Quest Journals
Journal of Electronics and Communication Engineering Research
Volume 3 ~ Issue 6 (2016) pp: 01-05
ISSN(Online) : 2321-5941
www.questjournals.org

Research Paper

Performance of OFDM PAPR by Using Turbo Code System

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Received; 14 October 2016 Accepted; 23 November 2016;

ABSTRACT: *OFDM is one of the proven multicarrier modulation techniques, which provides high spectral efficiency, low implementation complexity, less vulnerability to echoes and non-linear distortion. This technique is used by almost all 3G wireless standard and above. The every technique has some pit fall. The one major shortcoming in the implementation of this system is the high peak-to-average power ratio of this system. There are several techniques has been identified by researcher to overcome this problem. Selected Mapping (SLM) and Clipping Techniques are promising techniques to reduce the PAPR for OFDM. Almost all PAPR reducing techniques are degrading the BER performance. In this Paper we used these techniques with CC and RS code to improve BER. The performances of the system with and without the algorithm are also compared.*
Keywords: *Orthogonal frequency division multiplexing (OFDM), Peak-to-average power ratio (PAPR), Iterative clipping and filtering, selected mapping (SLM), BER,and Complementary Cumulative Distribution Function (CCDF).*

I. INTRODUCTION

The development of next generation mobile telecommunication system the 4th in line was inspired by the increasing user demands considering the data rate in 3G standards, OFDM(orthogonal frequency division multiplexing)modulation is efficient and robust technique which is capable to tackel fast variations and frequency selectivity of radio channel. high data rate transmission over mobile or wireless channels is required by many applications, however the symbol duration reduces with the increases of the data rate and dispersive fading of wireless channels will cause more severe inter symbol interference (ISI).if single carrier modulation such as in time division multiple access (TDMA)or global system for mobile communication(GSM),is still used to reduce the effect of ISI. The symbol duration must be much larger than the delay spread of wireless channels, in orthogonal frequency division multiplexing (OFDM) the channel is divided into many narrow band sub-channels, which are transmitted in parallel to maintain high data rate transmission and at the same time to increase the symbol duration to minimize ISI. The flexibility in OFDM provides opportunities to use advanced techniques such as adaptive loading, transit diversity and receiver diversity to improve transmission efficiency. Shannon's classical paper in1948[1] suggested that the highest data rate can be achieved for frequency selective channels by using an infinitely dense set of sub-channels and adapting transmission powers and data rates according to the signal–to-noise ratio(SNR) at different sub channels.

The Capacity in wireless system can significantly be improved if multiple transmit and receive antennas are used to form multiple-input multiple output(MIMO)channels. a MIMO system can improve the capacity by a factor of the minimum number of transmit and receive antennas for flat fading or narrow band channels for wideband transmission it is natural to combine OFDM with space time coding (STC) or spatial temporal processing deal with frequency selectivity of wireless channel and to obtain diversity and capacity gains .therefore MIMO-OFDM has widely used in various wireless systems and standards.

Peak to Average Power Ratio

PAPR is defined as the maximum power occurring in the OFDM transmission to the average power of the OFDM transmission. Mathematical representation has been given below [2] and [1].

$$\text{PAPR}=\frac{P_{peak}}{P_{average}} = 10log_{10}\frac{\max[|X_n|^2]}{E[|X_n|^2]} \quad (2)$$

Where, P_{peak} = peak power of the OFDM system

$P_{average}$ = average power of the OFDM system.

Mimo-Ofdma System Model

In this section a model is been given for multiuser MIMO-OFDM transmission, with its block scheme Before starting a brief summary provided about the three essential schemes as our point of view.

OFDM (Orthogonal frequency division multiplexing) modulation generates several sub channels (or subcarriers) on orthogonal frequencies, which allows realizing parallel communication on the carrier with the need of guard frequency bands. Broadband data is multiplexed onto the carriers. Resulting in traffic with low data rate on them. In terms of computational complexity OFDM scheme provides a transmission structure which is made resistant against multipath fading effects.

