Performance Analysis of 2*6 MIMO-MC-CDMA in Different Modulation Technique

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Abstract- *In this paper we estimate the performance analysis of 2*6 MIMO-MC-CDMA system in Rayleigh fading channel in numerous modulation techniques through MATLAB to determine optimized BER. Code Division for Multiple Access is a multiple user method that utilizes the spread spectrum system in which spreading of sequence is to be done through means of PN sequence generator. This system then combined with OFDM that is a multi-carrier system in which numerous broadband frequency selective carrier signals is rehabilitated into parallel flat fading narrowband multiple sub-carriers to elevate the performance of system, moreover their amalgamation of systems forms MC-CDMA system. Now arrangement further improved by means of implementing 2*6 MIMO system which means two transmit as well as six receive antennas respectively that utilizes the ZF decoder at the receiver to trim down bit-error-rate through transmit diversity of ½ rate convolutionally encoded Alamouti Space Time Block Code is utilized, which optimized the performance of the 3G as well as 4G communication system through reducing BER as well as improving gain in QPSK, 8-PSK, 8-QAM, 16-QAM, 32-QAM and 64-QAM modulation techniques.*

Keywords- CDMA, OFDM, MISO, MIMO-MC-CDMA and MC-CDMA.

I. INTRODUCTION

The linear Zero Forcing (ZF) receiver was primarily estimated for MIMO MC-CDMA scheme in which it demonstrated superior act intended for single user condition. Even with the fact that its performance is steadily degraded into multiuser case and high error appears in the middle of SNR range due to multiple access interference (MAI) and particular erroneous propagation. As explicate before, existing effort on MIMO MC-CDMA has revealed that the amalgamation of MC-CDMA systems all over MIMO technology for multiuser communications is not a basic system due to the event of interference formed from multiple antenna transmission and interference caused during multiple users that is Multiple User Interference (MUI). So, main plan of this reading has to offer ways to build up downlink MIMO MC-CDMA systems accordingly to overcome multi-access interference, in addition to outperform available techniques in provisions of system performance as well as by means of reducing difficulty.

One main plan of consequent generation wireless communication systems is the requirement of supplementary energy competent technologies. Saving power is not merely reduces functioning rate but also reduces the greenhouse gas release which is important for combating environment transform. For this reason, reduction of the energy utilization for least quantity is enormously important for the prospect wireless systems. In the earlier time, resource allotment has been worn in the way to diminish the total transmitted power into MC-CDMA systems. This mostly improves the energy usefulness of the system.

So, one extra important objective of this job is to reduce bit error rate of plan through forming a particular user MIMO-MC-CDMA organization for MIMO synchronization via MC-CDMA Space Time Block Code (STBC) i.e. spatial diversity technique so as to helps to lessen bit error rate. Bit error rate is additional optimized by convolution code as forward error improvement manner in MIMO-MC-CDMA system to estimate them in different modulation technique.

II. THEORETICAL BACKGROUND

2.1. MIMO MC-CDMA

MC-CDMA is a mixture of system of OFDM and CDMA technologies. This technique allows the various users to run the wireless channel concurrently by modulating and spreading their input data signals in frequency domain by different spreading orders. MC-CDMA combines the multipath fading of OFDM among the multi-user access of CDMA [21].

2.1.1 System Model of MC-CDMA

The MC-CDMA system model for Nu users is represented in Figure 1. The message data are combined into Nu frames and then every frame is modulated to P symbols.

So the symbol matrix for user nu (nu = 1, 2,……..Nu) can be shown as dnu =[$d_{nu,1}$ $d_{nu,2}$ …………… $d_{nu,P}$]^{T}€ C^{P*1}. The symbols of every user are changed firstly serial-to-parallel then swell with the related specific user spreading order to form the chip-level transmit matrix i.e.

$$s_{nu} = [s_{nu,1}\, s_{nu,2} \ldots\ldots\ldots\ldots\ldots\ldots\, s_{nu,PG}] = d_{nu} \otimes c_{nu} \text{ € } C^{1*PG} \quad (1)$$

where ⊗ represents the Kronecker product and the signature order of user nu is shown as

$$c_{nu} = \left[c_{nu,1} c_{nu,2} \ldots\ldots\ldots\, c_{nu,G} \right] \text{ € } C^{1*G} \quad (2)$$

in which C is the spreading code chip alphabet and G is the length of the spreading order. Every user is owed by a distinct spreading code for orthogonality among the users to differentiate. The chips of the frames of every users are then joint and all parallel data orders are mapped into Ns = P*G subcarriers and changed into the time domain by the IFFT [21]. The subcarrier is correlated to the p-th symbol (p = 1, 2,…………, P) and the g-th chip (g = 1,2,...,G) by

$$i(p,\, g) \; = \; (p \; - \; 1)G \; + \; g \quad (3)$$

It must be illustrious that the subcarrier index i, symbol index p, and chip index g are organized together by (2). That’s why the related symbol and chip indexes for i-th subcarrier are

$$p(i) \; = \; (i \; - \; 1) modG \; + \; 1 \quad (4)$$

And

$$g(i) \; = \left\lfloor \frac{(i-1)}{G} \right\rfloor + 1 \quad (5)$$

correspondingly where $\lfloor a \rfloor$ expresses the largest integer that is minor than a. The transmitted i-th multiplexed chip of every users can be illustrated as

$$x_i = \sum_{nu=1}^{N} s_{nu}, i = \sum_{nu=1}^{N} c_{nu}, g(i) d_{nu}, p(i) \quad (6)$$

The output from IFFT is supplementary with CP before transmission above the wireless multipath fading channel. The channel is known as quasi-static frequency selective fading corrupted by AWGN by power spectral density of N_0. The duration of CP is larger than the maximum remain spread of the channel to keep away from ISI.

