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Implementation of Improved Selective Mapping Technique for Reduction of PAPR in MIMO-OFDM Wireless Communication

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ABSTRACT—Wireless technology is becoming more and more necessary for communication on a daily basis. Without enhancing the spectral efficiency, the channel capacity in MIMO systems improves. Although it has a limited bandwidth, an OFDM system can reduce the significant inter-symbol interference that it suffers from. Increased data rates with strong multipath fading robustness are the key benefits of MIMO-OFDM systems. The design of the equalizer is straightforward in this system, which improves spectral efficiency. In this technique, greater PAPR is the main drawback. A well-liked distortion-free PAPR reduction technique called selective mapping can be used to get around this restriction. For the purpose of minimizing the PAPR, the data sequence and phase sequence are multiplied in the SLM approach. It is exceedingly difficult to select the ideal phase sequence from a huge collection.

KEYWORDS—GWO, ABC, MIMO, OFDM, SLM, PAPR, CCDF

1. INTRODUCTION

One of the main issues with the MIMO-OFDM system is the high PAPR value. Power amplifiers drive into the nonlinear area due to high PAPR values and produce unauthorized frequency components. The orthogonality between the subcarriers is thrown off, making it difficult to reconstruct the signal exactly at the receiver section, which lowers the MIMOOFDM system's BER performance. The MIMO-OFDM system becomes more difficult since flawless signal recovery calls for high resolution ADC converters. To solve all of these issues, numerous PAPR reduction approaches aresuggestedintheliterature.These are usually divided into three categories: distortion less, distortion, and coding approaches. In techniques with less distortion, PAPR is reduced withoutInterference with

the input signal PTS, SLM, and TR are the three main methods for minimizing PAPR value in this classification. For the purpose of minimizing the PAPR, the SLM approach multiplies the data sequence by the phase sequence. Finding the ideal phase sequence from a huge collection of phase sequences is exceedingly difficult. ABC algorithm, parallel ABC, and other methods are used in literature to achieve the best phase sequence with the least amount of complexity. In the searching phase, the ABC method converges slowly but is readily broken in local minima. For decreasing the computational complexity of conventional SLM, the Grey-Wolf optimization (GWO) and GWO-ABC algorithms are suggested in this study long with the supplied data, the details regarding the ideal phase order that lowers the PAPR must be transmitted .

This information is required for flawless information data recovery at the receiver. The GWO, ABC, and GWO-ABC algorithms are covered in great length in the sections that follow.

2. LITERATURESURVEY

Himanshu Bhushan Mishra in 2012 proposed a new SelectiveMapping (SLM) technique in WIMAX without side information which is the major issue in the classical SLM Technique. In this paper the PAPR performance is measured using complementary cumulative distribution function (CCDF) plot and the probability of SI detection error performance have been evaluated as the criteria for WiMAX standard IEEE 802.16e.

E. Al-Dalakta in 2012 proposed an efficient technique for reducing the bit error rate (BER) of Orthogonal Frequency Division Multiplexing (OFDM)signals transmitted over nonlinear solid-state power amplifiers (SSPAs).The proposed technique is based on predicting the distortion power that an SSPA would generate due to the nonlinear characteristics of such devices. Similar to the Selective-Mapping (SLM) or Partial-Transmit-Sequence (PTS) schemes, the predicted distortion is used to select a set of phases that minimize the actual SSPA distortion. Simulation results confirmed that the signal-to-noise ratio that is required to using the proposed technique is less by about 8 dB when it is obtain a BER of compared to the standard PTS utilizing 16 partitions.

Shiann-Shiun Jeng in 2011 proposes a new method based on companding Peak to-Average Power Ratio (PAPR) Reduction of Orthogonal Frequency Division Multiplexing (OFDM) signals.This paper suggests that uniformly distributed companding scheme and piecewise companding scheme cannot deliver the performance that satisfies various requirements of the system. So, the distribution of the OFDM signal is transformed into the trapezium distribution and the general formulas for the proposed scheme are derived that enable the de- sired performance to be achieved by controlling the parameter.

Jun Hou proposed a nonlinear companding scheme toreduce the Peak-to- Average Power Ratio (PAPR) and improve Bit Error Rate (BER) for OFDMsystems. This proposed scheme mainly focuses on compressing the large signals, while maintaining the average power constant by properly choosing transform parameters. Moreover, analysis shows that the proposed scheme without decompanding atthe receiver can also offer a good BER performance. Finally,simulation results show that the proposed scheme outperformsother companding scheme in terms of spectrum side-lobes, PAPRreduction and BER performance.

