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A SURVEY: PEAK AVARAGE POWER RATIO REDUCTION IN OFDM USING SLM TECHNIQUE

Amit Kumar, Himanshu Gupta, Mr. Sharad Kumar Gupta

ABSTRACT

In wireless communication, parallel transmission of symbols using multi carriers is applied to achieve high efficiency in terms of throughput and better transmission quality. Orthogonal Frequency Division Multiplexing (OFDM) is one of the techniques for parallel transmission. It effectively mitigates the effect on performance due to Inter-symbol Interference and delay spread caused by wireless medium. However, high peak to average power ratio (PAPR) is a major demerit of OFDM system. High PAPR leads to increased complexity of circuit and reduced efficiency of RF amplifier.This paper presents a survey of PAPR Reduction using all proposed techniques.

KEYWORDS: OFDM, PAPR REDUCTION, SLM, IFFT ETC.

I.INTRODUCTION

A. OFDM ( )

OFDM is a special form of multicarrier modulation scheme, which divides the entire frequency selective fading channel into many orthogonal narrowband flat-fading sub channels, in which high-bit-rate data stream is transmitted in parallel over a number of lower data rate subcarriers thereby substantially reducing the ISI due to larger symbol duration [2].The fundamental principle of OFDM originates from the paper by Chang [3], and over the years a number of researchers have worked on this technique [4]-[9].

Despite its conceptual elegance, its use was initially limited to military systems, such as KINEPLEX, KATHRYN and ANDEFT [2] due to its implementation difficulties.

Weinstein and Ebert's proposal to use the Discrete Fourier Transform (DFT) to perform the subcarrier modulation with a single oscillator [5] was a pioneering effort. Ebert, Salz and Schwartz demonstrated the efficacy of Cooley Tukey fast Fourier transform (FFT) algorithm to further reduce the computational complexity of DFT [10], thereby making it possible to utilize the OFDM technique in commercial communication systems. Its use in commercial systems started with a number of wire-line standards, which included High bit rate Digital Subscriber Lines (HDSL) [11], Asynchronous Digital Subscriber Lines (ADSL) [12], and Very high speed Digital Subscriber Lines (VDSL) [12], to support a throughput upto 100Mbps.

B. PAPR REDUCTION TECHNIQUES

A lot of techniques presents for the reduction of this PAPR [1]. About some of the reduction techniques like Clipping and Filtering, Coding, Partial Transmit Sequence, Selected Mapping, Tone Reservation, Tone Injection, Active Constellation Extension are briefly described here.

1. Clipping and Filtering

This is a simplest technique used for PAPR reduction. Clipping [8] means the amplitude clipping which limits the peak envelope of the input signal to a predetermined value.

However this technique has the following drawbacks:
• Clipping causes in-band signal distortion, resulting in Bit Error Rate performance degradation.
• It also causes out-of-band radiation, which imposes out-of-band interference signals to adjacent channels. This out-of-band radiation can be reduced by filtering.
• This filtering of the clipped signal leads to the peak regrowth. That means the signal after filtering operation may exceed the clipping level specified for the clipping operation.

2. Coding

The coding technique [10] is used to select such code words that minimize or reduce the PAPR. It causes no distortion and creates no out-of-band radiation, but it suffers from bandwidth efficiency as the code rate is reduced. It also suffers from complexity to find the best codes and to store large lookup tables for encoding and decoding, especially for a large number of sub carriers.

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3. Partial Transmit Sequence

In the Partial Transmit Sequence (PTS) [11] technique, an input data block of N symbols is partitioned into disjoint sub blocks. The sub carriers in each sub-block are weighted by a phase factor for that sub-block. The phase factors are selected such that the PAPR of the combined signal is minimized. But by using this technique there will be data rate loss.

4. Tone Reservation

According to this technique the transmitter does not send data on a small subset of subcarriers that are optimized for PAPR reduction. Here the objective is to find the time domain signal to be added to the original time domain signal such that the PAPR is reduced. Here the data rate loss will be take place also probability of power increase is more.

