

# Design A Hybrid Approach To Reduce Papr In Ofdm

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**Abstract**— Due to the advancement in wireless communication, multimedia based applications are growing and these applications require high speed data transmission. OFDM abbreviated as orthogonal frequency division multiplexing provides orthogonal subcarriers as well as uses bandwidth efficiently. OFDM is most preferable technique for signal encoding as compare to other techniques. The advantage of OFDM over other techniques is that it makes effective use of frequency spectrum. OFDM is a robust technique. It is much efficient against multipath fading channels. OFDM consist of guard bands and sub carriers which lead to the less effect of noise and ISI. The disadvantage of OFDM is that it affects the power efficiency due to the occurrence of PAPR. In this paper a new technique is proposed. In this work Companding and filtering is applied to the signals in order to decrease the PAPR and this technique s named as hybridization method to reduce PAPR. In order to prove the efficiency of the proposed technique results section is also described in this work.

**Keywords-** Orthogonal Frequency Division Multiplexing, Peak-to-average ratio, Companding,

## 1. INTRODUCTION

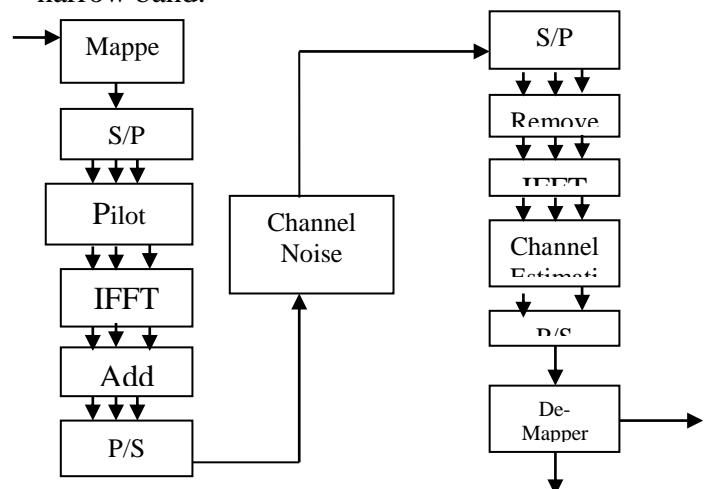
### OFDM

OFDM stands for Orthogonal Frequency Division Multiplexing. It is an effective method or technique

adopted in wireless channels. The wireless channels must be selective and time variance based. OFDM is an efficient technique which poses the property of flexibility and multicarrier modulation. **Orthogonal frequency division multiplexing** is a method or scheme for digital multi-carrier modulation using some independent subcarriers - a previously modulated signal modulated into other signal that have high frequency and bandwidth.

The orthogonal subcarriers transfers the data in parallely. The wireless channels are decomposed into sub channels which are posses the property of narrowband frequency and non selective. The Pilot system is used for channel equalization in OFDM. Channel equalization can be achieved by judging the value of channel transfer factor. For this pilot symbols is used. OFDM in digital domain can be implemented by using IFFT and FFT.

The OFDM works by dividing the range of the present spectrum into various sub channels which are orthogonal. The division is done so that flat fading can exist in every sub channel which is narrow band.



in a variable value and fluctuated wave or spikes. In order to represent PAPR a signal following equation is used:

$$PAPR(x) = \frac{\max|x(t)|^2}{E[|x(t)|^2]} \quad (1)$$

Figure 1 Model of OFDM

**Advantages**

- Due to increase in symbol duration, there is a reduction in delay spread. Addition of guard band almost removes the ISI and ICI in the system.
- Conversion of the channel into many narrow spaced orthogonal sub-carriers render it immune to frequency selective fading.
- As it is evident from the spectral pattern of an OFDM system, orthogonally placing the sub-carriers lead to high spectral efficiency.

**PAPR**

As it is observed that in OFDM the modulation technique is applied to the signals such as Quadrature Amplitude Modulation or PSK etc. After applying modulation the output signals undergoes for IFFT then it is transmitted. At the time of transmission that signals can pose highest peak value with respect to time domain. This problem of varying the signals is known as PAPR i.e. highest peak-to-Average power ratio. PAPR (Peak-to-Average Power Ratio) is the trendiest and challenging issue in the multi carrier systems i.e. OFDM systems. PAPR should be reduced in order to enhance the lifetime of the network. In comparison with single carrier systems PAPR is quite high in multi carrier system. Highest value of PAPR reduces the efficiency of the Power amplifier (Transmitter) [3]. PAPR affects the transmitted signal. PAPR is the problem exists in OFDM system. The input symbol stream in IFFT should have a constant value of power spectrum. But the output of IFFT can result

**PAPR REDUCTION TECHNIQUES**

Following tables shows the classification of PAPR Reduction techniques on the basis of two categories one is Signal Scrambling Technique and other is Signal Distortion Techniques. These techniques are explained briefly below the table.

