ISSN: 2277-5528
Impact Factor: 4.015

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

PERFORMANCE ANALYSIS OF PEAK TO AVERAGE POWER RATIO REDUCTION USING OICF TECHNIQUES WITH OFDM SYSTEM

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ABSTRACT

WiMAX which represents World Interoperability for Microwave Access is a major part of broadband wireless network (BWN), having IEEE 803.16 standard provides innovative fixed as well as mobile platform for broadband internet access anywhere in anytime. It is Wireless communication systems can be found all around the world today. It works on high data rate and it is a wireless technique so fading and attenuation in the signals is presence due to noise, inter symbol interference, inter carrier interference etc. OFDM modulation technique is used to work on multicarrier. OFDM works on orthogonality so presence of ISI is neglected. In this project, we analysis of the original OICF algorithm can achieve the desired PAPR while the simplified one exhibits almost the same performance for a different subcarrier (N=64, 128, 256 and 512), Quadrature phase shift keying (QPSK) modulated with OFDM system and AWGN channel, the PAPR-reduction performance shown between PAPR versus CCDF, with used simulation MATLAB R2013a toll .

Keyword: AWGN, CCDF, IFFT, OFDM, PAPR, QPSK.

INTRODUCTION

WiMAX is an IEEE 802.16 standard based technology responsible for bringing the Broadband Wireless Access (BWA) to the world as an alternative to wired broadband. Orthogonal Frequency Division Multiplexing is an efficient method of data transmission for high speed wireless communication systems. However, the main drawback of OFDM system is the high P. Average Power Ratio (PAPR) of the transmitted signals. Orthogonal frequency division multiplexing consists of large number of independent sub-carriers, as a result of which the amplitude of such a signal can have high peak (P_{high}) values. Coding, phase rotation and clipping are among many PAPR reduction schemes that have been proposed to overcome this problem. Here many different PAPR reduction techniques e.g. Partial Transmit Sequence (PTS), Optimized Iterative Clipping and Filtering (OICF), and Selective Mapping (SLM) are used to reduce PAPR.

ITERATION CLIPPING & FILTERING

The idea of adjacent channel emissions filtering after clipping has been presented in [2] the ICF. As the Filtering of Clipped Signals results in new peaks creation, the techniques of repeated clipping and filtering has been subsequently proposed in [3][4]. This method is based on the zero padding of the signal in the frequency domain (FD) and frequency domain filtering of clipped signal at the output of Inverse Fast Fourier Transform (IFFT). These repetitions result in huge signal processing - for each frequency domain filtering the pair of Fast Fourier Transform (FFT) and IFFT operation is necessary. Its PAPR reduction performance is approaching the PAPR of repeated clipping and filtering method with arbitrary number of repetitions.

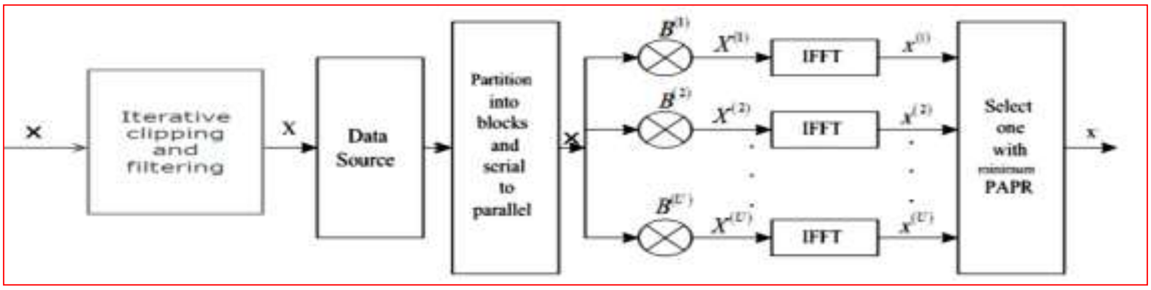

Fig. 1: Block diagram of the proposed method

OPTIMIZED-ITERATION-CLIPPING-FILTERING SCHEME

As mentioned earlier, iterative clipping and filtering (ICF) of 2K+1 IFFT/FFT operations, where K is the number of iterations, is necessary to obtain the desired clipped signal. In target clipped signal was produced through one iteration of (4 IFFT/FFT operations) with some additional processing (two vector subtractions). They assumed the clipped peaks as a series of parabolic pulses, which is true for large clipping threshold. The processing overhead might still be considerable due to the oversampling (by a factor ≥4) of original OFDM data block. In this section, a new scheme one iteration of clipping and filtering (OICF) is presented. As the name implies, this approach produces the desired clipped signal through one iteration with almost no additional processing. The OICF scheme employs a scaling of the original clipping threshold. We have derived an empirical expression based on re-growth of clipped-filter pulses, which relates the original clipping threshold to new scaled one. The simulation results show that the performance of OICF is comparable to the conventional method for large clipping threshold.

ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING

OFDM or multicarrier transmission scheme is an attractive technique for high-bit-rate communication systems. It has been widely used in modern wireless communication because of its high data rate, immunity to delay spread and frequency spectral efficiency and other advantages. Besides these advantages, one of the major drawbacks of OFDM is the high Pack ratio (PAPR) of the Transmitter's output signal, as it restricts the system performance. One of the effective methods used for reducing peak to average power ratio (PAPR) in OFDM systems is partial transmit sequence (PTS). In the conventional PTS (CPTS) several inverse fast Fourier transform (IFFT) operations and complicated calculation to obtain optimum phase sequence, increase the computational complexity of C-PTS.

The concept of Orthogonal Frequency Division Multiplexing has been known first, since 1966, but it only reached sufficient maturity for deployments in standard systems during 1990. OFDM is an attractive modulation (Mod.) technique for transmitting large amounts of digital data over radio waves. The major disadvantage of OFDM is that the time domain OFDM signal which is a sum of several sinusoids leads to high peak to average power ratio (PAPR).

OFDM is a Multicarrier Transmission technique which divides the available spectrum into many carriers each one being modulated by a low data rate stream. OFDM is similar to Frequency Division Multiple Access (FDMA) in that the multiple user access is achieved by sub-dividing the available bandwidth into multiple channels, which are then allocated to users. However OFDM uses the spectrum much more efficiently by spacing the channels more closely together.

This is achieved by making all the carriers orthogonal to one another, preventing interference between the closely. In FDMA each user is typically allocated a single channel which is used to transmit all the user information. The bandwidth of each channel is typically 10-40 kHz for voice communication. However, the minimum required bandwidth for speech is only 4 kHz. The allocated bandwidth is made wider than the minimum amount required to prevent channels from interfering with one another. This extra bandwidth is to allow for signals of neighboring channels to be filtered out and to allow for any drift in the center frequency of the transmitter or receiver. In a typical system up to 50% of the total spectrum is wasted due to the extra spacing between channels.

SIMULATION RESULTS

In attempt to compare the performance of the original and proposed algorithms, we consider an OFDM system with 128 subcarriers and QPSK modulation. The studies have suggested that the oversampling factor $L = 4$ can provide sufficiently accurate PAPR results, and thus L is set to 4 in our simulations. Our algorithm will be compared first with the original OICF algorithm and then with several existing clipping and filtering techniques.

We will discuss our simulation results. During our simulation we used cyclic prefix to minimize the Inter Symbol Interference (ISI) on the basis of (Quadrature Phase Shift Keying) modulation techniques through, the simulation environment which we used in our simulation on MATLAB R2013a version and AWGN communication channel. With the help of QPSK modulation techniques we got the PAPR versus CCDF results curve parameters.

A. Simulation Tool

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects. MATLAB was invented in the late 1970s by Cleve Moler, chairman of the computer science department at the University of New Mexico.

B. Mathematical Calculation of CDF

The CDF of a continuous random variable X can be expressed as the integral of its probability density function F_x as follows:

$$F_x(x) = \int_{-\infty}^{x} f_x(t)dt \quad (1)$$

In the case of a random variable X which has distribution having a discrete component at a value b,

$$P = (X = b) = F_x(b) - \lim_{x \to b^-} F_X(x). \quad (2)$$

If F_x is continuous at b, this equals zero and there is no discrete component at b.

C. Complementary CCDF

The Complementary Cumulative Distribution function (CCDF) is used to measure the probability That the PAPR of a certain data block exceeds the given Threshold. The CCDF of the PAPR of the data block is desired to compare outputs of various reduction techniques. It is defined as:

$$P(PAPR > z) = 1 - P(PAPR \le z)$$
$$= 1 - (1 - exp(z)) \quad (3)$$

Where $PAPR_0$ is a certain threshold value that is usually given in decibels relative to the Root Mean Square (RMS).

