International Journal of Scientific & Technical Development
(A Peer-Reviewed Bi-Annual Journal) ISSN: 2348-4047

REDUCING BER AND PAPR BY PTS WITH OPTIMIZATION TECHNIQUE

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Abstract
With the modern increasing demand on simultaneous multimedia, voice, video, and data communication over the internet along with the growing interest in the design and development of the next wireless communication systems generation, it has become necessary to develop new transmission techniques that are able to accommodate high bit-rate wideband signals and to cope well with the multipath fading of wireless channels. In this paper proposed approach trying ro reduce BER by PTS with particle swarm optimization
Index Terms-PTS,PSO,Clipping,BER,SNR

INTRODUCTION

In recent years, there is rapid growth in multimedia based applications, which require technologies that support high speed data transmission. To achieve this goal, orthogonal frequency division multiplexing (OFDM) is widely used. Single carrier scheme is easy to use for low data rates because of its simplicity, accuracy. Single carrier scheme saves more power since there is no need to add guard interval while transmitting the signal[7]. Single carrier scheme may have some drawbacks for high data rates including equalizing complexity. OFDM is used to overcome the drawback of single carrier system. Multicarrier (MC) modulation is a widely adopted technique in wireless communications because of its advantages.

With the modern increasing demand on simultaneous multimedia, voice, video, and data communication over the internet along with the growing interest in the design and development of the next wireless communication systems generation, it has become necessary to develop new transmission techniques that are able to accommodate high bit-rate wideband signals and to cope well with the multipath fading of wireless channels[2].

Orthogonal frequency-division multiplexing (OFDM) helps us to encode digital data on multiple carrier frequencies. OFDM has developed into a admired scheme for widebanddigital communication, used in applications such as digital television and audio broadcasting, DSLInternet access, wireless networks, powerline networks, and 4G mobile communications[3].

OFDM is a frequency-division multiplexing (FDM) scheme used as a digital multi-carrier modulation method. To carry dataon several parallel data streams or channels we use large number of closely spaced orthogonalsub-carrier signals[1] . Each sub-carrier is made to modulate using a conventional modulation scheme (such as quadrature amplitude modulation or phase-shift keying) at a low symbol rate, by maintaining total data rates similar to conventional single-carrier modulation schemes in the same bandwidth.

The main advantage of OFDM over single-carrier schemes is the ability to cope with strict channel conditions (for example, to attenuate high frequencies in a long copper wire, narrowband interference and frequency-selective fading due to multipath) without complex equalization filters. OFDM may be viewed as using many slowly modulated narrowband signals rather than one rapidly modulated wideband signal so that channel equalization is simplified[9].

OFDM is a special class of the multi-carrier modulation (MCM).In OFDM modulation scheme, multiple data bits are modulated simultaneously by multiple carriers. This procedure partitions the transmission frequency band into multiple narrower subbands, where each data symbol's spectrum occupies one of these subbands[4]. As compared to the conventional frequency division multiplexing (FDM), where such subbands are non-overlapping, OFDM increases spectral efficiency by utilizing subbands that overlap. To avoid interference among subbands, the subbands are made orthogonal to each other, which mean that subbands are mutually independent[5].

1.1 APPLICATIONS OF OFDM

This section identifies some of the current and future applications of OFDM. OFDM takes its place in the next generation of communication systems because of its high data rates and low complexity. The OFDM technique has considerably found a large number of applications in military systems as well as in many other fields such as DAB(digital audio broadcasting), ASDL(asymmetric digital subscriber lines), and HDTV(high definition television) terrestrial broadcasting. These days the OFDM technique is considered as a strong candidate for the fourth generation (4G) of mobile communication systems [6].

II. INTRODUCTION TO PAPR

The main issue of the OFDM system is high PAPR of transmitted signal in transmitter side which degrades the performance of the system when a non-linear HPA is used. So, it is necessary to use an appropriate PAPR reduction technique at the transmitter side.

