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BIT-ERROR RATE ANALYSIS OF OFDM-MC-CDMA SYSTEM UNDER AWGN AND RAYLEIGH FADING CHANNEL

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ABSTRACT

Multicarrier code division multiple access (MC-CDMA) is a novel radio access scheme that combines time domain spreading and multicarrier modulation suffer from the interference among users. This work is devoted for reducing and analyzing the bit error rate of the system proposed. 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 fadingchannel.

KEYWORDS: CDMA, multicarrier, interference, Additive white Gaussian noise (AWGN), Multi-Carrier Code Division Multiple Access (MC- CDMA).

INTRODUCTION

In recent years we have witnessed an increasing popularity of multimedia applications that run on personal mobile devices. Services such as high quality video calls, mobile TV, audio and video contents on demand and various interactive

map/locator services (such as GPS) are becoming widely supported in new generations of personal mobile devices. A majority of these services require a minimal guaranteed data rate between users (or between a user and a base station) in order to provide a minimal predefined quality of service, which puts a demand on transmission bandwidth and need for spectral efficiency on wireless channels. To provide support for bandwidth demanding applications on the physical layer, future standards need to specify both bandwidth requirements and type of signaling that achieves the data rate required for minimal predefined qualities of services for future applications.

Frequency bands used by mobile devices are strictly specified by responsible regulatory bodies, which set limits on the bandwidth available for communication. Therefore, a very natural and important question is what the maximum data rate is (equivalently, information rate) at which reliable communication over a mobile channel of a given bandwidth is attainable. This quantity is known as the channel capacity. For AWGN channels of a given bandwidth, Shannon.[1] has derived the well-known expression for the maximum data rate that can be achieved, for reliable communication. That is, the average bit error rate (BER) can be made arbitrarily close to zero by use of channel coding, for transmissions up to the maximum achievable rate. For mobile channels, that are time-varying and dispersive in time and frequency however, the channel capacity derivation is still an open research area. In this context, we point out the lack of equivalent vector channel models for realistic continuous-time SISO and MIMO dispersive fading channels. Such models serve as the foundation upon which channel capacity results are derived.

Multi-carrier code division multiple access (MC-CDMA) technique, which is a combination of orthogonal frequency-division multiplexing (OFDM) and code division multiple accesses (CDMA), has been considered as an important technique for the future generation wireless systems due to its bandwidth efficiency, frequency diversity, and immunity to channel dispersion. OFDM has already been employed in many areas, such as digital audio and video broadcasting, wireless local/metropolitan area networks, and asynchronous digital subscriber lines (ADSL).

Overview of work already done in the field

The multipath propagation causes arbitrary time dispersion, attenuation, and phase shift, known as fading, in the received signal.[1,4] Fading is caused by interference between two or more versions of the transmitted signal which arrived at the receiver at slightly different times.[5] 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.[6]

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 ratherthan conventional one dimensional O-CDMA codes, namely unipolar time-spreading codes. Basic one-dimensional asynchronous codes are optical orthogonal codes (OOCs),[10] and prime sequence codes (PSCs),[11] also known as prime codes.

In 2010, Mohammad Torabiet 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.

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 ofthe 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 bestperformance.

Ber Performanceanalysis

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"denotesthe number of sub- carriers;
2. "L" is the length of spreadingcode;
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 timingjitter.

The mean of the BER play the part on the carry through of sickly, balanced and pure metreare 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 correlatedtiming.

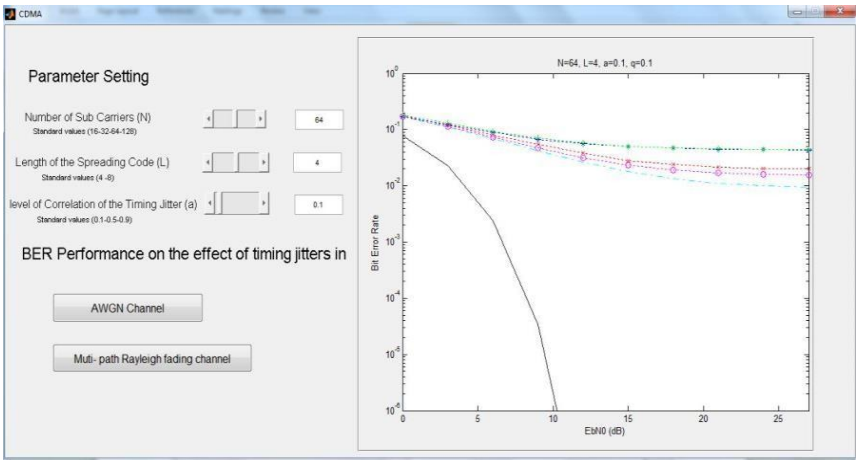

Figure 1: BER Performance under AWGN Channel.