Ms. V. B. Malode in 2010 proposed a new method to reduce Peak-to-Average Power Ratio (PAPR) Peak-to-Average Power Ratio (PAPR) by probabilistic method,modified selective mapping technique using the standard arrays of linear block codes. In this work lowest PAPR in each coset of a linear block codes is chosen as its coset leader from several transmitted signal, which further results in high performance ofwireless communication.

Stephane Y. Le Goff in 2009 suggest an improvement in classical Selective Mapping (SLM) technique and proposed a new method in which SLM can be implemented without sending the side information which is a major issue in classical Selective Mapping (SLM) technique .SLM requiresthe transmission of several side information bits for each datablock, which results in somedata rate loss. In this paper, we propose a novel SLM methodfor which no side information needs to be sent. This technique is particularly attractive for systemsusing a large number of subcarriers and the probabilityof SI detection error can be made very small by increasingthe extension factor and/or the number of subcarriers.

Sulaiman A. Aburakhia in 2009 proposed a new linear companding transform (LCT)with more design flexibility than linear nonsymmetricalcompanding transform (LNST) .Simulation results have been shown comparing both the above technique assuming AWGN channel .The results show that the proposed method has a higher PAPR reduction capability and better BER performance than LNST, with less spectral broadening. This work suggests that the proposed can be designed to meet system requirements, power amplifier characteristics, and achieve an excellent tradeoff betweenPAPR reduction and BER performance.

F.S. Al-kamaliet suggested the design of a new transceiver scheme for the SCFDMA scheme using the wavelet transform. No redundancy is added to the newsystem because of the discrete wavelet transform. Thus, itscomplexity is slightly increased as compared to theconventional SC-FDMA scheme.This workdescribes that the proposed scheme has better PAPR performance and BER performance than theconventional SC-FDMA scheme.Theproposed HW-SC-FDMA scheme provides about 3 dBgain when compared to theconventional SC-FDMAscheme over the vehicular A channel.

3. EXISTING SYSTEM

I. SELECTIVE MAPPING TECHNIQUE (SLM)

Selective Mapping (SLM) is a distortion less technique that can reduce PAPR efficiently without increase in power requirement and incurring data rate loss. The simulation result shows that proposed SLM technique has better PAPR reduction performance.

Selective mapping (SLM) is a promising PAPR reduction technique of OFDM system. The basic idea of SLM is to produce U alternative transmit sequences from the same data source and then to select the transmit signal exhibiting the lowest PAPR.

The idea stems from the fact that as the PAPR is determined by the sequence of the transmit data vectors; Xm multiplying the data vectors by some random phase will change the PAPR properties after the IFFT. Mathematically, a set of U markedly different, pseudo random fixed vectors are generated, Let us assume that the original input data X [X1, X2,…,XN-1] multiplied with independent phase sequences P=[P1 (u) P2 (u),…,PN(u)](u=0,1, U-1) , where U is the number of phase sequences.

Both the input data and phase sequences have the same length N (u= 0, 1…, U-1). After multiplication, inverse fast Fourier transform (IFFT) will be applied on each sequence to convert the signal from frequency domain to the time domain.

The result from multiplication will generate the data block of an OFDM system that has different time domain signals, with length of U, and different PAPR values, X(u)= [X1 (u) , X2 (u),…,XN-1(u)]. The last step is comparing the PAPR among the independent data blocks and the candidate with the lowest PAPR will be selected for transmission.

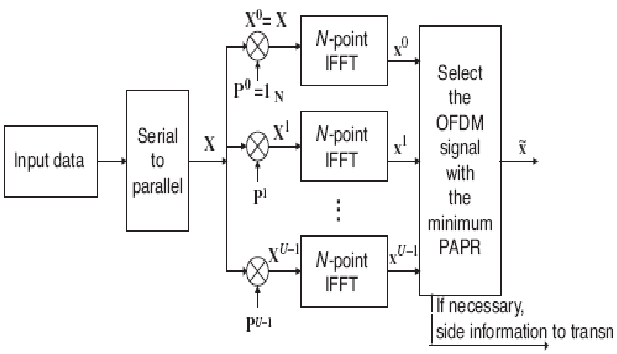

Fig:Scheme of a Modulator with Selective Mapping

Many methods are there to reduce the PAPR, but both complexity and redundancy are high and only small gains in PAPR are achieved. When the phases of different sub-carriers add up in phase the possibility of PAPR being high is for sure. Hence one method to reduce the in-phase addition is to change the phase before converting the frequency domain signal into time domain. Hence before taking the N point IDFT each block of input is multiplied by an φ vector of length N. Now there is a possibility that the PAPR may turn low.

4. PROPOSED SYSTEM

I.GREY WOLF OPTIMIZATION ALGORITHM (GWO)

The leadership hierarchy of the wolf has been imitated by a swarm intelligence strategy put out by Mirjalili et al.

