Review Paper of Hybrid PAPR Reduction Technique for Wavelet Packet Modulation

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Abstract— High peak to average power ratio (PAPR) of transmitted signal is one of the major drawbacks of multicarrier modulation system such wavelet packet modulation system. many PAPR reduction techniques are proposed to solve this problem such as Threshold and clipping method. In this paper a hybrid PAPR reduction method called Threshold –Clipping (TC) method has been proposed.

Key words: Peak to Average Power Ratio; multicarrier modulation; wavelet packet modulation

I. INTRODUCTION

Wavelet Packet Modulation (WPM) is a multiplexing method. In this method an information carrying bits modulate a set of orthogonal wavelet packet waveforms which are combined into a single composite signal. It is a best alternative to the popularly used Fast Fourier Transform (FFT) based Orthogonal Frequency Division Multiplexing (OFDM) [1]. However, high Peak to Average Power Ratio (PAPR) that affects the OFDM is also a problem in WPM. The large peaks increase the amount of inter-modulation distortion resulting in an increase in the error rate. The average signal power must therefore be kept low to ensure that the amplifier on the transmitter side operates in the linear region. Many proposals have been presented to reduce the PAPR in WPM systems [2-6].

Complex Wavelet Packet Transform (CWPT) is an elegant Computational structure introduced [7]. It is a form of discrete wavelet transform, which generates complex coefficients by using a dual tree of wavelet filters to obtain their both real and imaginary parts. The CWPT transform have the following features: such as good directional analysis, low redundancy,

Improved shift-invariance property, simplicity of implementation and reduced computational cost. In [8] Complex Wavelet Packet Modulation (CWPM), that uses CWPT in principle, is proposed as an efficient multicarrier modulation scheme. It has been shown that CWPM have better BER performance than WPM and most multicarrier modulation schemes based on OFDM.

In this paper the performance of all the three PAPR reduction techniques for CWPM system has been evaluated in the noisy and Rayleigh multipath fading channels. These are: threshold Method, clipping method and a proposed hybrid technique Composed of both the threshold and clipping methods.

II. WAVELET PACKET MODULATION

Fig.1 shows WPM system employs two filter banks performs the Inverse Discrete Wavelet Packet Transform (IDWPT) placed on the transmitter side and Discrete Wavelet Packet Transform (DWPT) placed on the receiver side. The input to the inverse wavelet transform is DQPSK real symbol.

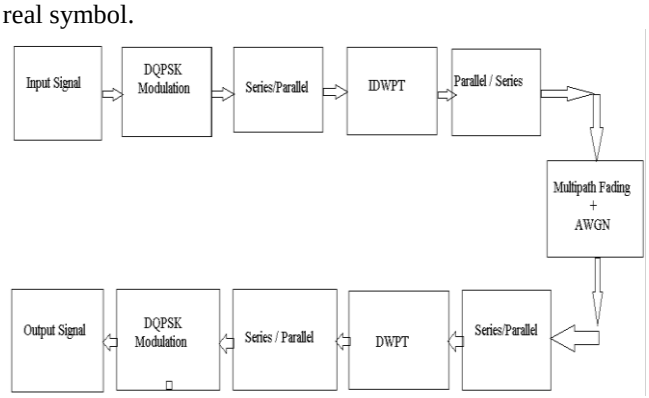

Fig. 1: Block diagram of WPM system

The outputs of two IDWPT are then combined together in complex form to introduce the transmitted signal $x[n]$. The transmitted signal is constructed as the sum of N waveforms $f[k]$ individually modulated with the DQPSK symbols. The IDWPT synthesizes a discrete representation of the transmitted signal as the sum of the N waveforms shifted in time that embeded information about the data symbols. The DWPT at the receiver side recovers the transmitted symbols through the analysis formula that exploits orthogonality properties of DWPT.

III. PEAK AVERAGE TO POWER RATIO REDUCTION

The PAPR of the base band transmitted signal is defined as the ratio of maximum power of the transmitted signal over the average power. Nonlinear distortion in HPA occurs in the analog domain, as the most of the signal processing operation for PAPR reduction occur in the digital domain. The Complementary Cumulative Distribution Function (CCDF) of the PAPR is one of the most frequently used performance measures for PAPR reduction techniques. The CCDF of the PAPR simply shows the probability that the PAPR of data block exceeds a given certain value. The amplitude of OFDM signal therefore has a Rayleigh distribution and its power distribution becomes a central chi-square distribution with zero mean and two degrees of freedom. The distribution obtained by the conventional analysis, however it does not fit into those PAPR of the OFDM signals obtained by computer simulations, even for very large N.

IV. THE THRESHOLD METHOD

The DWT is a batch processing that analyses finite length time domain signal by breaking up the initial domain into two parts: the detail and the approximate information. The approximation domain successively decomposed into detail and approximation and so on. As the discrete Wavelet Transform is scattered over many domains, very few coefficients of DWT dominates the representation. By using

this property, we can reduce the PAPR with little reconstruction loss. Since wavelet transforms always concentrate energy on some given number of bases, we can introduce a threshold T and compare it with the energy of each orthogonal base.

V. CLIPPING METHOD

The clipping method is one of the simplest and widely used PAPR reduction methods in multicarrier communication systems. By using the clipping method, any desired level of PAPR reduction can be achieved by presetting the clipping level at the transmitter. In a clipping based PAPR reduction scheme is investigated with application to WPM. To reduce the effect of nonlinear distortion that has been introduced by the clipping process, the authors in adopt an iterative maximum likelihood (ML) based approach at the receiver side. In this approach, estimates of the transmitted symbols are first attained via the ML detector. These transmitted symbol estimates which are then used to compute an estimate of the nonlinear distortion component. The nonlinear component estimate which is removed from the received signal, and revised Maximum Likelihood estimates(ML) of the transmitted symbols are obtained. The revised ML estimates of the symbols which are transmitted once again used to attain a revised estimate of the nonlinear distortion component. The process of revised nonlinear distortion component estimation and revised ML estimation of the transmitted symbols are repeated iteratively until a desired level of performance has been attained. Bit error rate (BER) results presented in shows the iterative ML receiver based clipping approach can closely mitigate the in-band distortion that introduced by the clipping process with three iterations in an Additive White Gaussian Noise (AWGN) channel. However, in the multipath fading channel, it is basically difficult to estimate the nonlinear distortion component at the receiver.

The clipping method causes both in-band and out-of-band distortion because of the nonlinear operation of clipping process, an in-band distortion causes the degradation of BER, while the distortion also causes out-of-band emission.

VI. THE PROPOSED HYBRID METHOD

By combing the concepts of both the threshold and the clipping techniques, a new formula can be proposed to reduce the PAPR of WPM signal. In this method we will combine output of both the methods and that will resulted into the proposed hybrid method.

VII. CONCLUSION

In this paper, we will investigate the performance of PAPR in wavelet based multicarrier modulation system (WMCM). We will reduce the high PAPR of the modulated signal by using hybrid PAPR reduction technique. we will analyze the performance of PAPR by using Complementary Cumulative Distribution Function (CCDF).

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