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PAPR REDUCTION OF OFDM SIGNALS USING SELECTED MAPPING TECHNIQUE: MODELLING& SIMULATION

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ABSTRACT

According to the demand of advance communication field there should be high datarate in addition to both power efficiency and lower bit error rate. This demand of highdata rate can be fulfilled by the single carrier modulation with compromising the tradeoff between the power efficiency and bit error rate. Again in the presence of frequencyselective fading environment, it is very difficult to achieve high data rate for thissingle carrier modulation with a lower bit error rate performance. With consideringan advance step towards the multi carrier modulation scheme it is possible to gethigh data rate in this multipath fading channel without degrading the bit error rateperformance. To achieve better performance using multi carrier modulation we shouldmake the subcarriers to be orthogonal to each other i.e. known as the Orthogonal Frequency Division Multiplexing (OFDM) technique.But the great disadvantage of the OFDM technique is its high Peak to Average Power Ratio (PAPR). As we are using the linear power amplifier at the transmitterside so it's operating point will go to the saturation region due to the high PAPRwhich leads to in-band distortion and out-band radiation. This can be avoided withincreasing the dynamic range of power amplifier which leads to high cost and highconsumption of power at the base station.This report presents an efficient technique i.e the Selected Mapping which reducesthe PAPR. Also the analysis of bit error rate performance and the computationalcomplexity for this technique are being discussed here.

Keyword:- Communication, Carrier ,Frequency

1.INTRODUCTION

The demand of high data rate services has been increasing very rapidly and thereis no slowdown in sight. We know that the data transmission includes both wiredand wireless medium. Often, these services require very reliable data transmissionover very harsh environment. Most of these transmission systems experience muchdegradation such as large attenuation, noise, multipath, interference, time variance,nonlinearities and must meet the finite constraints like power limitation and costfactor. One physical layer technique that has gained a lot of popularities due toits robustness in dealing with these impairments is multi-carrier modulation technique.In multi-carrier modulation, the most commonly used technique is OrthogonalFrequency Division Multiplexing (OFDM); it has recently become very popular inwireless communication.Unfortunately the major drawback of OFDM transmission is its large envelopefluctuation which is quantified as Peak to Average Power Ratio (PAPR). Since poweramplifier is used at the transmitter, so as to operate in a perfectly linear region theoperating power must lies below the available power. For reduction of this PAPR lotof algorithms have been developed. All of the techniques has some sort of advantagesand disadvantages [1]. Clipping and Filtering is one of the basic technique in whichsome part of transmitted signal undergoes into distortion. Also the Coding schemereduces the data rate which is undesirable. If we consider Tone Reservation (TR)technique it also allows the data rate loss with more probable of increasing power.Again the techniques like Tone Injection (TI) and the Active Constellation Extension(ACE) having a criteria of increasing power will be undesirable in case of power constraintenvironment. If we go for the Partial Transmit Sequence (PTS) and SelectedMapping (SLM) technique, the PTS technique has more complexity than that of SLMtechnique.This Selected Mapping is one of the promising technique due to its simplicity forimplementation which introduces no distortion in the transmitted signal. It has beendescribed first in [2] i.e. to be known as the classical SLM technique.

This techniquehas one of the disadvantage of sending the extra Side Information (SI) index alongwith the transmitted OFDM signal. Which can be avoided using a special techniquedescribed in [3].The concentration of this thesis work is specially upon the Selected Mappingtechnique. Here the three important analysis of this technique has been done. Out ofthem one is, how to avoid the transmission of extra information along with the OFDMsignal which will be discussed in the section Avoiding the SI index Transmission.Another one important analysis of this technique is how to reduce the computationalcomplexity. Also one important analysis is to be done about the mutual independencebetween the alternative phase vectors used in this technique. One technique also being

2.SELECTED MAPPING TECHNIQUE

This is an effective and distortion less technique used for the PAPR reduction inOFDM. The name of this technique indicates that one sequence has to be selectedout of a number of sequences. According to the concept of discrete time OFDMtransmission we should make a data block considering N number of symbols fromthe constellation plot. Where N is the number of subcarriers to be used. Thenusing that data block U number of independent candidate vectors are to be generatedwith the multiplication of independent phase vectors. Let us consider X is the datablock with X (k) as the mapped sub symbol(i.e. the symbol from the constellation).