OFDMA (Orthogonal frequency division multiple Access) means further advancement in terms of spectral efficiency by the exploit of the location dependent multiuser-diversity and represents the most efficient multiple access technique based on OFDM modulation. In OFDMA, the entire bandwidth is divided into a number of sub channels for parallel transmission of symbols from different users. OFDMA is being investigated as one of the most promising radio transmission techniques for LTE of the 3rd Generation Partnership Project (3GPP).

MIMO-OFDMA is a combination of downlink MIMO transmission and OFDM based multiple accesses. In MIMO (Multiple-Input Multiple-Output) communication System exploits the degrees of freedom introduced by multiple transmitted and received antenna to offer high spectral efficiency. In narrow band channels, when channels state information is available at the transmitter and instantaneous adaptation is possible, the capacity achieving distribution is found by using the well known water filling algorithm.[3,4]

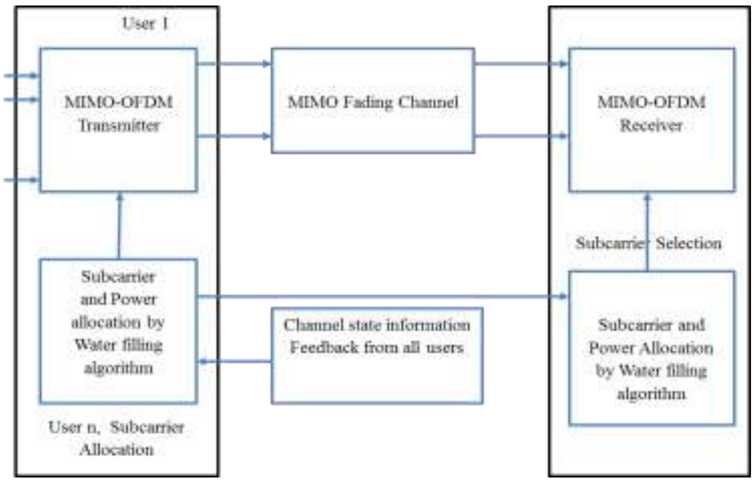

Fig.1. MIMO-OFDMA System model

As shown in Fig.1 subcarrier and power allocation algorithm is done at the transmitter side by knowing the availability of exact channel state information (CSI).Here each transmitter and receiver antenna is assigned to an individual OFDM transmitter and receiver. General parts of typical MIMO-OFDMA scheduling task and subcarrier allocation.Power control on per carrier basis, antennas on selected carriers etc. We consider a system with K users and N subcarriers and assume that the numbers of receive antennas and transmit antennas are N_t and $N_r$respectively. User $K(1 \leq k \leq K)$on subcarrier n($1\leq n \leq N$) is assigned a power $P_{k,n}$ and the corresponding channels state matrix is $H_{k,n}$ with dimensions $N_r \times N_t$ Assuming the eigen values of $H_{k,n}H_{k,n}^H$ are $\{\lambda_{k,n}^i\}_{i=1}^M$, where M=min($N_r, N_t$).for values of k and n there is a group of Eigen channels denoted by the above Eigen values. Here is a Eigen value $\lambda_{k,n}^i$ which is much larger than other values present in the group according to SVD decomposition. We use this Eigen channels to feedback channel state information (CSI).which makes subcarrier and power allocation decisions

MIMO-OFDMA channel model

The channel matrix in case of multiuser and multicarrier system. The matrix describes the channel behavior on a particular subcarrier (n) for a particular user (k),$H_{k,n}$denote it. In OFDM transmission in multi-user environment during a multi-user OFDM transmission the introduction of a k×n×$N_t \times N_r$Is given

Here k and n represents the number of users and subcarriers respectively n represent the number of users and subcarriers respectively. Which as follows—

$$H=\begin{pmatrix} H_{1,1} & H_{1,2} \dots \dots & H_{1,n} \\ H_{2,1} \ \ddots & H_{k,n} & \vdots \\ H_{k,1} \dots \dots & \dots & H_{k,n} \end{pmatrix} \qquad (1)$$

Where $H_{k,n}$ is already defined.
AMC

TURBO CODE
(a) Turbo encoder:-

Turbo code is based on convolutional encoding, was introduced by Berrou et al in 1993. The idea behind encoders and inter-leaver is

- If two encoders are used should be normally identical.
- The code should be in a systematic form. The input bits occur in output (shown in figure 2).
- The inter-leaver reads the bits in a pseudorandom order.