On receiving the signal, cyclic prefix is detached and the FFT of size Ns is perform. The received signal model after FFT can be represented by

$$r_i = H_i x_i + \; n_i \quad (7)$$

The estimates of the transmitted chips of other subcarrier can be obtained by performing Zero Forcing equalization on all subcarrier as reprented by

$$y_i = H_i^{-1} r_i = H_i^{-1} H_i x_i + H_i^{-1} n_i = x_i + \check{n}_i \quad (8)$$

The chip estimates are then de-spreaded with the desired user's spreading order can be represented as

$$z_{nu,\,p} = \sum_{g=1}^{G} c_{nu,\,g}\, y(i) = d_{nu,\,p} + \sum_{g=1}^{G} c_{nu,\,g}\, \tilde{n}_i \quad (9)$$

The possible p-th symbol exposure for the nu-th user is performed by slicing $z_{nu,p}$ using the quantization action Q(.) with respect to the type of assemblage in use

$$d_{nu,p} = \; Q(z_{nu,p}) \quad (10)$$

IV. SIMULATION RESULTS AND DISCUSSION

Table 1 depicts the simulated model parameters of MIMO-MC-CDMA in *QPSK, 8-PSK, 8-QAM, 16-QAM, 32-QAM and 64-QAM* modulation technique. Figure.1. shows performance investigation of MIMO-MC-CDMA in *8-PSK, QPSK, 8-QAM, 16-QAM, 32-QAM and 64-QAM* modulation scheme, Table 2 shows the BER as well as gain comparison in 64-QAM results shows that QPSK have very low BER as well as high gain in comparison to all other modulation technique. This gain evaluation is done in -5-dB SNR since at 0-dB BER of QPSK attained to zero so high performance is attained in QPSK. Figure.1 shows MIMO-MC-CDMA in various number of modulation technique. For 3G and 4G wireless communication to improve system performance we use MIMO-MC-CDMA [12-21] procedure for attaining high performance in QPSK modulation technique.

Table.1. Summary of simulated model parameters.

No. of bits transmitted by user	1560
No. of transmitting and receiving antennas	2*6
Channel Encoder	½ rate convolution encoder
Modulation Schemes	QPSK, 8-PSK, 8-QAM, 16-QAM, 32-QAM and 64-QAM
Signal detection scheme	Zero forcing
Channel	Rayleigh Fading Channel
Signal to Noise Ratio	-10dB to 20 dB
CP Length	1280
OFDM Sub-carriers	6400

Table.2. Performance analysis of MIMO-MC-CDMA in number of modulation technique in terms of gain w.r.t 64-QAM with reference to fig.5.1 in -5dB SNR:

Modulation	**BER**	**Gain w.r.t 64-QAM**
QPSK	0.005577	33.351dB
8-QAM	0.06269	12.335dB
8-PSK	0.1033	7.997dB
16-QAM	0.1287	6.087dB
32-QAM	0.2171	1.546dB
64-QAM	0.2594	0dB

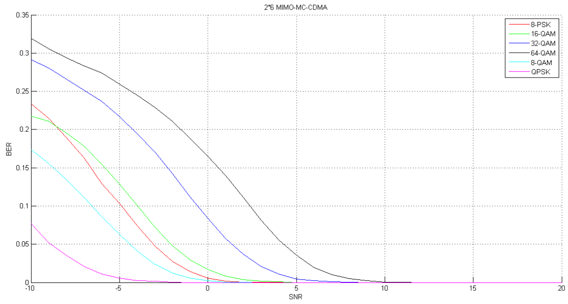

Figure.1. Performance analysis of 2by2 MIMO-MC-CDMA in *QPSK, 8-PSK, 8-QAM, 16-QAM, 32-QAM and 64-QAM.*

V. CONCLUSION

Fig.1 shows the comparative examination of MIMO-MC-CDMA in various number of modulation methods that represents the comparative analysis for different modulation echniques which shows that as modulation order is augmented then there is increase in BER. This thesis aims to lessen bit error rate which is represented by QPSK modulation scheme at the gain of 33.351 dB with respect to 64-QAM that shows that the gain of QPSK is higher as compared to other modulation technique with less probability of error. For 3G, 4G and 5G communication 64-QAM modulation scheme is utilized that contain BER up to 10dB, that means errors are removed in 64-QAM at 10dB of SNR that results by using 2by6 MIMO-MC-CDMA technique. Finally 2by6 MIMO-MC-CDMA gives optimized output as compared to other diversities in 64-QAM modulation technique that is mainly employed for 3G & 4G wireless communication.

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