Review on PAPR Reduction Techniques in MIMO OFDM Channel

Yuvraj Pant[1], Sanjeev Kashyap[2]
Research Scholar[1], Assistant Professor[2]
ECE Department Green Hill College of Engineering, Solan, Himachal Pradesh

Abstract **-** OFDM (Orthogonal Frequency Division Multiplexing) has been raised another tweak method. Due to its favorable circumstances in multipath blurring channel e.g. vigorous against ISI, ICI and some different favorable circumstances like best QoS for different clients, effective utilization of transfer speed it is recommended to be the tweak strategy for cutting edge 4G systems e.g. LTE. Be that as it may, alongside every one of its points of interest there are a few inconveniences moreover e.g. High PAPR (Peak to Average Power Ratio) at the transmitter end and BER (Bit Error Rate) at the accepting end. Since OFDM is just utilized as a part of the downlink of 4G systems. To diminish the issues of OFDM a few systems e.g. SLM, PTS, Clipping, Coding, and Pre-coding and so on are proposed however none of them is lessen the PAPR and BER to a worthy esteem. This Paper will examine a few systems of PAPR and BER decrease, and their focal points and weaknesses in detail

Keywords **-** *PAPR, PTS, CLIPPING*

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is an effective technique to mitigate ISI(Inter Symbol Interference). OFDM is a frequency division multiplexing (FDM) scheme utilized as a digital multi-carrier modulation method. In other words OFDM is frequency division multiplexing of multi-carriers, which are orthogonal to each other i.e. they are placed exactly at the nulls in the modulation spectra of each other. This makes OFDM spectrally more efficient. In OFDM data is divided into several parallel data streams or sub-channels, one for each sub carrier which are orthogonal to each other although they overlap spectrally Each sub-carrier is modulated with a conventional modulation scheme(such as QAM or PSK) at a low symbol rate maintaining total data rates similar to conventional single-carrier modulation schemes in the same bandwidth. In today's scenario MIMO is very useful with the combination of OFDM system. Exploiting the flexibility of MIMO systems in order to have high data rates is an especially attractive research topic for future scheduling scheme designs and their applications. Multiple-input multiple-output (MIMO) systems offer much larger channel capacity over traditional single-input single-output (SISO) system.

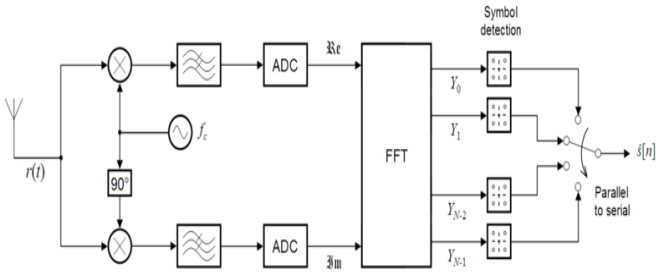

Figure 1.1 OFDM Block Diagram

II. PAPR REDUCTION TECHNIQUES

Peak-to-Average-Power Ratio is challenging thing in the multi-carrier systems which uses OFDM. It creates problem because they create uniform envelope. Linear distortion and spectral spreading is the result of high peak signal which amplifies the power to non0-linear region. PAPR reduce the orthogonality and leads to distortion and inter carrier interference.

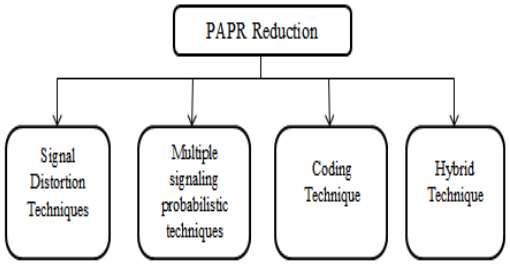

Figure 1.2 PAPR reduction Techniques.

A. Signal Distortion techniques: In this type of reduction signal is altered in the wave form. Distortion is divided into two parts that are linear and non-linear. Some signal distortion approaches are following:

- Clipping and filtering
- Peak Cancellation
- Peak windowing
- Companding techniques.

B. Multiple signaling and probabilistic approaches: These types of approaches are based on the multiple signal and probabilistic function. Some of them are defined below:

- Selective Mapping
- Partial transmit sequence
- Tone injection
- Active constellation injection

C. Coding techniques: In this types of techniques code is used for correcting the errors occurred in the OFDM. This code may be occurred linearly in blocks and some time in turbo way. These are the methods used in coding techniques:

- Linear Block Coding
- Golay Sequence
- Turbo Coding

D. Hybrid Techniques: These techniques are the combination of two techniques which is used to reduce the PAPR error in the OFDM. These techniques provide the effective results in error reduction because two approaches perform effectively. Mostly used hybrid approaches are:

- Joint clipping and commanding
- Joint ACE and Clipping
- Joint PTS-QC approach.

