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Result Analysis of Bit-Error Rate (BER) of the MC DS-CDMA System

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Abstract

Multi-Carrier Code Division Multiple Access (MC-CDMA) is a multiple access scheme used in OFDM-based systems, allowing the system to support multiple users at the same time. Multi Carrier modulation has a significant role in mobile communication because of frequency diversity and bandwidth efficiency. Multi-Carrier Code Division Multiple Access (MC-CDMA) suffers from timing errors due to the large number of carriers. So in this paper we present the Analysis of Bit-Error Rate (BER) of the MC DS-CDMA System under Additive white Gaussian noise (AWGN) and multipath rayleigh fading channel.

Keywords

CDMA, DS-CDMA, multicarrier, interference

1. Introduction

This multipath propagation causes arbitrary time dispersion, attenuation, and phase shift, known as fading, in the received signal [1], [2]. Fading is caused by interference between two or more versions of the transmitted signal which arrived at the receiver at slightly different times [3]. DS-CDMA technique has the advantages of increasing the channel capacity along with the immunity against jamming [4]. In multi-user CDMA systems, multiple access interference (MAI) is considered one of the main sources of performance degradation. Adaptive filtering techniques have been successfully used to equalize the channel and thus reduce the MAI in the DS-CDMA system [5].

Several two-dimensional (2-D) wavelength-hopping time spreading codes have been reported to improve the performance of optical code-division multiple access (O-CDMA) systems [6]–[9]. These codes can increase the number of subscribers and simultaneous users rather than conventional one dimensional O-CDMA codes, namely unipolar time-spreading codes.

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Basic one-dimensional asynchronous codes are optical orthogonal codes (OOCs)[10] and prime sequence codes (PSCs)[11], also known as prime codes. We provide here a result analysis of BER performance of MC DS-CDMA which is in terms of BER and timing error [12][13].

The bit error rate or bit error ratio (BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval [14]. BER is a unit less performance measure, often expressed as a percentage [14][15].

We provide here an overview of MC DS-CDMA. Other sections are arranged in the following manner: Section 2 describes about Related Work; Section 3 shows the performance analysis; Section 4 describes conclusions.

2. Related Work

In 2010, Mohammad Torabi et al. [16] investigate the combination of different techniques, resulting in user scheduling schemes for multiuser MIMO-OFDM systems employing orthogonal space–frequency block coding (OSFBC) over multipath frequency selective fading channels. Our contribution is a performance analysis framework that evaluates the advantages of employing user scheduling in MIMO-OFDM systems employing OSFBC in conjunction with adaptive modulation schemes. They derive analytical expressions for the average spectral efficiency (ASE), the average bit error rate (BER), the outage probability, and the average channel capacity for different scheduling and adaptive modulation schemes. Discrete-rate and continuous rate adaptive modulation schemes are employed to increase the spectral efficiency of the system. They assume a signal to-noise-ratio (SNR)-based user-selection scheme and the well known proportional fair scheduling (PFS) scheme.

In 2011,Ashutosh Dubey et al. [17] proposed a Modernize SLM (MSLM) scheme to reduce the PAPR by using the complex signal separate into real & imaginary parts and individually phase sequence multiple real as well as imaginary part of complex signal then select minimum PAPR signal of real &

imaginary and these are combine. The simulation show achieves good PAPR, which is a strong candidate for Future wireless communication.
In 2011, George A. Ropokis et al. [18] present an analytical bit error rate (BER) performance study of three detect-and-forward (DaF) policies under a common framework. More specifically, the direct, threshold and link-adaptive schemes are studied, which differ in the way the decision on the transmitted symbol is forwarded from the relay to the destination. The analysis is carried out for a single relay DaF transmission protocol and takes into account the symbol decision errors that may occur at the relay. Simple closed-form analytical BER expressions are derived for all three schemes, which are completely verified by simulations.

In 2011,Vikas Gupta et al. [19] present a comprehensive analysis of MC-CDMA system over the AWGN (Additive White Gaussian Noise) and Raleigh channel for different number of subcarrier and different number of users, system analysis is performed by simulating the MC-CDMA using MATLAB program, and finally they also presents a comparison between simulated and theoretical results.

In 2012, Rekha et al. [20] proposed algorithm which extends the CM criterion to blind equalization using complex exponential basic expansion model (CEBEM) and the channel is assumed as time varying MIMO-FIR. The methods only employ the Second order statistics (SOS) and finally, it estimates only one pulsation. In this way, the system increases the SNR of the transmitted symbols and produces most beneficial result in time-varying channels. The fast convergence is also achieved through zero forcing equalization.