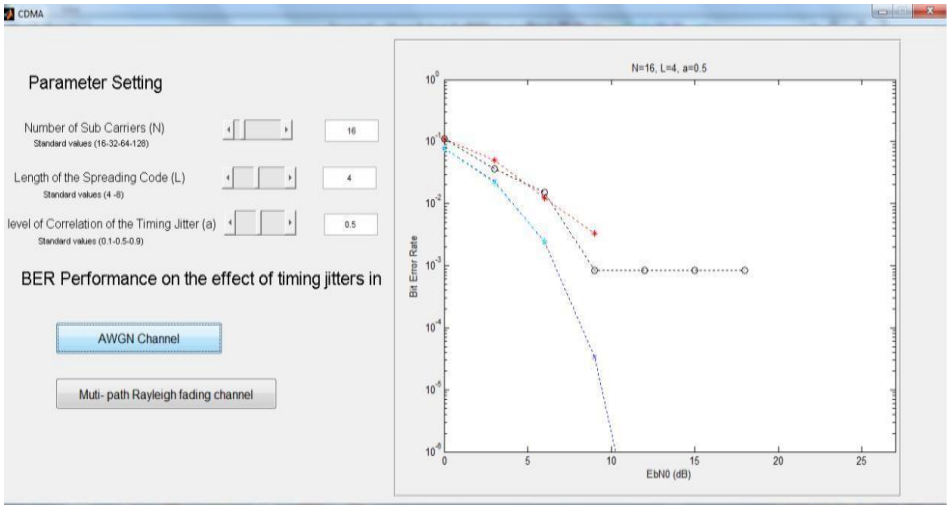

Figure 2: BER Performance under Rayleigh Fading Channel.

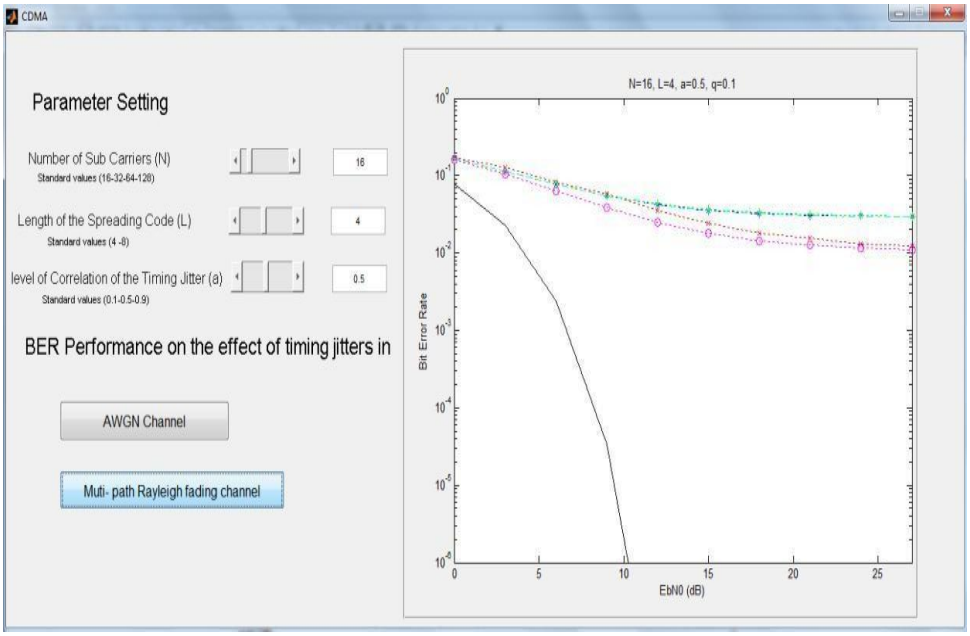

Figure 3: BER Performance under AWGN Channel.