5. Tone Injection Technique

The basic idea used in this technique is to increase the constellation size so that each symbol in the data block can be mapped into one of the several equivalent constellation points, these extra degrees of freedom can be exploited for PAPR reduction. Here the transmitted power increases.

6. Active Constellation Extension (ACE) Technique

This technique for PAPR reduction is similar to Tone Injection technique. According to this technique [12], some of the outer signal constellation points in the data block are dynamically extended towards the

outside of the original constellation such that PAPR of the data block is reduced. In this case also there will be increase of transmitted power take place.

7. Selective Mapping method

Selective Mapping method (SLM) is a distortion less PAPR reduction method [7]. In this technique, the transmitter generates a set of sufficiently different candidate data blocks, all representing the same information as the original data block, each block is multiplied with u different phase vectors and selects the most favorable for transmission.

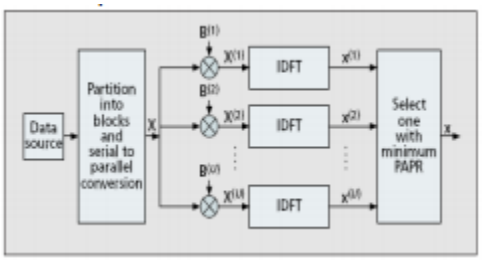

Figure 1: SLM techniques

Information about the selected phase sequence should be transmitted to the receiver as side information to allow the recovery of original symbol sequence at the receiver, which reduces the data transmission rate. SLM needs to transmit bits as side information, where denotes the smallest integer that does not exceed by, and U IDFT operations for each data block. This approach is applicable with all types of modulation and any number of subcarriers. The amount of PAPR reduction for SLM depends on the number of phase sequences U and the design of the phase sequences.

II. LITRATURE SURVEY

Purpose of literature survey is to collect the published information through the various research papers. Filter useful information for research work by doing literature survey. Literature survey interprets old information and generates a combination of new information with old information. So, in this section there is a brief description of various research papers and occurrence of summary and synthesis of research papers.

Zeyad T. Sharef et.al [1] proposed that it has been accepted by the present IEEE standards. In 1980, Hirosaki presented an equalization algorithm to overturn both lay to rest symbol interference (ISI) and ICI, which could must resulted from a channel (frequency) alteration, organization error, or section error. In the interim, Hirosaki similarly regulates QAM modulation, pilot tone, and lattice coding scheme in his high-speed OFDM method, which worked in voice-band spectrum. In 1985, Cimini presented a pilot-centered method to decrease the meddling originating from the multipath and co-channel (frequency)

Kyung ah Kim et.al [2] labeled that OFDM methods have been subjugated for high statistics rate communiqués. In the IEEE 802.11 standard, the carrier frequency can go up as high as 2.4 GHz or 5 GHz. Researchers incline to pursue OFDM operating at even considerable higher frequencies today. For example, the IEEE 802.16 standard recommends yet higher carrier frequencies ranging from 10 GHz to 60 GHz. However,

one of the foremost disadvantages of OFDM is its sensitivity contrary to carrier frequency offset which causes inter-carrier interference (ICI).

T. Jiang and Y. Wu et.al [3] recommended that PAPR ensues due to huge dynamic range of OFDM symbol waveforms. High PAPR in OFDM basically increases because of IFFT pre-processing (i.e. OFDM signal covers a number of separately qualified sub-carriers which can afford a great peak once new up with same units). Here, information symbols crosswise sub-carriers add up to harvest high Peak worth signals.

Ali Nawaz Naqui et.al [4] considered that Network Simulator (NS) version 2.34 is suitable for the calculation of Wi-max. Dissimilar parameters such as distance, number of subcarriers stations, dissimilar kind of modulation patterns and size of connected packet traces the performance of 4G communiqué method i.e. Wi-max communiqué method. Performance analytical parameters like completed put, average delay and average jitter are used to research the performance of Wi-max. Distance between the subscriber station and base station have been dignified for the calculation of Wi-max communiqué method.

