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Research Article

A Study between SLM and PTS Techniques

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Abstract

Orthogonal Frequency Division Multiplexing or we can also say OFDM is a technique for rapid data-transmission in wireless communication system (applications). A basic problem in OFDM is that the time domain OFDM signal, which is a sum of several signal high peak towards they are leading to power ratio which is average PAPR. Many of the number of techniques for reduction in PAPR in OFDM systems form of system. Here two techniques had been introduced for reducing the PAPR are Selected Mapping or SLM and Partial Transmit Sequence or we can say PTS. We can achieve efficient gains by SLM whereas complexity remains quite moderate. The PTS scheme achieves an excellent PAPR reduction performance of OFDM signals at cost effective. In this paper, we compare the performance of SLM and PTS techniques. The analysis of complementary cumulative distribution function or CCDF of the PAPR being used to measure the performance of reduction techniques also in SLM instead of applying reference data symbols for estimation of channel and synchronization only and carefully selected codeword's can be transmitted on the pilot subcarriers caring additional information about the selected vector mask for PAPR minimization.

Keywords: *Orthogonal Frequency Division Multiplexing (OFDM), Peak- to- average power ratio (PAPR), Selected Mapping (SLM), Partial Transmit Sequence (PTS), Complementary Cumulative Distribution Function (CCDF), Inter-Symbol-Interference (ISI), Fast Fourier Transforms (FFT), inverse fast Fourier transforms (IFFT), IDFT (Inverse discrete Fourier Transform).*

1. Introduction

OFDM is a carrier of multi transmission technique which includes all sub channels are orthogonal to each. This is very favorable technique, mostly in the field of mobile communication. The reason of OFDM can clear main conditions of mobile communication, like multipath fading, mobility and limited bandwidth. The basic principal of OFDM is to split a high of rate data stream into number streams of lower rates that are transmitted alternately over a many of the number or subcarriers. Thus these subcarriers are with each other uniquely overlapped because the duration increases for symbol and lower rate parallel subcarriers. The relating amount of time of dispersion is caused by multipath spread of delay is decreased. Inter-Symbol-Interference (ISI) is dismissing almost complete by introducing a guard time in every OFDM symbol (Jenn-Kaie Lain, Shi-Yi Wu and Po-Hui Yang, 2009). The whole data stream of OFDM is divided into other blocks of N symbols, and every block is multiply with U different phase factors to generate U modified blocks before giving to IFFT block. Every modified block is given to different IFFT blocks to generate OFDM symbols. PAPR is calculated for every modified block and which is having minimum PAPR ratio also select the following block. This technique in PAPR can be reduced considerably.

We can say that this technique will increase circuit complexity since in IFFT it contains many calculations. In SLM method, firstly M statically independent sequences which represent the same information are generated and then the resulting M statically independent data blocks Sm= (Sm,0 , Sm,1 ,Sm,N-1)T, m= 1,2,.....M are then forward into IFFT operation simultaneously. Final stage at the end of receiving the symbol of OFDM Xm = (x1, x2, ... xN)T

Time domain for discrete are acquired and for the vectors of m PAPR are to be calculated individually. Now the sequence xd with the PAPR which is more smaller will be selected for transmission of final series (Seung Hee Han, Student Member, and Jae Hong Lee, Senior Member, 2004).

In The subcarriers in each sub block are multiplied by a phase factors. Also the factors of phase are selected such that the PAPR of the sub blocks is minimized. Techniques used for optimization is to select the factors of phase in order to achieve the above objective. Each of the sub blocks having the lesser or we can say less PAPR and further for the signal which we can say with the combination of the different sub

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blocks is having the minimized PAPR (Namitha.A.S, Amrita Vishwa Vidya Peetham, Sudheesh.P, 2010).

In this section of paper we had defined the method for PAPR reduction technique and their (SLM and PTS) comparison in SLM and PTS.