The bits are scramble in a pseudo-random fashion by inter-leaver because for two reasons. First, if the input to the second encoder is interleaved, its output is usually quite different from the output of first encoder. One of the output code words has low weight, then the other doesn"t, and there is a smaller change of producing an output with very low weight.

Higher weight is beneficial for good performance of the decoder.

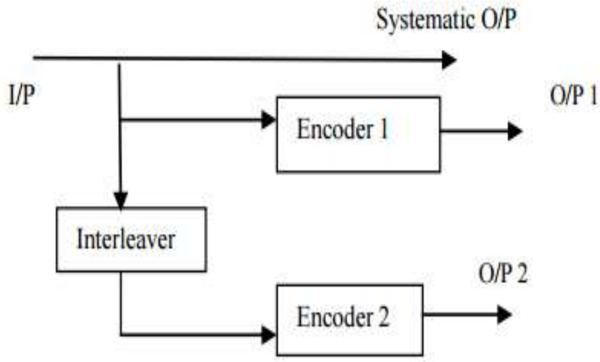

Fig 2: The Turbo Code encoder. [4]

Secondly, the code is parallel concentration of two codes; the divide-and-conquer strategy can be employed for decoding. If the input of second decoder is scrambled, its output will be different and uncorrelated from first encoder. The corresponding two decoders will gain more information exchange. For short block sizes, the odd-eveninter-leaver has been found to outperform the pseudorandom inter-leaver and vice-versa. The choice of inter-leaver is important part in the success of the code. [4]

(b) Turbo decoder: -

The first requirement of decoder is decoder should able to use soft input and produce soft output. Number of decoder work in a pair to estimate original information bits. The decoder work on Maximum A posteriori Probability (MAP) and output soft decision information from noisy parity bits.

The MAP algorithm minimizes the probability of bit error by using the entire received sequence to identify the most probable bit at each stage. The MAP algorithm does not constrain the set of bit estimates to necessarily correspond to a valid path. So the results can differ from those generated by a Viterbi decoder which identifies the most probable valid path.

A soft-in-soft out (SISO) decoder receives as input a soft" valve of signal. The decoder then outputs for each data bit an estimate expressing the probability that the transmitted data bit was equal to one. The number of decoders equal to number of encoders. Each decoder provides estimates of same set of data bits all in a different order. In decoding process all intermediate valves are soft valves, the decoder can gain more from exchanging information, after appropriate record of valves. Initially, first decoder starts estimating information (are set to 0). After that in subsequent iterations, the soft decision information of one decoder is used to initialize the other decoder and so on. The decoder information is cyclic around in a loop until soft decision can"t come on a stable set of values. Number of time information can be iterated to enhance the system performance. After every round, decoder re calculate their estimates.

Only in final stage will hard decisions be made, each bit is assigned by 1or 0. The turbo code uses three simple ideas: parallel concatenation of codes to allow simpler decoding; interleaving to provide better weight distribution; and soft decoding to enhance decoder decisions and maximize the gain from decoder interaction. But turbo code is difficult to implement. [5]

II. RESULT

The OFDM-PAPR with turbo code system are simulated with the following parameters

S. No.	Parameter	Specification
1	FFT size	256
2	Cyclic Prefix	1/4
3	FEC code	Turbo coding
4	Channel	AWGN ,Rician ,Rayleigh
5	Modulation technique	QAM
6	SNR range	0:24

The comparisons have been performed with the different detection technique for different modulation scheme. The AWGN channel is used to avoid the complexity of fading effect and determine good BER performance .The result is given below.