Typically, wolves stick together and follow the pack leader.using a hierarchy to find prey. A strict social structure exists among Grey Wolves, and the male or female leader is designated as Alpha ().The wolf is responsible for making wise decisions.The entire pack is required to abide by the wolf's judgments. The subordinate wolves known as "" support the "" in making decisions and uphold order in the pack. The Wolf "Beta" is superior to the Wolf "Omega." The wolf that belongs to none of these groups is known as (delta), and it rules over omega while deferring to beta and alpha.

A mathematical model of the social hierarchy and hunting strategy of wolves serves as the foundation for the Grey-Wolf optimization approach. The performance of the GWO technique is

Compared to other approaches, it exhibits better exploitation and exploration properties after being tested using benchmark functions. This optimization method has been successfully used to resolve various engineering issues. Many swarm-based solutions do not require a leader to be present at all times when using optimization techniques to solve problems. GWO has the solution to this issue because of their innate leadership abilities. Additionally, the GWO technique has fewer parameters and is easier to use than earlier ones, making it superior. Because of all these important traits, the GWO algorithm is utilized to resolve challenging optimization issues.

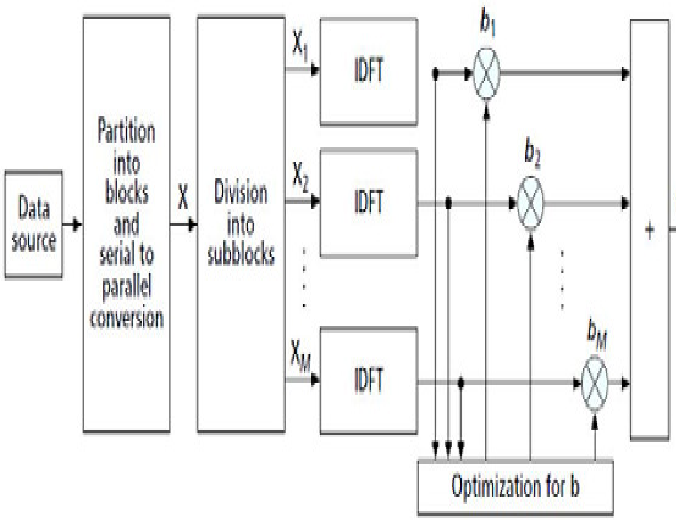

Fig: I GWO system block diagram

II. MIMO-OFDM SYSTEM WITH IMPROVED SLM

One of the biggest issues with the MIMO-OFDM system is the significant PAPR. In the MIMO-OFDM system, GWOABC based SLM is employed to reduce this large PAPR. QPSK modulation is used to improve the original input data'sbandwidth effectiveness. Without boosting input powers, the modulated data is space-time block coded to increase BER performance.

The GWO-ABC based SLM is utilized to further reduce the PAPR, and N point IFFT is carried out to convert the time domain data symbols into frequency domain data symbols. Cyclic prefix is appended to the data symbols before transmission in order to reduce ICI.To rebuild the data bits, the equivalent reverse operations are carried out at the receiver.

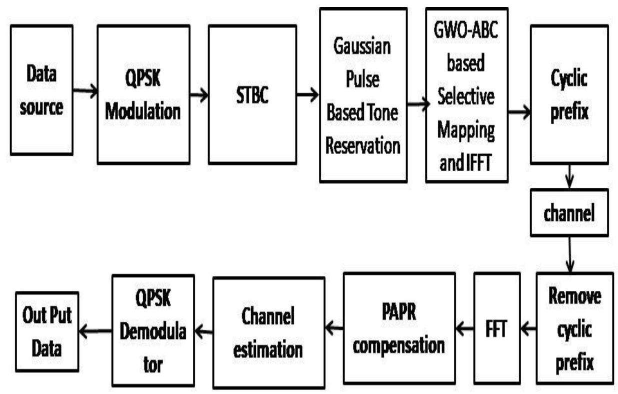

Fig:IIMIMO-OFDMsystemwithimprovedSLMPAPRreductiontechnique.

5. SIMULATION PARAMETERS

SIMULATION PARAMETERS	VALUES
NumberofOFDMsymbols	10000
SizeofOFDMsymbol(N)	128
Numberofsub carriers	128
Numberofchanneltaps(L)	6
Cylicprefixlength	6
Number ofantennas	2
Modulationscheme	QPSK
Phaseweightingfactorset	1,-1,j,-j
Numberofreplications(M)	50

6. RESULTS:

Fig: I PAPRperformancecomparisonofMIMO-OFDM,GWO,SLMtechniques.

