Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 8, August 2015, pg.1 – 7

RESEARCH ARTICLE

Performance Analysis of Channel Estimation in MC-CDMA over OFDM in Fading & Non Fading Channel Environment

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Abstract— Multi-carrier code division multiple access (MCCDMA)systems receive a great deal of attention due to their great potential in achieving high data rates in wireless communication. This paper presents the simulation and analysis of MC-CDMA system over orthogonal frequency division multiplexing technique. performance when the data is sent and received over AWGN channel and Rayleigh channel. These two cases are simulated separately to show the performance of the MC-CDMA system when it has users, 4, 16, 32 and 64. For each SNR between 0dB and 50dB the BER value showed an effect of AWGN and Rayleigh fading channel on the MC-CDMA.

Keywords: MC-CDMA, OFDM, BER, SNR, Adaptive Modulation, QPSK, channel estimation, MMSE

INTRODUCTION

Nessecitiy is the min the author of invention so urge to communicate with the people played an important role in the gradual development of mass communication system. Since the inception of Galileo, Marconi invention of wireless radio to enable continuous contact with the ships and the English Channel in 1997 paved the way of further development in the field of wireless mass communication system. The combination of OFDM and CDMA for mobile radio transmission has been proposed by several authors [1-6] such as “Multicarrier (MC-) CDMA”, “Multicarrier DSCDMA”, “Mutilating (MT-) CDMA”. These signals can be easily transmitted and received using the fast Fourier transform (FFT) without increasing the transmitter and receiver complexities, and have the attractive feature of high spectral efficiency due to minimally densely subcarrier spacing.

An attempt has been made in the present work to enhance the quality of MC-CDMA system and evaluate the performance by OFDM through by calculating SNR (signal to noise ratio) & BER(bit error rate) and using modified MMSE technique. The following are the set objective to release the goal.

- Simulate the OFDM channel estimation in MATLAB environment.
- Evaluate the performance by calculating SNR and BER in OFDM channel estimation through MMSE and LS technique.
- Simulate the MC-CDMA channel estimation using modified MMSE technique.
- Evaluate the performance of MC-CDMA channel environment by calculating SNR and BER.
- Compare the result over OFDM and MMSE channel estimation.

OFDM (ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING TECHNIQUE)

Orthogonal frequency division multiplexing modulated by a low rate data stream. Each carrier in the available spectrum of OFDM is derived into many carriers. In OFDM, spectrum is used with more efficacy as the channels are much closer. OFDM is a broadband multicarrier modulation method that offers superior performance and benefits over older, more traditional single-carrier modulation methods because it is a better fit with today's high-speed data requirements and operation in the UHF and microwave spectrum. Three combination of OFDM and CDMA come in to existence i.e. (MC-DS-CDMA), multi-tone CDMA(MT-CDMA) and multi-carrier CDMA(MC-CDMA). This provides way for 4G mobile communication system.

SYSTEM MODEL AND CHANNEL MODEL

The discrete time baseband OFDM system model with N subcarriers is shown in Figure. It consists of transmitter block, channel block and receiver blocks.

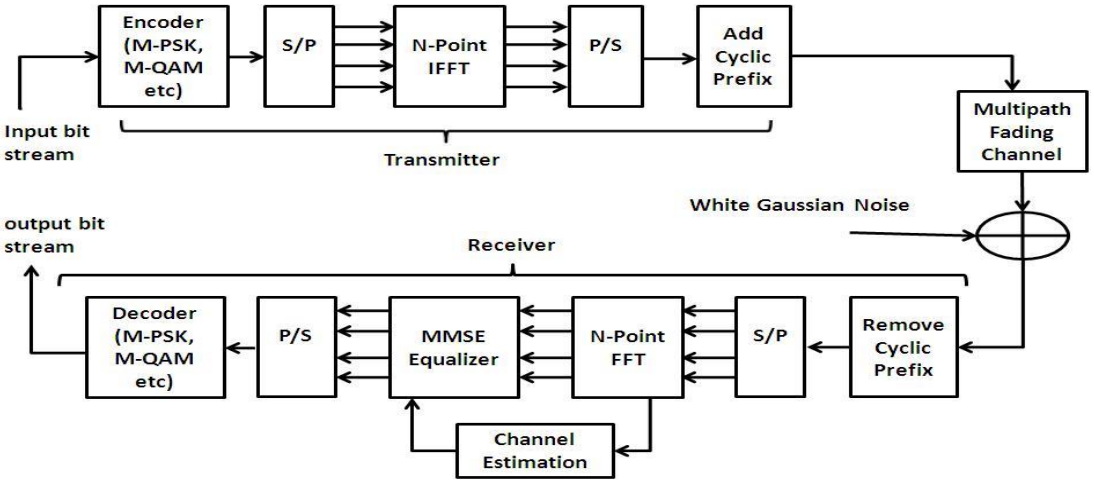

Figure 3.1 Baseband OFDM system model

MC-DS CDMA (MULTICARRIER DIRECT SEQUENCE CDMA)

Namely multicarrier direct sequence CDMA transmitter using giving spreading code interim domain spread the serial to parallel convertor data stream and creates spectrum of code sub carrier which satisfy the orthogonal condition with the minimum frequency separation.