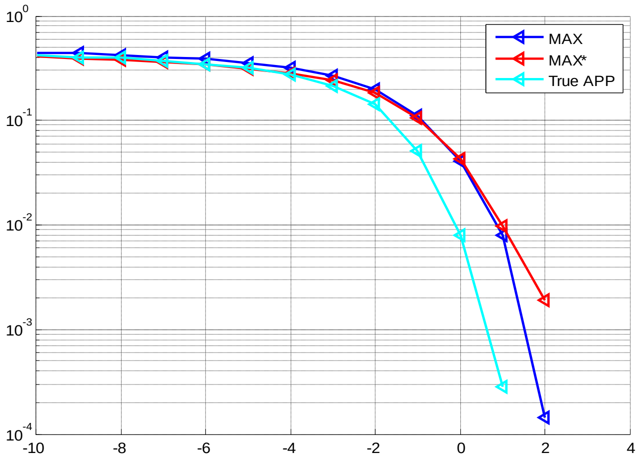

Figure 7.9 BER Comparisons between different decoding techniques for turbo code with QPSK modulation over AWGN channel

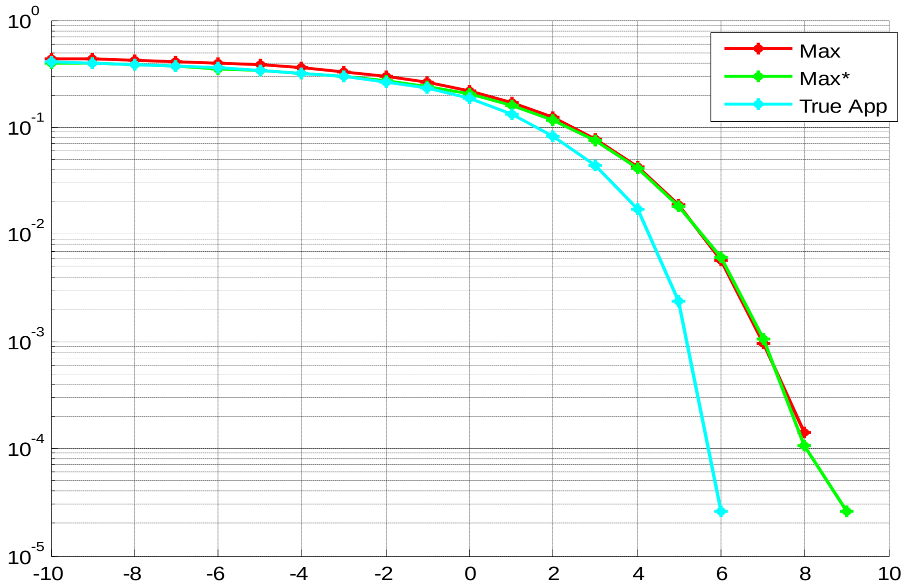

Figure 7.10 BER Comparisons between different decoding techniques for turbo code with QAM modulation over AWGN channel

III. CONCLUSION

The BER performance is also evaluated for various detection technique of turbo code. The true APP technique are found better than MAX and MAX* detection techniques. The numbers of iteration are reducing to half in the true APP compare to other for similar BER performance.

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REFERENCE

[1]. Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G.Kang, "MIMO-OFDM Wireless Communications with MATLAB" Book IEEE Press Conference, 2010.
[2]. Emilia Kasper "Turbo Codes" ekasper[at]tcs.hut.fi http://www.vashe.org "Turbo_Code_Primer" July 4, 2005.
[3]. HemanthSampath, ShilpaTalwar, Jose Tellado and VinkoErceg, Iospan Wireless Inc. ArogyaswamiPaulraj, Iospan Wireless Inc. "A Fourth-Generation MIMO-OFDM Broadband Wireless System: Design, Performance, and Field Trial Results" IEEE Communications Magazine September 2002.
[4]. HrudanandaPradhan, Dissertation on "Block Turbo Code And Its Application To OFDM For Wireless Local Network" Department Of Electrical Engineering National Institute Of Technology Rourkela 2007-2009.
[5]. Hongwei Yang, Alcatel Shanghai Bell Co., Ltd. "A Road To Future Broadband Wireless Access: MIMO-OFDM Based Air Interface" IEEE Communications Magazine 2005.