CDMA Networks",IEEE Photonics technology letters,Vol.15,No.1,January 2003.

[2] Jawad A. Salehi , "Code Division Multiple -Access Techniques in Optical Fiber Networks-Part 1: Fundamental Principles", IEEE Transactions On Communications, Vol.37, No.8, August 1989

[3] C. S. Weng and J. Wu, Perferct difference codes for synchronous fiber-optic CDMA communication systems. J. Lightw. Technol., 2001. vol. 19(no. 2): p. 186- 194.

[4] "Principles of Communication Systems Simulation with Wireless Applications" by William H. Tranter, K. Sam Shanmugan , Theodore S Rappaport, Kurt L. Kosbar.

[5] H. Kobrinski and K. W. Cheung, Wavelength-tunable optical filters: applications and technologies. IEEE Comm. Mag., 1994. vol. 32(no. 12): p. 50–54.

[6]. E. D. J. Smith, R. J. Blaikie, and D. P. Taylor, Performance enhancement of spectral-amplitude-coding optical CDMA using pulse position modulation. IEEE Trans. on Comm., 1998. vol. 46(no. 9): p. 1176-1185.

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