International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

PAPR Reduction using DCT of MIMO-OFDM Systems Based Modified SLM Technique

Kailash Sahu, Sandeep Shukla, Rajesh Nema,

Abstract— In this work, an endeavor has been made to consolidate adjusted SLM and PTS with DCT improves the PAPR decrease execution and limit the computational unpredictability without debasement in BER execution. This methodology has sensible PAPR decrease and computational multifaceted nature increments exponentially with increment in the subcarriers. In addition, when huge quantities of subcarriers are utilized, there exist high PAPR. So huge improvement is required for PAPR decrease and this can be accomplished utilizing changed SLM and PTS joined with DCT alongside CMA, interleaving and heartbeat forming. Despite the fact that, both these strategies give worthy PAPR decrease it conjures unsuitable multifaceted nature and influences data transfer capacity effectiveness.

Keywords— PTS, DWT, DCT, MIMO-OFDM, PAPR

I. INTRODUCTION

With the modernization of the advancements remote correspondence frameworks are confronting a few requests for fast remote administrations, for example, exchanged traffic, Internet Protocol (IP) information bundles and mixed media. This suggests that a future age framework will go for wideband, broadband and Ultra-Wide Bandwidth (UWB), which are fit for accomplishing the high ghostly productivity by utilizing the different remote procedures. Nonetheless, the framework plan ought to fulfill the client's necessities with no pay. A well balanced multifaceted nature, adaptability, information rate, Quality-of-Service (QoS) and cost are the significant contemplations for business applications especially. The incredible progress made in the fields of microelectronics, signal handling, portable registering, and so on, flourish in accomplishing ghastly proficiency with high adaptability [1].

In remote system, the correspondence for the most part happens by parallel information framework, where the sign is basically ordered in explicit number of non-covering channel, which are called as sub-channel with explicit recurrence.

Manuscript published on 30 September 2019
* Correspondence Author
Kailash Sahu*, M. Tech. Scholar, Dept. of Electronics and Communication TIT, Excellence, Bhopal
Mr. Sandeep Shukla, Assistant Professor, Dept. of Electronics and Communication TIT, Excellence, Bhopal
Dr. Rajesh Nema, Professor, Dept. of Electronics and Communication TIT, Excellence, Bhopal

A tweak system is received for each such sub-channel utilizing various sorts of image and after that the framework performs multiplexing as for recurrence for all these sub-channels [2]. Be that as it may, there was a development of another issue called as phantom covering [3] in the middle of such sub-directs so as to address the impedance related issues. Accordingly, the analysts during 1960 have come up with a thought for structuring a multiplexing strategy utilizing recurrence factor for such covering sub-channels.

Their answer makes appropriate game plan of such covering sub-diverts so as to cover the sidebands of the individual sign bearers without raising any probability of obstruction. Be that as it may, the asset usage was very poor as just a little pace of sign is transmitted over an enormous data transfer capacity channel with a help of isolated bearer recurrence allotted for every sign. There were noteworthy dividing between the bearer recurrence so as to oppose being in the state of covering. It additionally underpins the utilization of channels for upgrading the sign quality as well as ghostly effectiveness. Despite the fact that the analysts have developed up with a thought of recurrence division multiplexing yet the affectivity of such system was absent.

The prime explanation for this was obliviousness of the way that such types of transporters must bear the symmetrical property so as to address the issue in multiplexing. It was in this time OFDM took birth and took the shape as different models for example 802.11 g/a [4-5].

The prime thought of utilizing OFDM was ordinarily to utilize various sub-bearers to transmit the sign so as to keep away from either bearer or image related impedance. The plan guideline of OFDM is very basic as it fuses the highlights of narrowband in its sub-channels for guaranteeing level blurring. Aside from its use in sound and video broadcasting [6], OFDM is presently utilized in 4G systems [7], LTE (Long-Termed Evolution) organize, and forthcoming 5G arrange [8]. Despite the fact that, OFDM is one of the most requesting innovations for present day multi-bearer based correspondence framework, yet at the same time the system experiences certain entanglements. This section examines around one of the potential and an unaddressed issue in OFDM called as PAPR (Peak-to-Average Power Ratio) and proposes a answer for defeat it.