MT-CDMA (MULTI TONE- CODE DIVISION MULTIPLE ACESS)

Multitone–code division multipal access technique use in wireless body area network application.MT-CDMA combine orthogonal frequency division multiplexing and it combine direct spread-spectrum (DS-SS) modulation. This combination give multipal access capabilities and high data rate transmission.

MC-CDMA (MULTI CARRIER- CODE DIVISION MULTIPLE ACCESS)

The MC-CDMA transmitter spread the original data stream different sub-carriers in the frequency domain using a given spreading code. In MC-CDMA different users use same frequency band at the same time and the sub carriers. The received data is combined in the frequency domain at the receiver. MC-CDMA is combination of CDMA and OFDM. MC-CDMA user spread each symbol with a symbol periodic DS sequence. This DS sequence is subsequently modulated by OFDM. IFFT is use for modulate the DS sequence in transmitting mode. In the receiving mode we use fast Fourier transform (FFT). In convert frequency domain signal to time domain signal. It work in two mode i.e. transmitting mode and receiving mode.

MC-CDMA BASED ADAPTIVE MODULATION

MC-CDMA with adaptive modulation is under scrutiny as appealing procedures for 4G portable system, in which the received signal is normally undermined by multipath fading effect. Steele and Webb (1991) proposed block-by-block adaptive Quadrature Amplitude Modulation (AQAM) for misusing the time variation Shannon channel capacity of narrowband fading channels (Jungiang et al 2005).

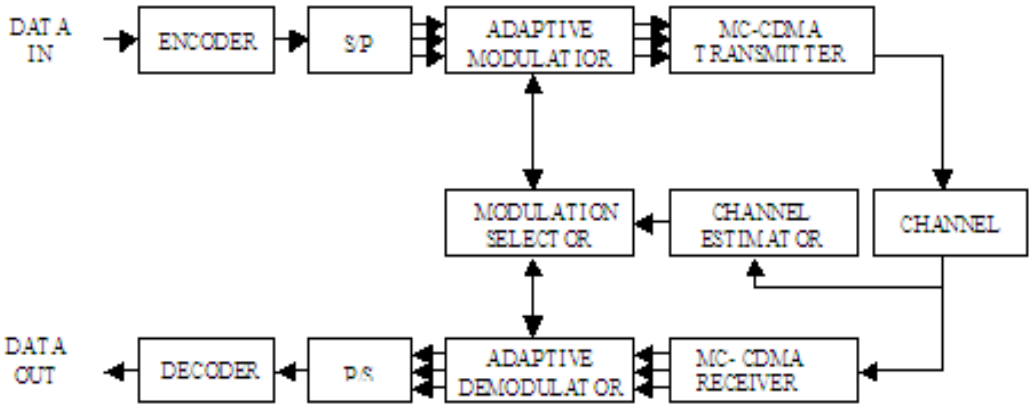

Figure 2 :-Proposed System Model for Adaptive Modulation based MC-CDMA system

The block representation of the proposed adaptive modulation based MCCDMA system is demonstrated in Figure. Binary information is initially encoded utilizing Turbo coding, trailed by serial-to-parallel transformation to deliver low bit rate streams (Wasantha and Fernando, 2002).