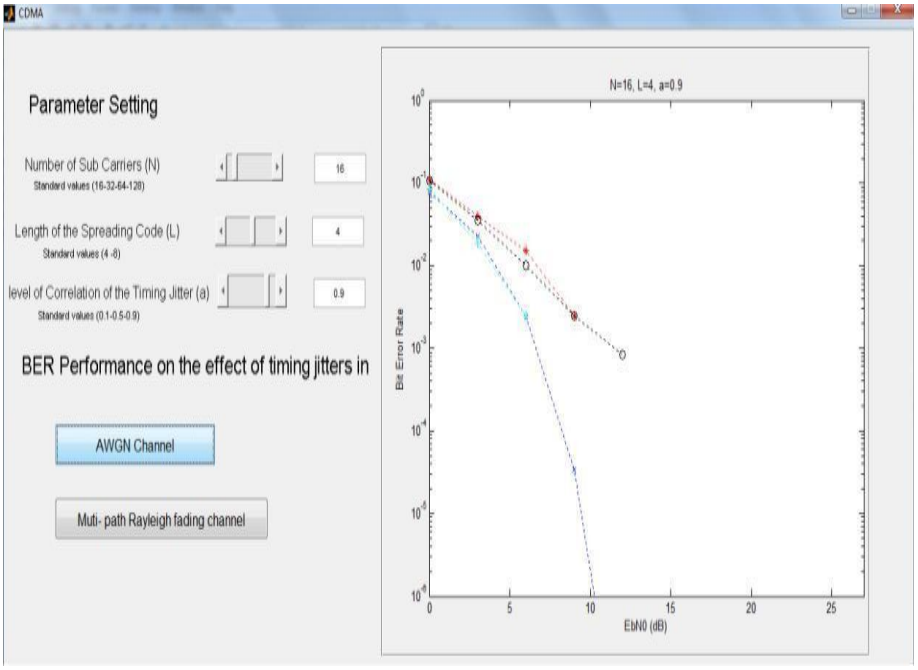

Figure 4: BER Performance under Rayleigh Fading Channel.

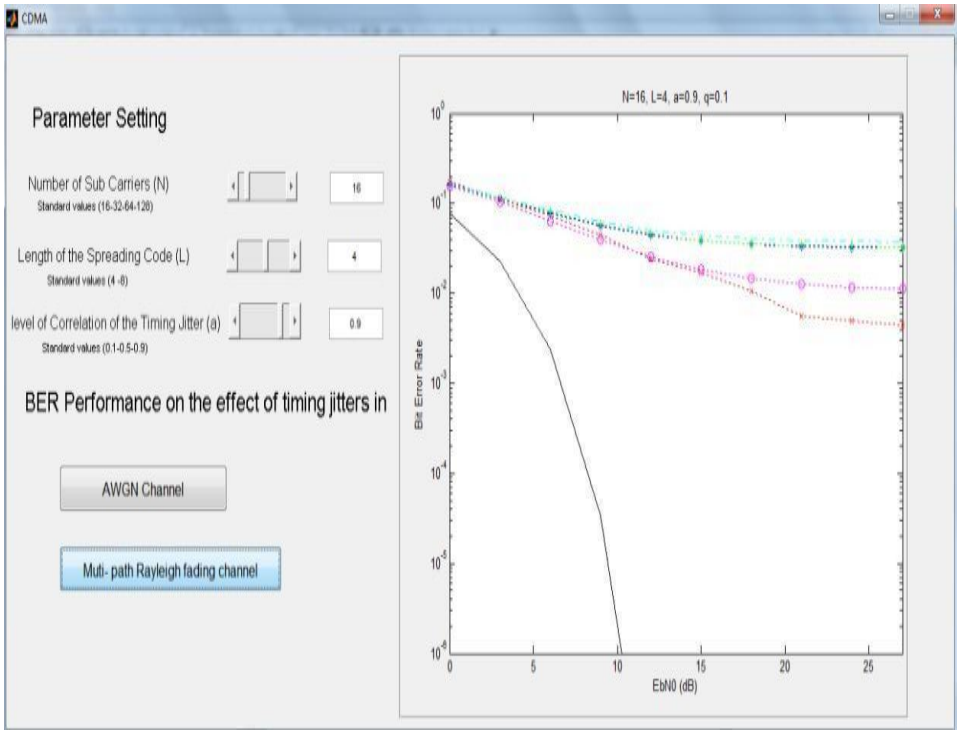

Figure 5: BER Performance under AWGN Channel.

CONCLUSION

Orthogonal Frequency Division Multiplexing (OFDM) modulation has been widely used in communications systems due to its robustness against multipath distortion and fading. Application examples include the DVB-T and ISDB-T digital terrestrial

television systems. To achieve acceptable performance the insertion of both reference pilot carriers and intersymbol time guard intervals are necessary. Performance improvement under deep fading and impulsive noise is usually improved by employing long time interleaving (e.g. up to 0,5s in the ISDB-T system). However, time interleaving does not reduce total bit error rate; burst errors are spread in time until the average bit error rate is reduced within the capabilities of an error correcting code. There is the need of finding time errors.

In this we survey several aspects of multicarrier code division multiple access (MC-CDMA). We also analyses the BER. We discuss several related study in the direction of the survey and present the analysis based on the study and discussion.

In this work we analyzed the performance of proposed system under the effects of timing under AWGN channel and multi-path Rayleigh fading channel with bit error rate.

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