II. MIMO-OFDM SYSTEM

The ability of OFDM is additionally upgraded by including the numerous quantities of radio wires over the remote connections that is fundamental to upgrade the unearthly proficiency just as predominant dependability factor of a connection in up and coming age of versatile systems and correspondence framework. Fig.1 demonstrates the methodology of the OFDM-MIMO where the figure speaks to two significant squares for example OMOD (OFDM Modulation) and ODEMOD (OFDM Demodulation).

The crucial procedure behind this structure rule is the addition of the gatekeeper interim that is called as CP (Cyclic Prefix). CP is basically a reproduction of conclusive portion of OFDM image. The chart demonstrates the utility of the CP that controls the transmitted sign into cyclic convolution from straight convolution.

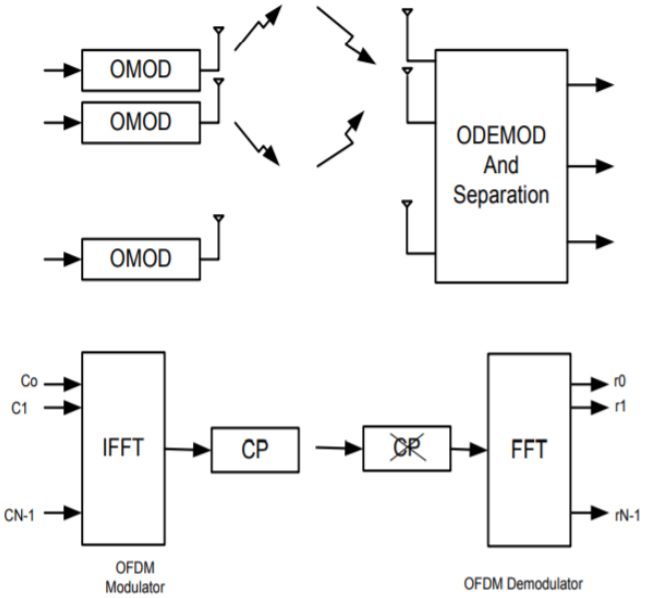

Figure 1: Strategy of OFDM-MIMO System

The MIMO framework is useful for expanding the information rate just as limit of the framework, while customary OFDM framework helps with limiting the multipath blurring, impedance, and so on. Consequently, the joint mix of MIMO and OFDM instrument permits better limit, adaptability, and effectiveness with expanded pace of information transmission with negligible piece blunder rate [7]. Accordingly, the various receiving wires are used for dropping the impedance just as to understand the assorted variety and addition in cluster utilizing reasonable mix.

There is a lot of antagonistic vibe in the remote medium that is observed to be profoundly inclined to blurring and obstruction. Existing framework uses time and recurrence decent variety as often as possible in its methodology of structure approach [2]. The idea of spatial decent variety in MIMO is progressively embraced attributable to its ability of upgraded ghostly proficiency [7]. There are additionally ideas in MIMO called as get decent variety that relates to the improve ability of the collector [1]. Be that as it may, the greatest challenge is to send the various reception apparatuses in the handheld specialized gadget.

Such issues are tended to by utilizing system coding and sign handling on the transmit side utilizing space-time coding [2]. There are different investigations to demonstrate that information rates could be altogether expanded because of utilization of various receiving wires in both transmitters just as collector module. The component of spatial multiplexing too upgrades the ghastly effectiveness. Use of Orthogonal Frequency Division Multiplexing can conceivably limit the intricacy of the recipient in remote correspondence framework and the literary works have seen a critical degree of research work by together utilizing both MIMO and OFDM.