PAPR occurs due to large dynamic range of OFDM symbol waveforms. High PAPR in OFDM essentially arises because of IFFT pre-processing (i.e. OFDM signal consists of a number of independently modulated sub-carriers which can give a large peak when added up with same phases).

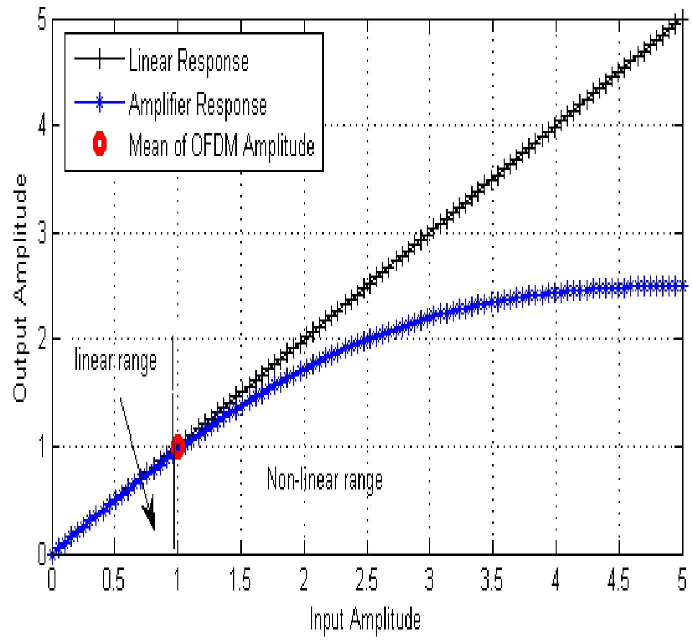


Fig 2.1 Amplifier Characteristics

2.1 IMPACT OF PAPR ON THE SYSTEM

The operating area of HPA is normally at or near the saturation region. Also the nonlinear characteristics of the HPA are very tender to the difference of the signal amplitudes.

This difference in the OFDM amplitudes is very large with high PAPR. So, the high PAPR on the HPA will introduce intermediation between different sub-carriers and interference into the systems. This interference decreases the BER performance. Also, this high PAPR forces the amplifier for having huge back off power for linear amplification of the signal. This type of linear working amplifier has poor power efficiency. Digital to Analog Converter (DAC) should have sufficient dynamic range to accommodate the large peaks of the OFDM signals because of the high PAPR. Even if, a high precision DAC supports high PAPR with low quantization noise but it is very expensive. On the other hand, low precision DAC is cheaper and its quantization noise is more. For large number of OFDM sub-carriers, OFDM signals follow the Gaussian distribution. In such type of distribution average of the peak signal rarely occur and uniform quantization by the Analog to Digital Converter (ADC) is not desirable. If clipping of the signal is done, in-band distortion and out-of-band expansion (adjacent channel interference) will be occurred.

The major impacts of a high PAPR are:

- Increased complexity in the ADC and DAC.
- Reduced in efficiency of radio frequency (RF) amplifiers.

2.2 Mathematical expression of PAPR

An OFDM signal consists of a number of independently modulated sub-carriers, which can give a large PAPR when added up coherently. When N signals are added with the same phase, they produce a peak power that is N times the average power of the signal. So OFDM signal has a very large PAPR, which is very sensitive to non-linearity of the high power amplifier. In OFDM, a block of N symbols{X , k = 0,1,....,N -1} k , is formed with each symbol modulating one of a set of subcarriers, {f , k = 0,1,.....,N -1} k . The N subcarriers are chosen to be orthogonal, that is, f k= k Δf , where Δf=1 NT and T is the original time period.

The resulting signal is given as:

$$X(t) = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} x(k)\, e^{j2\pi kt/N}$$

PAPR is defined as

$$|PAPR| = \frac{\max\,[X(t)]^2}{E[X(t)]^2}$$

Where E[.] denotes the expectation operator, and denotes mean or average value of x(t).