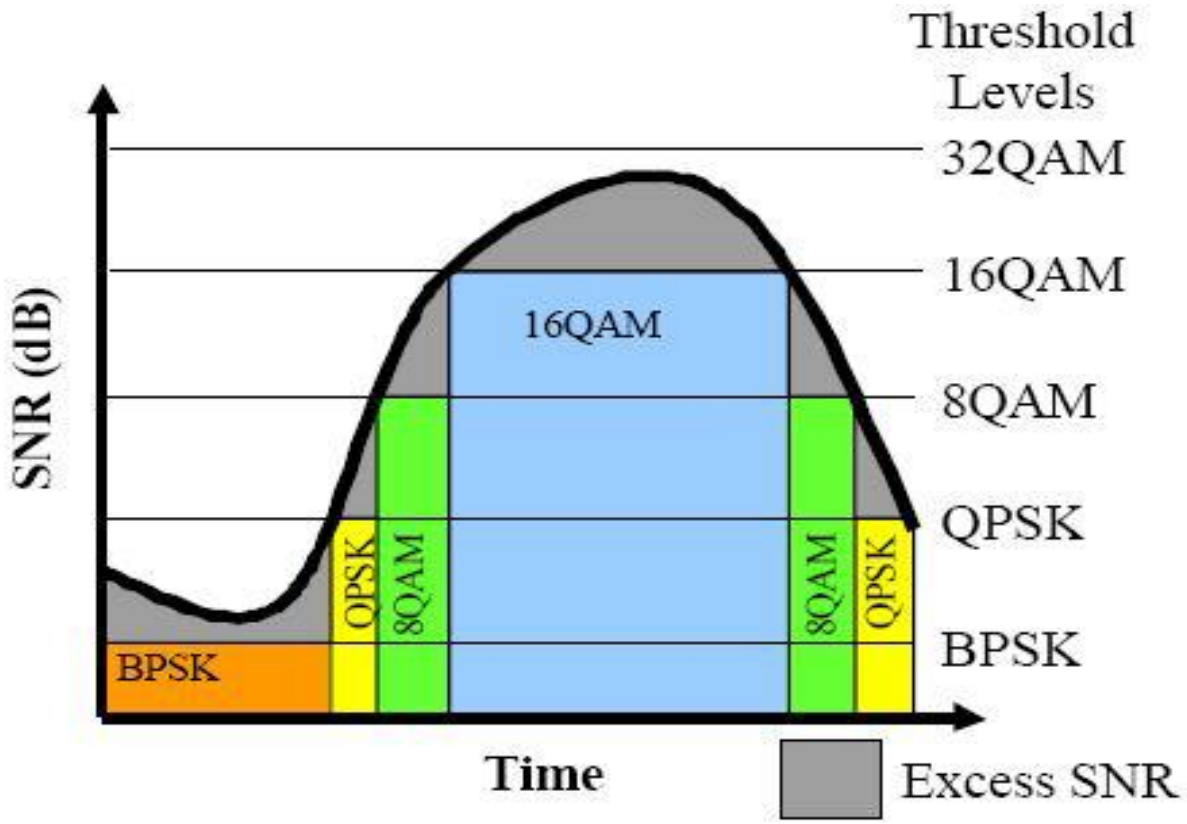

Figure 3:-Assignment of Modulation Scheme Based on SNR

Above figure clarifies the way a specific modulation plan is being chosen when SNR changes with time. When the SNR crosses the threshold limit levels the following or the relating adjustment plan is adjusted.

SIMULATION AND RESULT

The below figure 4 and figure 5 shows the combined graph of all the implemented technique of MC-CDMA. It clearly shows that the proposed MC-CDMA has lower mean square error (MSE) and Bit error rate (BER). Minimum bit error rate achieved is 10^{-4} and minimum mean square error achieved is 10^{-6}.