$$X^{(u)}(k) = X(k)\ \ B^{(u)}(k)$$

Analysis of PAPR using CCDF

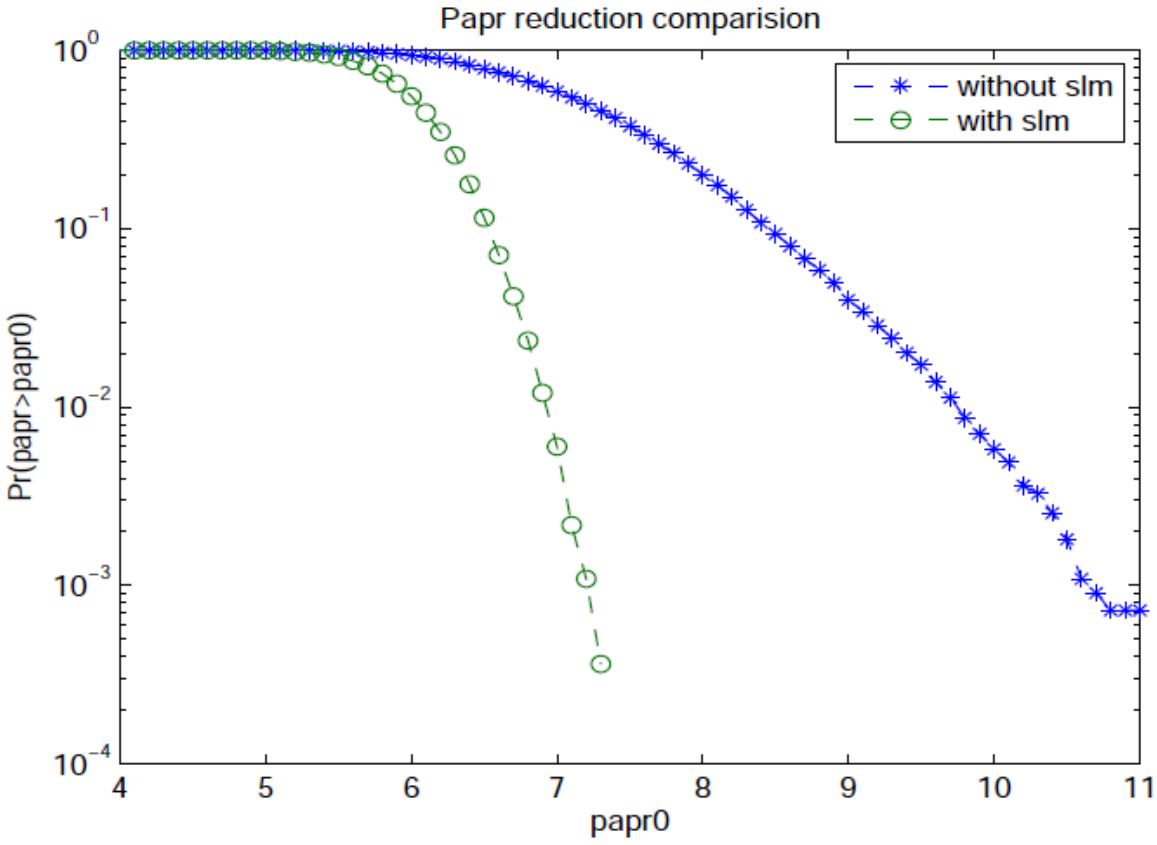
As discussed above the analysis of the performance of PAPR reduction is very easythrough the CCDF. This performance using the classical SLM technique is shown in

figure 2.2. If we consider all the candidate vectors in a matrix form then without

following the oversampling concept the dimension of that matrix will be U × N and with following the oversampling concept the dimension becomes U × V N. Here the

number of subcarriers used to be N = 128 and the oversampling factor V = 4.So this figure 2.2 describes the performance criteria of the classical SLM technique

on the basis of PAPR reduction performance. Another PAPR analysis also being



vectors in case 2 the CCDF plot for PAPR reduction moves away from the theoretical plot. The expression of theoretical PAPR [13] for the classical SLM is given by

$$\Pr\left(PAPR\{x\} > \gamma\right) = \left(1 - \left(1 - e^{-\gamma}\right)^{N}\right)^{U}$$