2. OFDM systems

OFDM is a method which is quite efficient of data of high rate transmission in communication system. System of OFDM consists of large number of sub carriers which are almost independent. They are orthogonal sub carriers are used to carry data and closely spaced (Amrutha.V.Nair and T.Sudha, 2013).

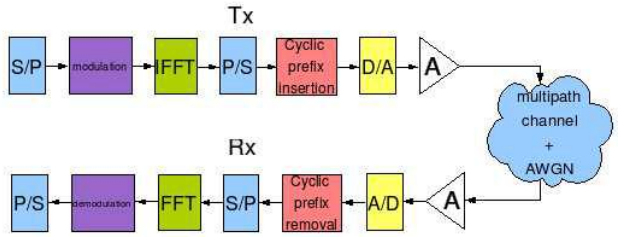

Fig.1 Block diagram of OFDM system

In the section of transmitter we can say in several parallel streams of channels of data is divided for each sub carriers. In shifting with the phase of keying as we can say PSK or quadrature amplitude modulation or QAM mapping techniques those sub carriers are modulated by total transfer of signal in domain of time over a channel is only possible. IFFT performed on this modulated signal with the conversion of OFDM signal in domain of frequency to time. Then cyclic prefix is inserted. The cyclic prefix is a period increment of the part which is probably the last of symbol of OFDM that is added to the front of the symbol in the transmitter before at the demodulation it is being removed. The carriers of sub signals which are probably different are thus added up to from the OFDM signal. Also the signal is amplified using a amplifier of power to overcome the effects of fading and passed through the AWGN of distortion with channel and to be undergoes by signal from white noise in the form of Gaussian and multipath effects. At the receiver section the process goes on at transmitter at operation side is accordingly performed. The data symbols are converted from serial to parallel and using IFFT to achieve the time domain OFDM symbols. Time domain symbols can be represented as,

$$x_n = \text{IFFT}\{X_N\} \quad (1)$$

$$x_n = \frac{1}{N}\sum_{k=0}^{N-1} X_k e^{\frac{j2\pi kn}{N}} \quad 0 \leq n \leq N-1 \quad (2)$$

where,

X_N is the transmitted symbol on the k^{th} subcarrier and N is the number of subcarriers.

3. PAPR problem

Peak power and the average power ratio is to be defined by PAPR

$$\text{PAPR} = \frac{\text{Ppeak}}{\text{Paverage}} \quad (3)$$

$$\text{PAPR}_{\text{dB}} = 10\log\left(\frac{\max\left[x(t)x*(t)\right]}{\left[x(t)x*(t)\right]}\right) \quad (4)$$

Operator which is conjugates corresponds to where ()*also PAPR is a measure of a multicarrier signal. Number of independently modulated symbols to be consisted by the signal of OFDM and the sum of independently ratio of PAPR (Tao Jiang, Yiyan Wu, 2008).

4. SLM technique

In the form to technique as we can say for SLM the input data sequence is multiplied by each of the sequence to generate symbol at input sequences which is almost alternative. Each of these alternative input data sequences made the IFFT operation and then the one among the least or with lower is selected for transmission among PAPR.

The CCDF of the signal of the sequence which is original of PAPR above threshold $PAPR_0$ is written as $Pr(PAPR>PAPR_0)$. Thus for K data independent signal waveforms, CCDF can be written as $[Pr(PAPR>PAPR_0)]^R$. Thus larger the chances of PAPR as we are comparing to threshold Z can be written as

$$P(PAPR<Z)=F(Z)^N=[(1-\exp(Z)]^N \quad (5)$$

Let us now assume about the symbols as M OFDM which is suppose to carry the same information and that they are independent of each other accordingly. In the following case for PAPR the probability is greater we can thus clear that Z is equal to the product which carries for each probability including probability. This process can be written as