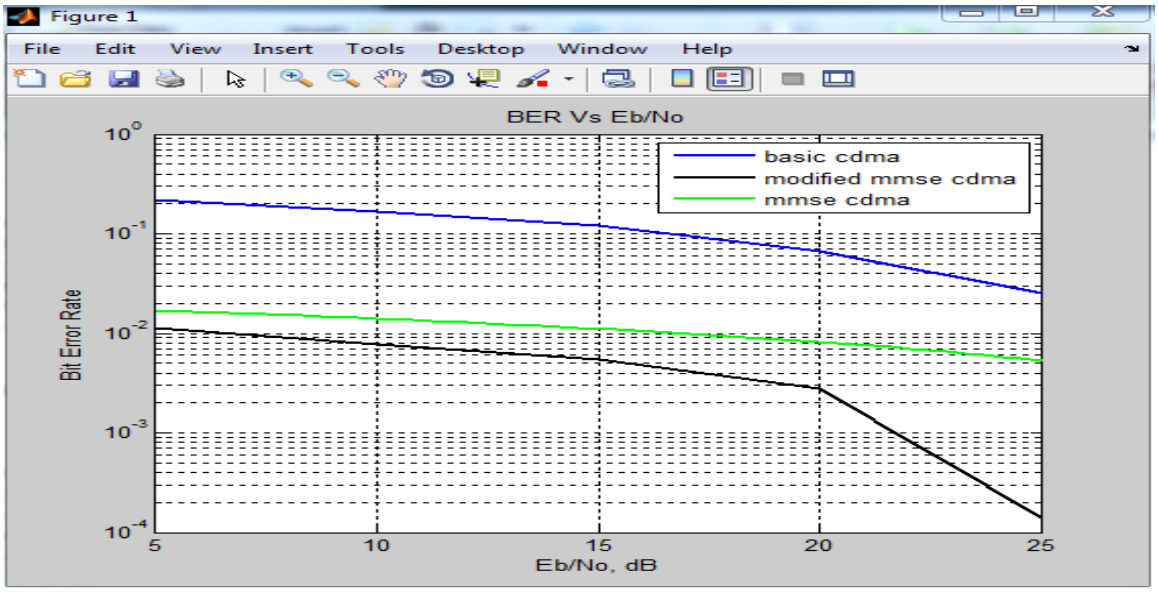

Figure 4:-Combine graph BER using MC-CDMA

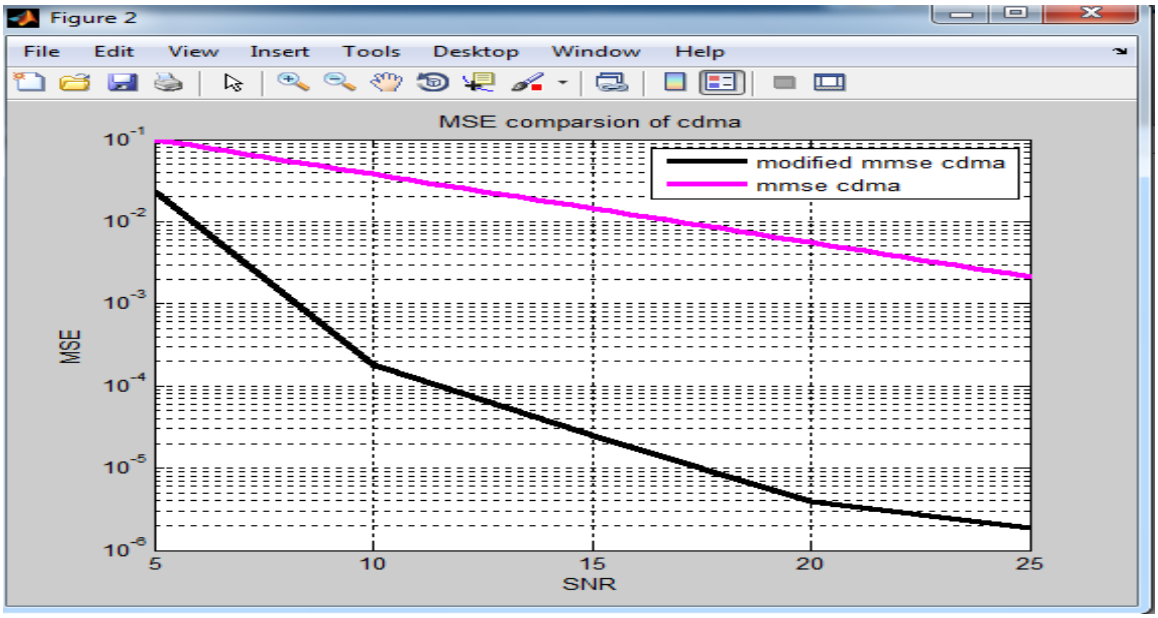

Figure 5 Combine graph MSE using MC-CDMA

The below figure 6 and figure 7 shows the combined graph of all the implemented technique of OFDM. It clearly shows that the proposed OFDM has lower mean square error (MSE) and Bit error rate (BER). Minimum bit error rate achieved is 10^{-3} and minimum mean square error achieved is 10^{-7}.