Table 1: Parameter in PAPR Reduction

Parameter	Value
OFDM	128 subcarriers
Modulation	QPSK
Channel	AWGN & Raylight
Oversampling Factor	4
Claping Ration	2.10

D. PAPR Reduction performance

In this performace we are used N= 64 and 128sub-carriers, QPSK, claping ration ϒ is still set to 2.10, L=4 with PAPR with OFDM signal. Fig. 4.1 shows the PAPR verses CCDF curves for the signals processed by using the orignal & simplified OICF algorothms, respectively.

D.1: PAPR Reduction performance for N=64

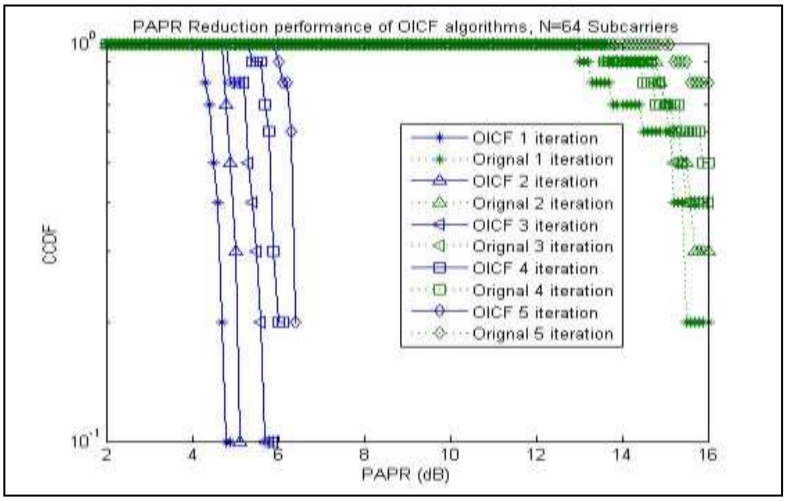

Fig. 2: PAPR Reduction performance of OICF algorithms, QPSK, 64 subcarriers

D.2: PAPR Reduction performance for N=128

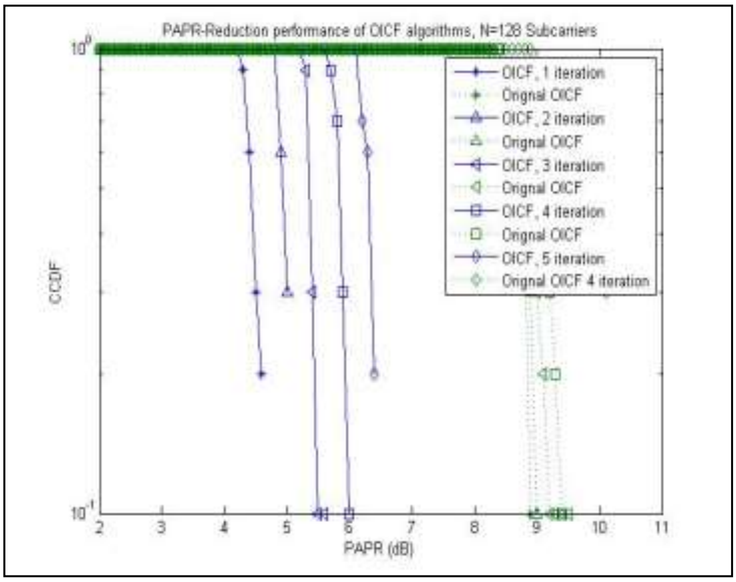

Fig. 2: PAPR Reduction performance of OICF algorithms, N=128 subcarriers

Table 2: Analysis of PAPR Reduction Parameters

S. No.	Used Parameter	CCDF	Subcarriers	Claping ration ϒ	PAPR
01	Original OICF, 1st Iteration	10^{-05}	128	2.10	8.80dB
02	Simplified OICF, 1st Iteration				4.6dB
03	Original OICF, 2nd Iteration				7.9.0dB
04	Simplified OICF, 2nd Iteration				4.9.0dB
05	Original OICF, 3rd Iteration				9.1dB
06	Simplified OICF, 3rd Iteration				5.4dB

Result Analysis: In the above graph shows the original OICF-$1st$, $2nd$ and $3rd$ iteration & Simplified OICF,$1st$, $2nd$ and $3rd$ iteration. The performance at the 10^{-1} clipping probability in simplified OICF, 1st iteration the PAPR 4.2dB, and another simplified OICF, $2nd$ iteration the PAPR 3.0 dB. The iteration performance PAPR reduce by 1.2dB batter at $1st$ iteration.

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