In 2012, Santanu Kumar Sahoo et al. [21] proposed an adaptive model for a digital communication system based on RLS algorithm with binary input signal. Also, the LMS (Least mean Square), RLS (Recursive Least Square) structures are simulated for linear and nonlinear channels. Convergence characteristics, along with bit-error-rates are analyzed for better performance of these equalizers than the standard equalizers.

In 2012, Mohamed Samir et al. [22] proposes an enhancement to the performance of a Direct Sequence Code Division Multiple Access (DS-CDMA) system by utilizing an adaptive filter in the presence of different jamming techniques. In order to combat the impact of such jamming, the adaptive filter utilizes three adaptive algorithms which are the Variable Step-Size Affine Projection (VSS-APA) algorithm, the Generalized Normalized Gradient Descent (GNGD) algorithm, and the Generalized Square-Error-Regularized (GSER) NLMS algorithm. According to the authors these algorithms have the advantages of fast convergence, low steady state mean squared error and the ability to improve the bit error rate (BER) performance of the conventional CDMA system, in the presence of multi-path, multiple-access, and different jamming signals. Results show that the VSS-APA outperforms other algorithms in the presence of barrage jamming. Whereas in the presence of partial band jamming the GSER-NLMS adaptive filter gives the best performance.

3. BER Performance Analysis

The MC-DS-CDMA systems are more sensitive to errors in time. Timing error caused by mismatch of sampling time between the transmitters and receiver degrades performance of the system seriously because timing destroys orthogonally among sub-carriers.

The results of the BER performance of MC-DS-CDMA system on the effect of timing are discussed here.
Terminology:

1. 'N' denotes the number of sub-carriers;
2. 'L' is the length of spreading code;
3. 'a' corresponds to the level of correlation of the timing jitters, for instance, 'a=0' corresponds uncorrelated timing jitter and 'a=1' means fully correlated timing jitter.

The mean of the BER play the part on the carry through of sickly, balanced and pure metre are presented. The dashed hook forth connection denotes the BER make believe affected by white timing jitter. The dashed subservient alongside dignitary open-handedness the BER deception due to correlated timing.