Claudio Cicconetti et.al [5] proposed that in multinational zone network for broadband wireless communiqué method, IEEE802.16 mechanism as a normal which provide four dissimilar services to achieve the QOS necessities of software applications. These four dissimilar services are unsolicited grant service (UGS), real time polling service (RTPS), non-real time polling service (NRTPS) and best effort (BE).The chief goal of this research paper is confirmation finished simulation and the efficiency of all these four services in dealing traffic. In Wi-max mechanism on point to point topology with frequency division duplex (FDD) and full duplex subscriber station (SS).

Geeta H. Karande et.al [6]proposed to design an efficient scheme for orthogonal frequency division multiplexing (OFDM) using 8x8 multiple input multiple output (MIMO) antennas. However, the major drawback of MIMO-OFDM system is the transmitted signals on different antennas exhibit high peak-to-average power ratio (PAPR). In this paper the PAPR of 8x8 MIMO OFDM systems is simulated and is shown with the use of SLM techniqueand with 8-PSK modulation comprising of 1024 subcarriers and data rate of 792Mbps results in reduction of PAPR up to 4.17dB.

Mangal singh et.al[7] reviewed that anOrthogonal Frequency Division Multiplexing (OFDM) that is one of the most promising technique for today's wireless broadband communication systems.3GPP's LTE was the first to adopt OFDM as its downlink technique. They also notice the one of the major disadvantage is its high peak-to- average power ratio (PAPR). This author presented two main PAPR Reduction Techniques i.e. Selective Mapping (SLM) and Partial Transmit Sequence (PTS) are discussed along with their advantages, disadvantages and comparison between them.

Arun Gangwar et.al [9] proposed anOrthogonal Frequency Division Multiplexing (OFDM) has become the popular modulation technique in high speed wireless communications. It is more advantageous over other technologies. But despite its advantages it has some obstacles also. The high peak-to average ratio is the main obstacle which causes non-linearity at the receiving end. In this paper they discuss about the PAPR in the OFDM system its effect and name some techniques which can be used to reduce the PAPR according to the requirement.

Sun et.al [13] presented a DCT precoded PAPR reduction technique for MSE–OFDM system and it is shown that DCT based precoding technique can considerably reduce the PAPR without degrading the error performance. In this we proposed another DCT precoder based SLM technique and HADAMARD precoder based SLM and VLM precoding SLM technique for PAPR reduction with less computational complex than other precoders and it does not require any complex optimization technique.

III. CHALLENGES

PAPR reduction technique in OFDM has until now faced a significant challenge: the complexity of the PAPR views rapidly increases when many virtual objects fight for screen space to mark physical entities in the dynamic views of multiple fast-paced roaming users.

1. High PAPR and intercarrier interference (ICI) are the two major issues in the implementation of an OFDM system. OFDM system requires tight frequency synchronization in comparison to single carrier systems, because in OFDM, the subcarriers are narrowband. Therefore, it is sensitive to small frequency offset between the transmitted and the received signal, which may arise due to Doppler Effect in the channel, or due to mismatch between transmitter and receiver local oscillator frequencies. This carrier frequency offset (CFO) disturbs the orthogonality of the subcarriers and the signal on any particular subcarrier will not remain independent of the remaining subcarriers. This phenomenon, known as inter-carrier interference (ICI), is a main challenge in the error-free demodulation and detection of OFDM symbols.

2. Increasing the spectral efficiency of wireless communication systems is one of the greatest challenges faced by wireless communication engineers. The available bandwidth is scarce and costly, whereas, there is a huge demand for data rate created by increasing number of subscribers and increase in multimedia applications, which require large bandwidth.

IV. NEED OF PAPR REDUCTION

The envelope dynamic of signal s(t) can be objectively measured using the parameter calledPeak to Average Power Ratio (PAPR) defined as:

$$\text{PAPR}\{s(t)\} = \frac{\max\{|s(t)|2\}}{E\{|s(t)2\}} \quad (1)$$

The PAPR of OFDM signal with N subcarriers sampled at symbol rate is upper bounded by the value N. This result is quite pessimistic (PAPR of about 18 dB for 64 subcarriers!) and most of the time the instantaneous value of PAPR is much smaller. Statistically it is possible to characterize the PAPR distribution (probability that PAPR exceeds given threshold γ) using its cumulative distribution function (CDF) or complementary cumulative distribution function (CCDF). For the case of OFDM, the following expression for the PAPR CCDF holds [9]:

$$\Pr(\text{PAPR} > \gamma) = 1 - (1 - \exp(-\gamma))N \quad (2)$$

For practical purposes, it is possible to distinguish between the PAPR of pass-band and band pass signal. As derived in [10], the PAPR of real pass band signal is twice the PAPR of corresponding complex envelope. For realistic PAPR CCDF results, the oversampling (usually by zero-padding in the frequency domain) of multicarrier modulation signal is necessary [10]. The oversampling has been used thorough all the experiments described below. The influence of oversampling on CDF and CCDF plots for the case of OFDM system with 64 subcarriers is illustrated on Fig. 2. Note the following relationship between CCDF and CDF:

CCDFPAPR = 1-CDFPAPR (3)

According to [11], the equation 3 is valid also for MC-CDMA downlink and represents the lower bound for MC-DS-CDMA systems. Note that all the assumptions above are valid forsufficiently large *N*. Then, according to the central limit theorem, the real and imaginary part of OFDM signal are Gaussian distributed [12], while the amplitude and phase have Rayleigh anduniform distribution, respectively.
As the PAPR of OFDM system is higher than the PAPR of conventional single-carriersystems, its reduction is desirable.

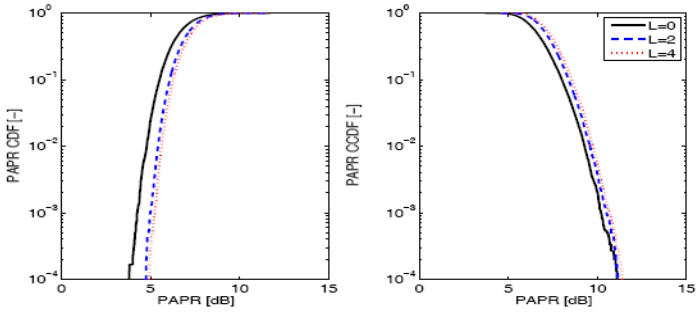

Figure 2: Effects of oversampling on CDF and CCDF for OFDM system. L=0 corresponds to nooversampling, L=2 corresponds to oversampling by factor 2 (1*64 zeros inserted) etc.

V. DISSCUSSION

In above presented literature survey and PAPR technique , we analyze regarding various or many existing research concept in terms of PAPR reduction in OFDM using SLM and various other technique approach which are given us to emerging method about PAPR reduction operation on the bases of OFDM theme that provide consistent communication and aware from the error. In PAPPR environment every reduction techniques are maximize and minimize information related to each session.

VI. CONCLUSION

In this paper, we have analyzed various PAPR reduction techniques and also compared these techniques for different parameters. We observe that SLM is most effective technique to mitigate PAPR to great extent and also improve BER performance of the system.The explanation and research of several techniques of PAPR reduction was discussed and SLM technique. The selected technique provides us

with a good range in performance to reduce PAPR problem. The SLMtechnique that is reduced the PAPR with respect to CCDF transmission subcarrier is much better as compare to other technique but PAPR reduction is high for initial users with same total number of combinations or IFFT for weighting factor 1 and 2 in M-Qam modulation.

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Author Details

First Author

Amit Kumar Diwakar completed Bachelor's Degree from MMMEC,Gorakhpur,U.P in year 2009 and is presently pursuing Master's Degree in Electronics and Communication Engineering from Maharana Pratap Engineering College(046),Kanpur,U.P

Third Author

Himanshu Gupta completed Bachelor's Degree in Electronics & Communication Engineering from Sri Balaji College of Engineer Technology,Jaipur in year 2009 and is presently pursuing Master's Degree in Electronics & Communication Engineering from Maharana Pratap Engineering College(046),Kanpur, U.P.

Second Author

Mr. Sharad Kumar Gupta is working as Associate Professor and Head of the Department of Electronics & Instrumentation Engineering in Maharana Pratap Engineering College(046),Kanpur,U.P.