Table 1: classification of PAPR Reduction Techniques:

S. NO	TECHNIQUES	
	Signal Scrambling Techniques	Signal Distortion Techniques
1	SLM (Selective Mapping)	Amplitude Clipping and Filtering
2	PTS(Partial Transmit Signals)	Peak Windowing
3	Tone Reservation	Peak Reduction Carrier
4	Tone Injection	Companding
5	Interleaving	-----

**Signal Scrambling Technique**

**1.1 SLM (Selective Mapping)**

SLM is selective mapping technique. In this technique the input signals is divided into small data blocks with respect to length N.

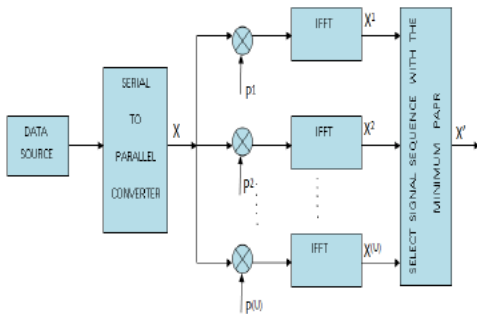


Figure 2. Block Diagram of SLM technique

In this technique the signals are converted into parallel signals and then these data blocks is combined individually along with phase sequence as follows:

$$P^u = [P^1, P^2, P^3, \dots, P^U] \quad (2)$$

### 1.2 PTS (Partial Transmit Signals)

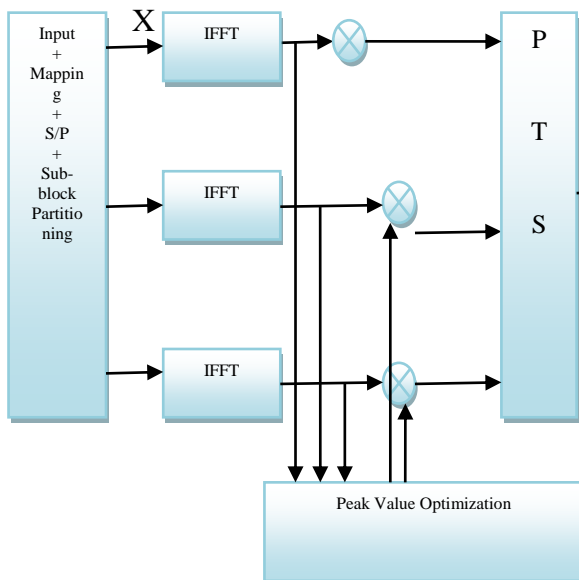


Figure 3. Block Diagram of PTS

Transmitting just part of information of shifting sub-carrier which covers all the data to be sent in the signal overall is called Partial Transmit Sequence Technique. It is one of the popular techniques for PAPR reduction. Figure 3 shows the concept of PTS technique.

### 1.3 Interleaving Technique

It is a PAPR reduction technique which collects the interleavers for reducing the value of PAPR. It is quite different from PTS and SLM as it does not uses the set of phase sequence for PAPR reduction. The following diagram shows the concept of interleaving PAPR reduction technique.

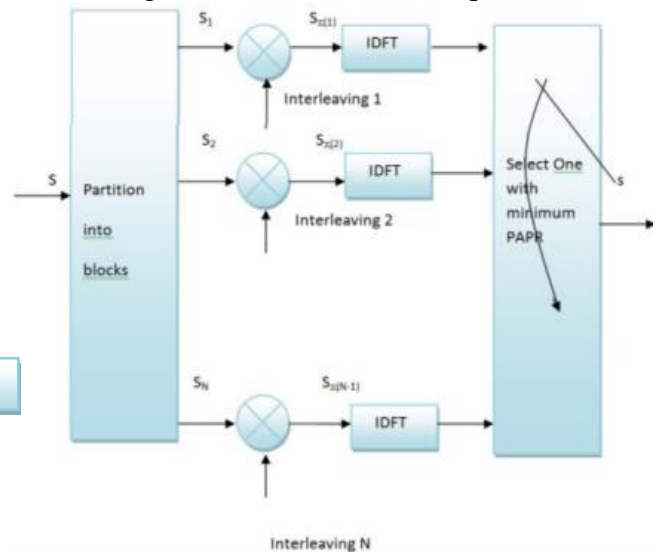


Figure 4. Block diagram of Interleaving PAPR technique.