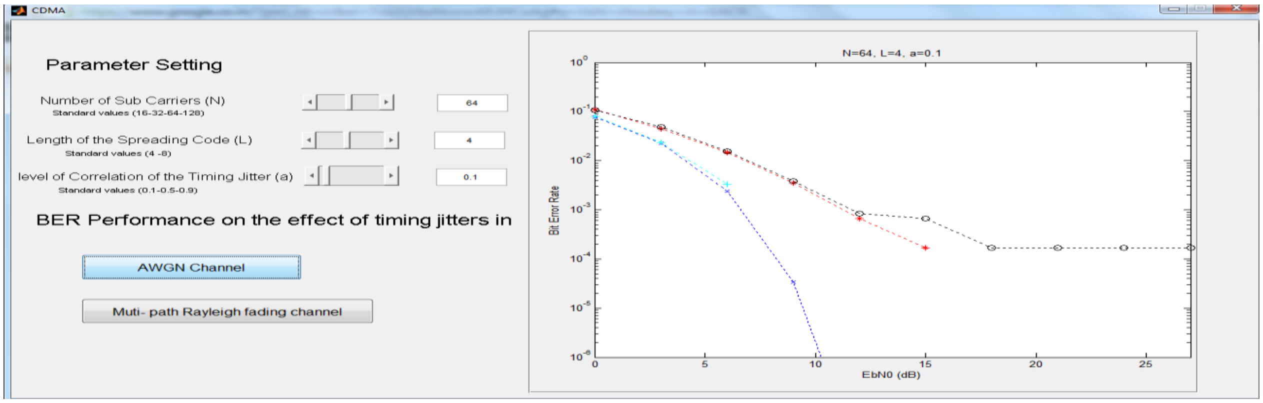

Figure 1: BER Performance under AWGN Channel

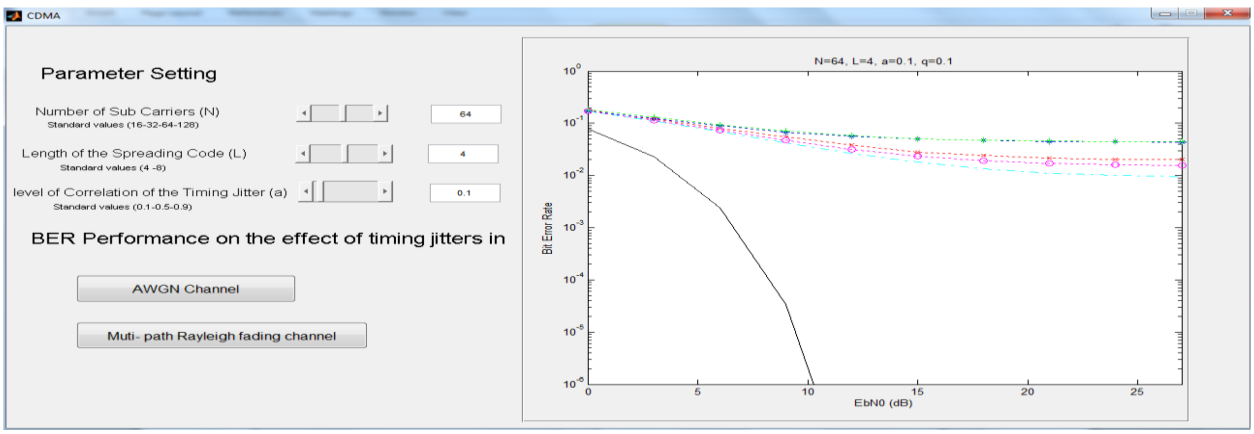

Figure 2: BER Performance under Rayleigh Fading Channel

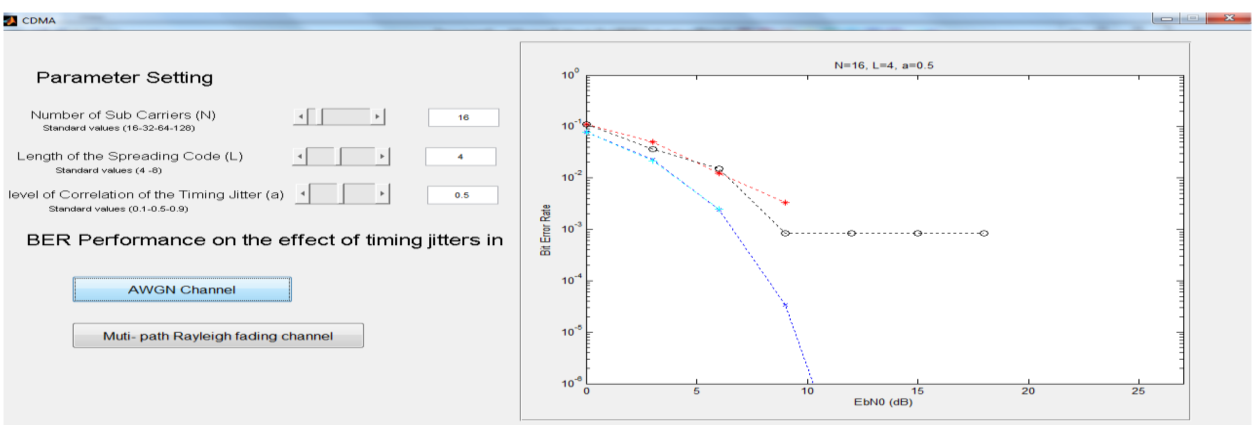

Figure 3: BER Performance under AWGN Channel

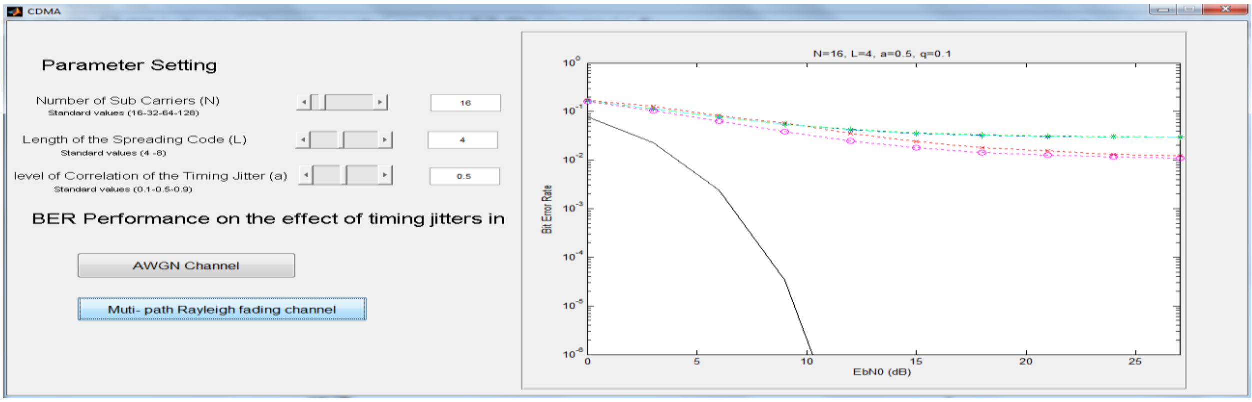

Figure 4: BER Performance under Rayleigh Fading Channel

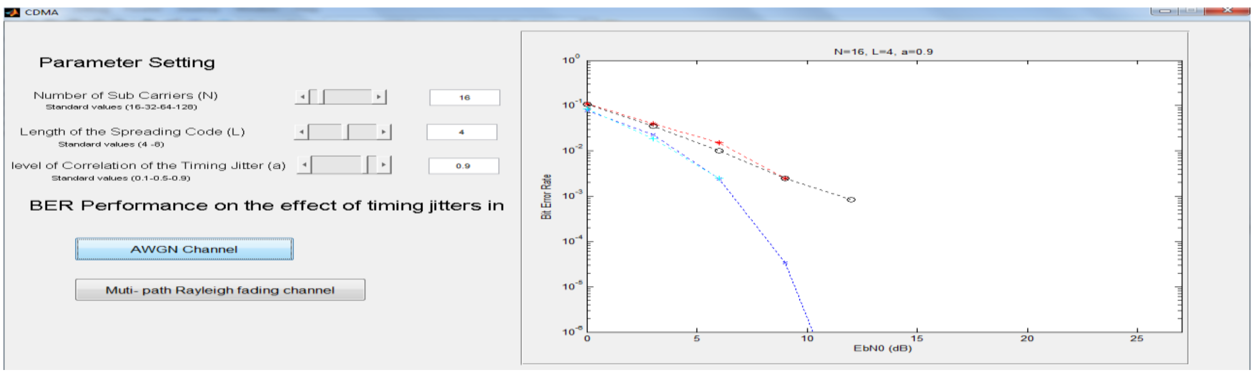