III. RELATED STUDY

Joo, Hyun-Seung, et al. worked upon partial transmit schemes without side information to reduce the peak-to-average power ratio of OFDM. The proposed method does not transmit the side information for identifying a rotating vector. Maximum likelihood detector is used to extract the side information from received signal and recover the data sequence. The maximum likelihood method is used to calculate the distance between the signal constellations and rotated by phase offset [1]. Kumar, Arun et al. designed MIMO-OFDM by using 4: 8 antenna and OSTBS encoder which combines the different techniques and used to control the inter-symbol interference. Performance evaluation of the proposed system is done by using Bite error rate, signal to noise ratio, constellation plot and MSE [2]. Zheng, Beixiong, et al. Investigates the MIMO-OFDM with index modulation method which provides the flexible trade-off between spectral efficiency and error performance in 5G wireless communication. In this work author detects the interchannel interference which is a challenging task. It is done by using low complexity detectors which is based on Monte carlo theory. These detectors work on the sub-blocks level and sub-carriers level to reduce the complexity [3].

Basar, Ertugrul. et al. investigates the MIMO-OFDM with index modulation method which provides the flexible trade-off between spectral efficiency and error performance in 5G wireless communication. In this work minimum means square error detector and maximum likelihood detector are proposed for performance investigation [4]. Pachori, et al. proposed a combination approach called active partial sequence to reduce the PAPR in OFDM under fading environment. In this approach approximate gradient is combined with partial transmit sequence approach. This approach provides the same data without disturbing the performance of the BER and provides the effective quality of service in wireless communication [5]. Azhar experimented on indoor wireless communication at one giga bits per second. The communication is performed by using MIMO-OFDM which supports visible light communication [6].

Hammerstrom et al. proposed an approach for power allocation which amplify and forward MIMO OFDM relay links. The work is done on the time and space domain to transfer the power over the subchannels. Two optimization processes is done in this work that are separate optimization of source and joint optimization of source [7]. Yang et al. gives a brief overview on MIMO-OFDM which is based on air-interface which includes spatial channel modeling, design of transreciever and channel estimation. It also works on error correction code method [8]. Stuber focused on the challenges in OFDM system design, space time approaches for OFDM and analog beam forming techniques which uses adaptive antenna. This work is also consider the implementation of MIMO-OFDM [9]. Barhumi worked on the channel estimation process by using least square channel approach in OFDM. In this work firstly means square error is calculated and then optimal pilot sequences and optimal placement. Recursive LS scheme is proposed to enhance the channel estimation. RLS algorithm enhances the gain in signal to noise ratio.

Table 1.1 Comparison of various PAPR reduction approaches.

Name of approaches	Name of Parameters			
	Distortion Less	Data Rate Loss	BER Improved	Power Increase
PTS	Yes	Yes	Yes	No
SLM	Yes	Yes	Yes	No
Companding	No	No	No	Yes
PW	No	No	No	Yes
DCT-SLM	Yes	Yes	Yes	Yes
Peak cancellation	No	No	No	No

IV CONCLUSION

The high PAPR is thought to be one of the real downsides of OFDM frameworks, in light of the fact that the extensive flag vacillation offers ascend to the low power effectiveness. In this paper, we gave a diagram of the traditional PAPR diminishment plans such as cut-out, SLM, PTS, TR, TI, and ACE, and their changes for accomplishing a low computational unpredictability. In spite of the fact that numerous PAPR decrease plans have been created, none of them fulfills business prerequisites or has been received as a standard for remote correspondence frameworks. In any case, the adjusted PAPR lessening plans with low computational many-sided quality can be connected to high information rate OFDM frameworks. Future examinations on PAPR lessening may incorporate a blend of various

V. REFERNCES

[1]. Joo, Hyun-Seung, et al. "New PTS Schemes for PAPR Reduction of OFDM Signals Without Side Information." *IEEE Transactions on Broadcasting* 63.3 (2017): 562-570.

[2]. Kumar, Arun, and Manisha Gupta. "Design of 4: 8 MIMO OFDM with MSE Equalizer for Different Modulation Techniques." *Wireless Personal Communications* 95.4 (2017): 4535-4560.

[3]. Zheng, Beixiong, et al. "Multiple-input multiple-output OFDM with index modulation: Low-complexity detector design." *IEEE Transactions on Signal Processing* 65.11 (2017): 2758-2772.

[4]. Basar, Ertugrul. "On multiple-input multiple-output OFDM with index modulation for next generation wireless networks." *IEEE Transactions on Signal Processing* 64.15 (2016): 3868-3878.

[5]. Pachori, Khushboo, and Amit Mishra. "PAPR Reduction in MIMO-OFDM by using active partial sequence." *Circuits, Systems, and Signal Processing* 34.12 (2015): 3999-4010.

[6]. Azhar, Ahmad Helmi, T. Tran, and Dominic O'Brien. "A gigabit/s indoor wireless transmission using MIMO-OFDM visible-light communications." *IEEE Photonics Technology Letters* 25.2 (2013): 171-174.

[7]. Hammerstrom, Ingmar, and Armin Wittneben. "Power allocation schemes for amplify-and-forward MIMO-OFDM relay links." *IEEE Transactions on Wireless Communications* 6.8 (2007).

[8]. Yang, Hongwei. "A road to future broadband wireless access: MIMO-OFDM-based air interface." *IEEE communications Magazine* 43.1 (2005): 53-60.

[9]. Stuber, Gordon L., et al. "Broadband MIMO-OFDM wireless communications." *Proceedings of the IEEE* 92.2 (2004): 271-294.

[10]. Barhumi, Imad, Geert Leus, and Marc Moonen. "Optimal training design for MIMO OFDM systems in mobile wireless channels." *IEEE Transactions on signal processing* 51.6 (2003): 1615-1624.