$$P[PAPR_{low}>Z]= [P(PAPR>Z)]^M=\{[1-\exp(-Z)]^N\}^M \quad (6)$$

In the method of mapping selection if we talk firstly M statistically independent sequence which represent the same information are generated, and next, the resulting M statically independent data blocks $S_m=[S_{m,0}, S_{m,1}\ldots\ldots, S_{m,N-1}]^T$ for m=1,2,.....,M are then IFFT being forwarded operation according to the sequence as $X_m=[X_1,X_2,\ldots..,X_N]^T$ in discrete time-domain are acquired and then the PAPR among the following vector of M are calculated separately. The sequence x_d with the smallest PAPR is selected for final serial transmission. The following figure 2 shows the basic block diagram technique of SLM for the PAPR (Md. Kislu Noman1, Md. Mojahidul Islam 2, Md. Shafiul Azam 3,Nur Hossain Khan4, 2013).

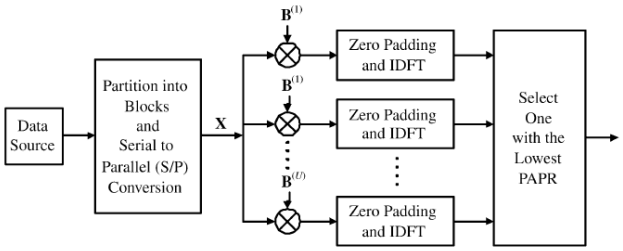

Fig.2 The Block diagram of SLM Technique

5. PTS technique

PTS algorithm refers to a technique which improves the signal which is multicarrier statics. The basic idea of algorithm of PTS is to divide the sequence of OFDM original in to several subsequence and for each subsequence multiplied by different weights whenever an optimum values is chosen

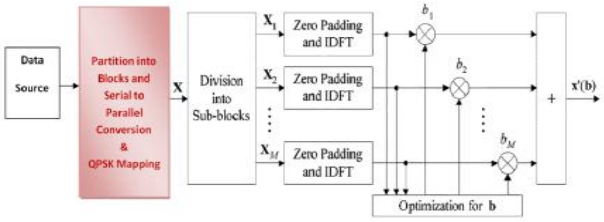

Fig.3 The Block diagram of PTS Technique

The block diagram of conventional PTS is shown in Fig-3. The basic principles of PTS are as follows. Firstly, we use vector data X to define the symbols and secondly, divide this vector into M groups, denoted by { X_m, where m=1, 2..... M}. Then the M group summed up as follows by(Pawan Sharma, Seema Verma, 2010; Guillem Rojo, Milica Stojanovic; Wang Yi Gu linfeng, 2009; Md. Abdullah Al Baki, Mohammad Zavid Parvez, 2010).

$$X'(b) = \sum_{m=1}^{M} b_m X_m \quad (7)$$

Where, {b_m, where, m=1,2..... M} is the weighted coefficient, so that, $b_m=e^{j\phi m}$

$\phi m=[0,2\pi]$ which are commonly can be considered as information which is auxiliary later IDFT is being adopted to X(b), so we obtain X′(b)= IDFT{X(b)}. Instruction of IDFT instruction reference we can use of M separate IDFT given as follows by

$$X'(b) = \sum_{m=1}^{M} b_m \,.\, \mathrm{IDFT}\{X_m\} = \sum_{m=1}^{M} b_m X_m \quad (8)$$

choose appropriate weighted-coefficients {b_m=1, 2....., M}corresponding to minimum PAPR of sequence X(b) described as follows:

$$\{b_1, b_2 \ldots\ldots, b_m\} =$$

$$\arg\min_{\{b_1, b_2, \ldots\ldots, b_m\}} \left(\max_{1 \le n \le N} \left| \sum_{m=1}^{M} b_m . X_m \right| \right)^2 \quad (9)$$

Where, argument (.) represents the sentence condition which defines the function to achieve its least value. Thus M-1 IDFT we use to search the optimized weight coefficients {bm} and to achieve the purpose of reducing the PAPR value in OFDM system (Gaber Ahmed Mahmoud Maha , H. H. M. , Nelly** M.Hussien Ghouz).