2.3 EFFECT OF HIGH PAPR

High PAPR corresponds to a wide power range which requires more complicated analog-to-digital (A/D) and digital-to-analog (D/A) converters in order to accommodate the large range of the signal power values. Therefore, high PAPR increases both the complexity and cost of implementation .. This additional interference leads to an increase in the bit error rate (BER) of the system. One way to avoid such non-linear distortion and keep low BER low is to force the amplifier to work in its linear region.

III. INTRODUCTION TO PSO AND PTS

3.1 PSO (PARTICLE SWARM OPTIMISATION)

Particle swarm optimization (PSO) is a computational method to optimize a problem by iteratively trying to recover a candidate solution in regard to a given measure of quality. By having a population of candidate solutions and dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity, it solves a problem. Each particle's movement is manipulated by its local best known position but, is also guided toward the best known positions in the search-space, which are updated as better positions which are found by other particles. This is expected to move the swarm toward the best solutions.

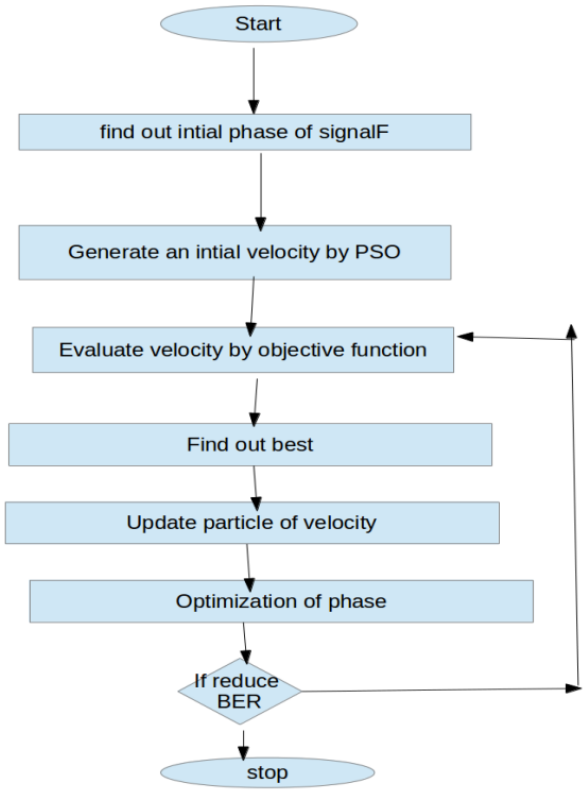
PSO is originally attributed to Kennedy, Eberhart and Shi and was first proposed for simulating social behaviour, as a stylized representation of the movement of organisms in a bird group or fish school. The algorithm was simplified and it was observed to be performing optimization. The book by Kennedy and Eberhart describes many philosophical aspects of PSO and swarm intelligence. An widespread survey of PSO applications is made by Poli. Recently, a comprehensive review on theoretical and experimental works on PSO has been published by Bonyadi and Michalewicz.

PSO makes few or no assumptions about the problem being optimized and can search very large spaces of candidate solutions so it is a metaheuristic. However, metaheuristics such as in PSO there is no guarantee for an optimal solution required by classic optimization methods such as gradient descent and quasi-newton methods.

3.2 PTS(PARTIAL TRANSMIT SEQUENCE):

Partial transmit sequence is a efficient technique which is used to reduce PAPR in the OFDM system. And it can be presented in two main steps. First, by dividing the original OFDM signal into a number of sub-blocks. Secondly, adding the phase rotated sub-blocks to develop a number of candidate signals to pick the one with smallest PAPR for transmission. There is another way that it can also be used to express PTS method by multiplying the original OFDM signal with a number of phase sequence.

III.METHODOLOGY



In this process first the initial phase and initial velocity is generated using PSO. Then we find out the best velocity at which it should be optimized . After optimization we check if the BER is reduced or not . If still not reduced then recontinue to find out the evaluate the velocity using objective function till the required BER is achieved.