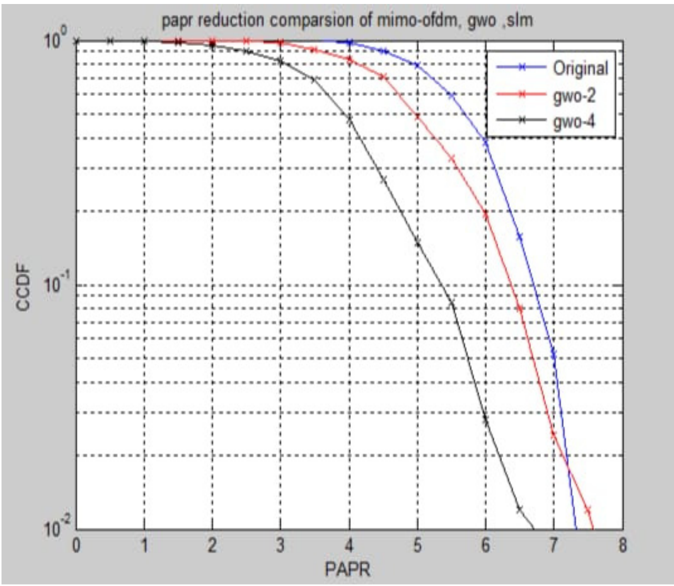

Fig: IIBERperformancecomparisonofMIMO-OFDMwithSSPA,GWO,GWO-ABC,OFDMwithLinearpoweramplifier.

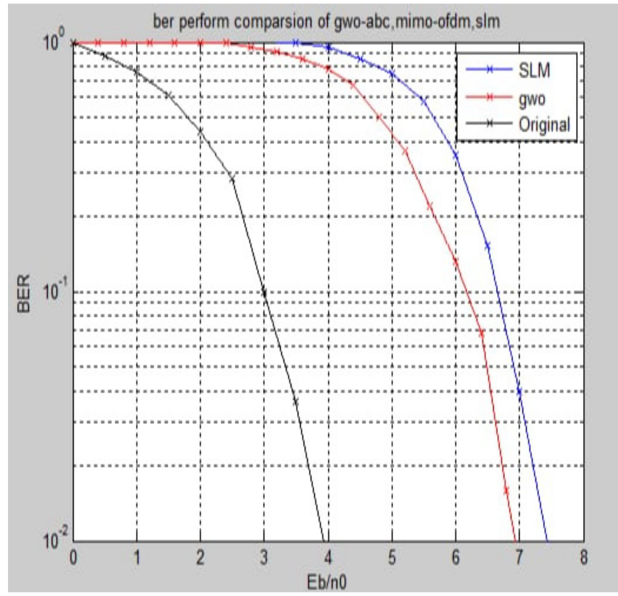

TABLE:1PAPRPerformanceComparison OfSLM,GWO,MIMO-OFDM

Technique	PAPRatCCDF=0.01	%ofPAPR reduction
OFDM	9.15	----
GWOwithw=2	7.8	14.75
GWOwith w=4	6.96	23.9
SLM	6.4	30.05

APAPRgraphfortheGWOalgorithmwithdifferentweights is appeared in Fig: 6 When CCDF= 0, the PAPR ofGWOis7.8dBwithnumberofweightsare2(w=1,-1),whileutilizingGWOis6.96dBwithnumberofweightsare4(w=1,-1,j,-j).ThePAPRperformancewithmorenumberofphase factors (weights) is better than the less number ofphasefactors.

TABLE: 2 BER PERFORMANCE COMPARISON OF SLM WITH GWO, SLM WITH GWO-ABC, OFDM WITH LINEAR POWER AMPLIFIER, OFDM WITH SSPA.

Technique	BERatSNR=4 dB	% of BERreduction
OFDM withlinearpoweramplifier	0.0015	-----
SLMwithGWO-ABC	0.04	25.66
SLMwithGWO	0.05	32.33
OFDM withSSPA	0.08	53.33

TheBERcomparisonoftheoriginalMIMO-OFDMsystem with linear power amplifier, SLM with GWO-ABC,SLMwithGWOandOFDMwithnonlinearpoweramplifier

(SSPA)isdepictedinFig.3.Accordingtosimulationresults ,BER performance of SLM with GWO-ABC algorithm isbetterthanthe performanceofothersystems.

7. CONCLUSION

The fundamental drawback of the MIMO-OFDM system's high PAPR is reduced in this chapter by combining the SLM technique and the Gaussian pulse-based Tone Reservation technology. GWO and GWO-ABC algorithms reduce the high computational complexity of SLM. Based on the outcomes of the simulation, the GWO-ABC algorithm offers a superior set of phase factors with fewer cycles than the ABC method and the GWO algorithm. When compared to MIMO-OFDM, the PAPR performances of the Gaussian pulse-based Tone Reservation approach with the GWO-ABC-based SLM techniqueisimprovedby26.06%.

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