6. Simulation and Result

Peak to average transmit power ratio reduction of multicarrier modulation system is called SLM or Selected Mapping thus which is appropriate for a wide applications of range. Significant gains can be achieved by selected mapping where as complexity remains quite moderate. The partial transmit sequence (PTS) scheme achieves an excellent peak to average power ratio or PAPR performance related to reduction of frequency of orthogonal division of multiplexing (OFDM) signals at the cost of extensively finding of all possible phase of rotation combinations which results in high computational complexity. The simulation results show that the performance of SLM and PTS and compare between them.

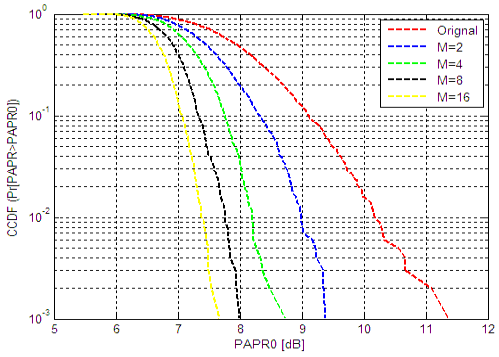

Fig. 4 PAPR reduction of SLM scheme with QPSK modulation

Fig- 4 shows different PAPR values using for SLM technique with M=2,4,8,16. Results shows the greater the no of M will provides better performance, In this simulation minimum PAPR is achieved with minimum no of routes.

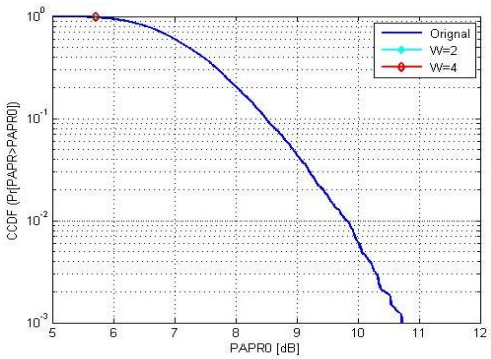

Fig.5 PAPR reduction of PTS scheme with QPSK modulation

Fig-5. shows different PAPR values using PTS PAPR reduction technique with W= 2,4. Result shows that performance are same with W= 2,4 routs.

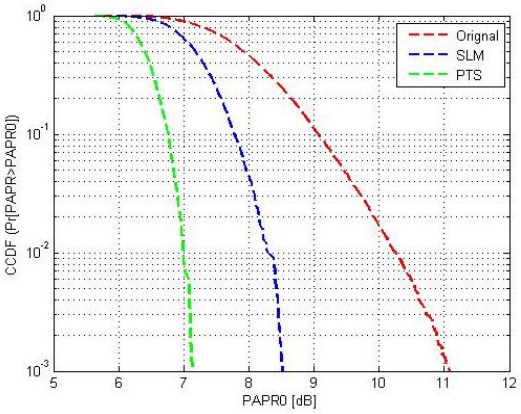

Fig. 6 PAPR comparative performance for SLM and PTS scheme with M=4 and QPSK modulation reduction of PTS scheme with QPSK

Fig-6 shows performance comparison of both schemes SLM PAPR reduction and PTS PAPR reduction using M=4 routes. It is clear by this result the PTS PAPR reduction technique give better performance than SLM technique.

Conclusions

In this paper, we investigate the PAPR reduction techniques, which are selective mapping (SLM) and partial transmit scheme (PTS) .The performance analysis defined PAPR reduction of SLM scheme with QPSK modulation M with Fig- 4, PAPR reduction of PTS scheme with QPSK modulation W with Fig- 5, and comparisons performance for SLM and PTS scheme with M=4 and QPSK modulation respectively thus although the comparison method of SLM and PTS where PTS method performs better than SLM in reducing PAPR method finally we can define on the basis of fig-6, PTS technique better than SLM technique.

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