### Signal Distortion Technique

#### 1.4 Amplitude Clipping and Filtering

Amplitude clipping is considered as the easiest strategy which may be under taken for PAPR lessening in an OFDM system. A limit estimation of the abundance is situated for this situation to point of confinement the crest envelope of the info signal. Sign having qualities higher than this foreordained

worth are cut and the rest are permitted to go through un-aggravated where,  $B(x)$  is defined as amplitude value after applying clipping.  $X$  is an initial value of the signals.  $A$ , is used to define the threshold value which is predefined by the user. It is measured in dB (decibels).

## 2. METHODOLOGY

PAPR is the major problem in OFDM technique, so there is need to reduce the PAPR, in order to get better quality signal. Many techniques have been applied earlier to reduce its effect. The methodology of proposed work to reduce PAPR is as follows:

### Methodology:

**STEP 1:** Firstly generate a signal that carries information, which is to be sent to the receiver.

**STEP 2:** After the generation of the information signal, apply the modulation technique, so that the signal get boosted and modulated during transmission process.

**STEP 3:** After the modulation, perform padding of signal after that apply the IFFT as IFFT is major section of OFDM communication in wireless.

**STEP 4:** Now step is to work on PAPR reduction and for that apply proposed technique on the signal.

**STEP 5:** Finally the calculation of the PAPR is done. The signal with lesser PAPR is obtained.

### Block Diagram:

The block diagram of proposed work is as given in figure below:

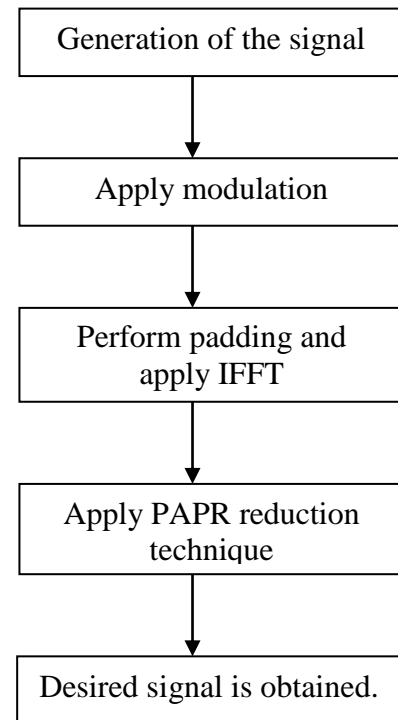


Figure 5. Block diagram of proposed work

## 3. PROBLEM FORMULATION

In OFDM modulation, the high peak-to-average power ratio (PAPR) of transmitted signal due to the superposition of many subcarriers is one of the major problems. Due to the rise of PAPR in the signal the quality of the signal is degraded, also the complexity is increased in the analog to digital and digital to analog converter. So it is essential to decrease the PAPR, there are many techniques have been suggested for PAPR reduction, with different levels of success and complexity. Techniques like clipping, filtration, PTS etc were proposed but these techniques achieve PAPR reduction at the bit error rate (BER) increase, data rate loss, computational complexity increase, and so on. So there is need to proposed some other techniques that can reduce PAPR to a great extent, by studying previous PAPR

reduction techniques, a new technique is proposed in this.

#### 4. PROPOSED SYSTEM

In OFDM modulation, the high peak-to-average power ratio (PAPR) of transmitted signal due to the superposition of many subcarriers is one of the major problems. Due to the rise of PAPR in the signal the quality of the signal is degraded, also the complexity is increased in the analog to digital and digital to analog converter. So there is a need to reduce the effect of PAPR, Many techniques have been suggested for PAPR reduction, with different levels of success and complexity. Techniques like clipping, filtration, PTS etc were proposed but these techniques achieve PAPR reduction at the expense of transmit signal power increase, bit error rate (BER) increase, data rate loss, computational complexity increase, and so on. So there is need to proposed some other techniques that can reduce PAPR to a great extent, by studying previous PAPR reduction techniques, a new technique is proposed.