IV. RESULT AND DISCUSSIONS

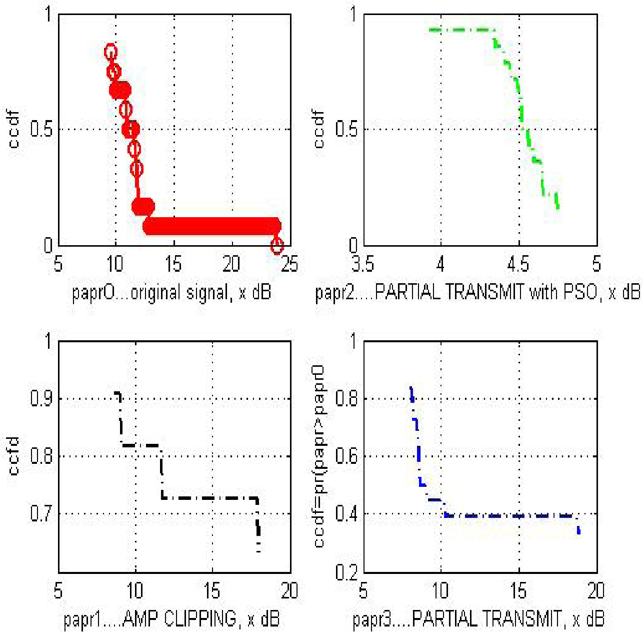
TABLE :SIMULATION PARAMETERS

P ARAMETER DESCRIPTION	
Number of carrier count	123
Bits per symbol	5
Symbols per carrier	12
FFT SIZE	1024
Number of OFDM block	10000
Modulation	QAM
SNR	12
Channel	AWGN

These are the parameters which are used in our required work. The initial SNR whch we have taken is 12 but as we go fuangethur with our work we will observe changes in SNR.

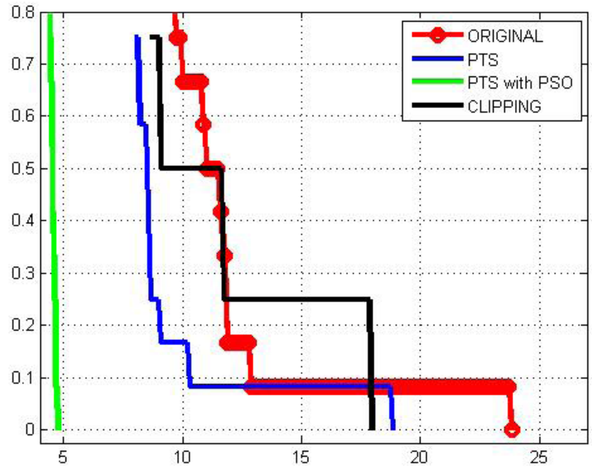
TABLE AT 16 QAM

	ORIGINAL	PTS	PSO with PTS	Clipping
BER	0.2	0.1	0.1	0
SNR	24	18	5	17
Phase Factor	26	18	4.7	16
PAPR	1	0.7	0.5	0.8



This is the graph wich shows us the comparison between three techniques (PTS,PTS+PSO,CLIPPING) used to reduce PAPR in MIMO-OFDM.

Following is the combined graph for PAPR reduction in all the three techniques.



V.CONCLUSIONS

This paper presents the study of existing PAPR reduction and PTS adaptive optimization and proposes improved schemes for PAPR reduction and BER in OFDM systems. This paper also proposes a PAPR reduction scheme for OFDM system utilizing PTS adaptive optimization. Based on the study of PAPR reduction schemes it has been found that the error performance of existing PSO optimization degrade by increasing the parameter controlling the nonlinearity. Based on our findings, an improved PSO optimization scheme i.e. quadrilateral PSO optimization transform has been proposed, which has better flexibility to design the PSO optimization function in comparison to existing PSO optimization schemes. Quadrilateral PSO optimization transform has better BER performance with good PAPR reduction capability in comparison to existing PSO optimization based PAPR reduction schemes. Non-distortion PAPR reduction techniques like PTS and SLM are the two most promising techniques to reduce the PAPR of the OFDM .In result modulation in between 16,32,64 QAM , 16 QAM perform better than other modulation by PTS with PSO increases SNR reduce BER .

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