Figure 5: BER Performance under AWGN Channel

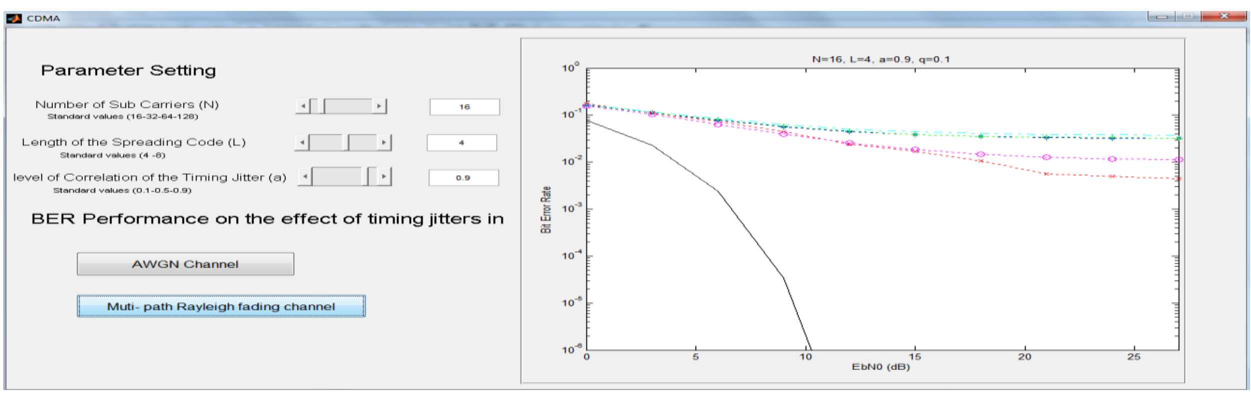

Figure 6: BER Performance under Rayleigh Fading Channel

4. Conclusion

In this paper the analyzed the performance of MC-DS-CDMA system under the effects of timing has under AWGN channel and multi-path Rayleigh fading channel with bit error rate.

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