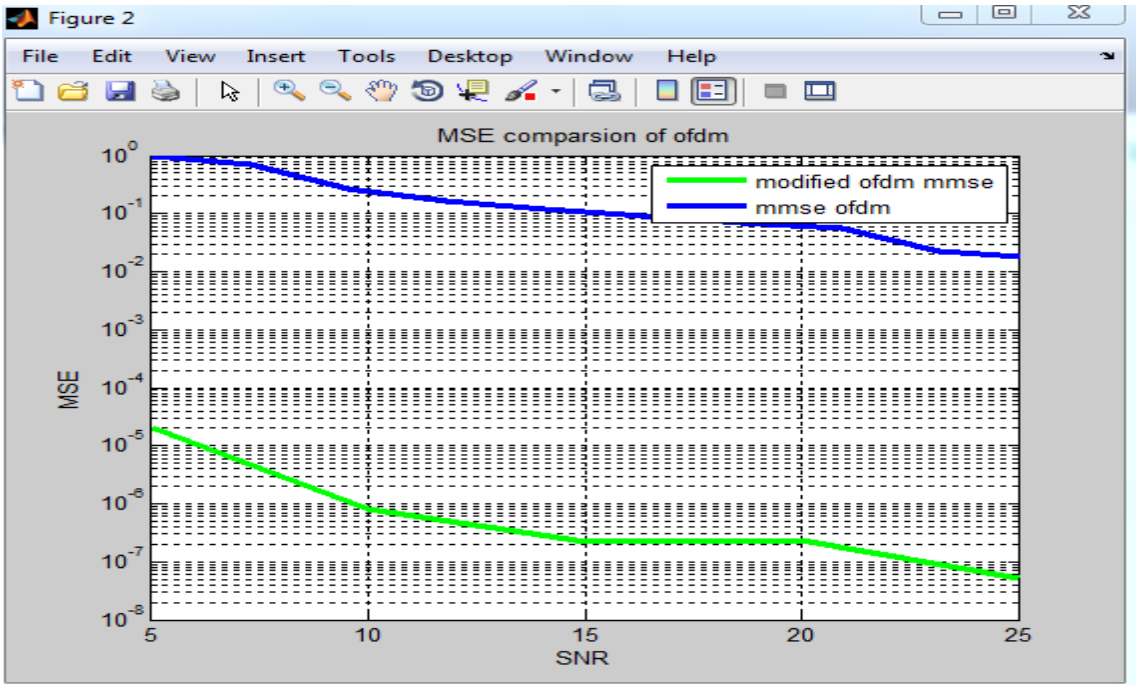

Figure 6:- Combine graph MSE using OFDM

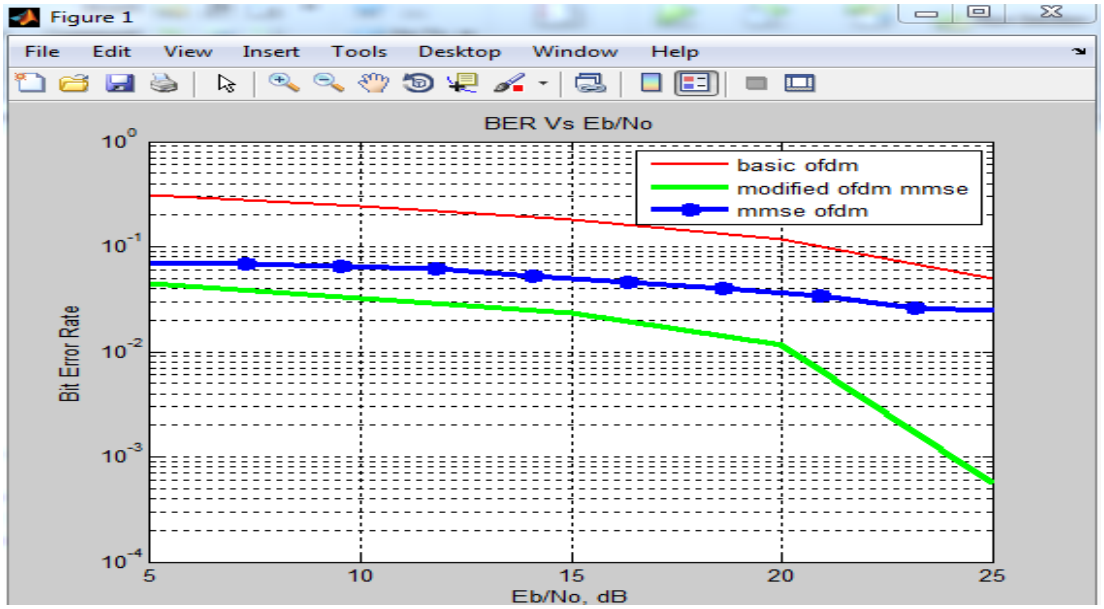

Figure 7:- Combine graph BER using OFDM

CONCLUSION

In this proposition, an enhanced MC-CDMA system with versatile sub carrier portion has been considered, in which every users waveform is transmitted over the entire sub carrier. The execution attributes of the proposed system in frequency particular fading environment with narrowband interference existing are dissected. The Root-discovering

calculation and Water-filling calculation are utilized to discover the best sub-carrier out of the existing sub-bearers. The Water-filling calculation is utilized as a part of the proposed MCCDMA system.

In this proposition firstly we design a system, in which we use all technique in OFDM then we compare the result with same system OFDM to MC-CDMA. After that we get better result in respect to BER and SNR. In this we have taken complete glance of performance analysis of OFDM and MC-CDMA. After analysis it is concluded that BER of MC-CDMA system is better than OFDM system and MSE of OFDM system is better than MC-CDMA.

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