3.SIMULATION& RESULT

For the simulation studies the SFBC scheme has been used. According to the figure 3.1the same phase sequence will be multiplied to the two different signals that are X1 andX2. Then do the IFFT of these signals for one antenna and choose the OFDM signalwith minimum PAPR and also the same thing will be done for the another antenna.Then to find out the Complementary Cumulative Distribution Function plot for theperformance analysis of PAPR the maximum PAPR value will be considered out oftwo different minimum PAPR value from that of two antennas.the two different signals that are X1 andX2. Then do the IFFT of these signals for one antenna and choose the OFDM signalwith minimum PAPR and also the same thing will be done for the another antenna.Then to find out the Complementary Cumulative Distribution Function plot for theperformance analysis of PAPR the maximum PAPR value will be considered out oftwo different minimum PAPR value from that of two antennas. So with considering 64number of subcarriers and oversampling factor of 4 the PAPR reduction performance.

Also the application of the proposed scheme has done for this 2×1 transmit diversity case with consideration of 64 number of subcarriers and over sampling factor of 4 which is shown in figure 3.1

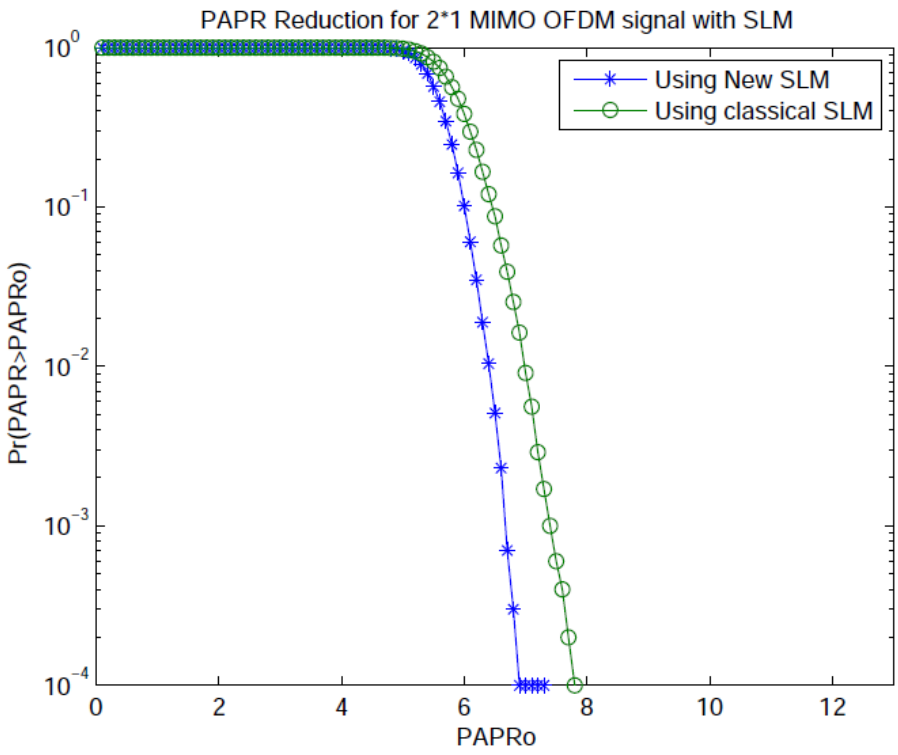


Figure 3.1: PAPR Reduction of 2*1 MIMO OFDM signal with Proposed Scheme

4. CONCLUSION

Here various types of Selected Mapping technique have been verified for the PAPRreduction performance. Some techniques also being there which avoids the sendingof Side Information (SI) index along with the selected OFDM signal. One techniquealso being described with low computational complexity having same PAPR reductioncriteria as that of the classical SLM. Also some techniques are presented herewhich satisfy the criteria of the mutual independence between the alternative phasesequences that leads to better PAPR reduction.The proposed scheme also being presented here which has better PAPR reductionperformance than that of the classical SLM. Moreover it also fulfills the criteria of lowcomputational complexity. But this amount in reduction of complexity is not betterthan that of the technique depending

upon the PBISLM. This proposed scheme hasan additional advantage of avoiding the extra SI index along with the OFDM signal.Also verification of this technique has been done for the MIMO-OFDM system.It is much more required to reduce the computational complexity in case of transmitdiversity case than that of SISO (Single Input Single Output) case.

5. FUTURE WORK

The application of this Selected Mapping technique also can be verified in the OFDMAsystem. Analysis for avoiding the sending of SI index in case of the Riemann matrixshould be done.

Also further reduction of the computational complexity for the proposed techniquecan be predicted.

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