In this work is done on the basis of hybridization of reduction techniques. As filtering is used to remove distortion of signal. So in this work Companding and filtration is combined. By combing these two techniques the ratio of PAPR in the received signal is low. So this approach can result in the output signal with lessen PAPR. Also there is low implement complexity and there is rise in gain of the signal. Along with this the analysis of the BER is done over various fading channels.

#### 5. RESULTS AND DISCUSSIONS

This section describes the results which are obtained after applying the proposed technique for PAPR reduction.

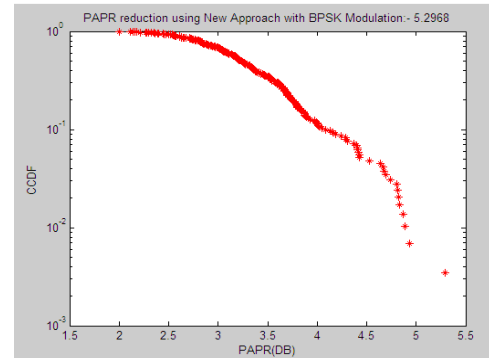


Figure 6. Graph shows the proposed PAPR reduction with BPSK modulation

The figure above shows the effect of modulation i.e. BPSK modulation on the reduced PAPR signals. The figure 7 describes the comparison of PAPR in normal OFDM system, SLM system and propose technique i.e. CP-FL. From the graph below it is clear that the value of PAPR is less in proposed work.

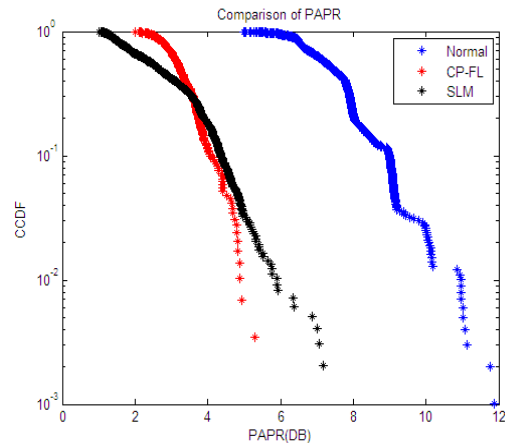


Figure 7. Graph shows the comparison between PAPR of proposed and normal and SLM system.

Figure 8 shows a comparison graph which compares the effects of fading in proposed work. From the graph below it is observed that when there is no fading in signals then the BER (Bit Error Rate) is low and in case where the fading effects is Rician then the BER is optimal but in case of Rayleigh fading the BER is quite high.

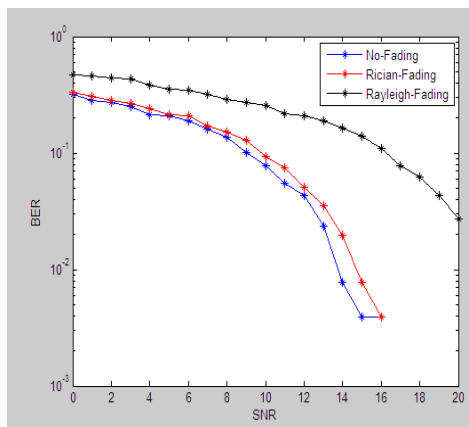


Figure 8. Graph shows the comparison of fading effects that are in proposed work.

## 6. CONCLUSION AND FUTURE SCOPE

OFDM facilitates the data transmission at a high speed rate. **Orthogonal frequency division multiplexing** is a method or scheme for digital multi-carrier modulation using some independent subcarriers - a previously modulated signal modulated into other signal that have high frequency and bandwidth. . The only disadvantage of OFDM is that it does not support the higher PAPR. To overcome this problem we used a hybrid approach in proposed work. In proposed hybrid technique two methods are combined together to reduce PAPR. The two combined techniques are Filtering and Companding. From the results obtained it is concluded that this method is efficient, accurate and secure than the traditional approaches. A comparison is also performed that shows the accuracy of the system is more.

In future this technique can be enhanced further by developing a new hybrid approach which can lead to the best results of PAPR reduction. Hybrid approach can consist of multiple technique of PAPR reduction. The selection of technique for

hybrid approach is based on the performance ratio of the techniques.

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