III. PROPOSED METHODLOGY

By and large, the OFDM framework is utilized by thinking about symmetrical premise of complex exponential capacity set. In any case, OFDM can likewise be actualized by utilizing a solitary arrangement of co-sinusoidal capacity as a symmetrical premise. This sinusoidal capacity is incorporated alongside a DCT. The arrangements typically utilized in any kind of change from one area to the next are alluded to as the premise groupings. These are unpredictable occasional successions if there should be an occurrence of Discrete Fourier change. In this way, it is critical to see whether there exist some genuine esteemed premises grouping those outcomes in a genuine esteemed change arrangement. This has wound up in finding up of a great deal of different changes, which are on the whole symmetrical changes, for example, Hadamard Transform, Hartley Transform and so on. In any case, there is another change which is firmly identified with the DFT, which is known as the DCT. DCT communicates a arrangement of limitedly numerous information focuses as far as a whole of cosine capacities wavering at various frequencies. DCTs are imperative to various applications in science and designing, from lossy pressure of pictures where little high recurrence parts can be disposed of. The most widely recognized variation of discrete cosine change is the sort II DCT, which is frequently called just "the DCT" and its opposite, the sort III DCT, is correspondingly frequently called essentially "The converse DCT" or on the other hand "the IDCT". The utilization of cosine instead of sine capacities is basic in these applications: for pressure, things being what they are, cosine capacities are significantly more proficient as less capacities are expected to rough a run of the mill signal.

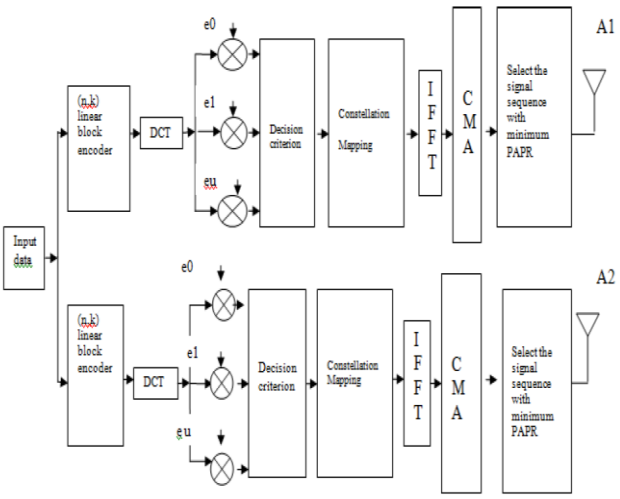

Figure 2: Block Diagram of MIMO-OFDM using Modified SLM IFFT with CMA Technique for the Reduction of PAPR

Algorithm

- $X_1, X_2 \ldots X_n$ are Binary information blocks.
- Encoding code word is w.
- Every block is encoded into w using Hamming encoder.
- A control bit is appended to w and extended hamming code of 8-bits is calculated.

- The error table and coset leader is computed.
- Vectors w+e1, w+e2, …, w+e16 are constructed for (every code word)
- Code word that has minimum value is chosen and transformed into MIMOOFDM signal through constellation mapping and IDCT.
- Constant modulus approach is applied with Steepest descent and unit circle method using IFFT and IDCT.
- The signal sequence with minimum value is obtained.

DCT with Modified Selective Level Mapping

DCT alongside Selective Level Mapping become a productive PAPR decrease method by incorporating SLM and DCT network change. PAPR is decreased by changing the OFDM signal with no contortion, yet at the same time the intricacy of SLM is high. For each OFDM outline, SLM system requires 'n' IFFT activity and this activity makes the framework entangled. To win over framework intricacy of SLM, altered SLM is proposed. The adjusted SLM lessens IFFT square and furthermore the PAPR. This strategy includes an IFFT hinder at the transmitter end and the choice of choosing information with most minimal PAPR is achieved utilizing a choice calculation before IFFT. The calculation for changed SLM is given as pursues,

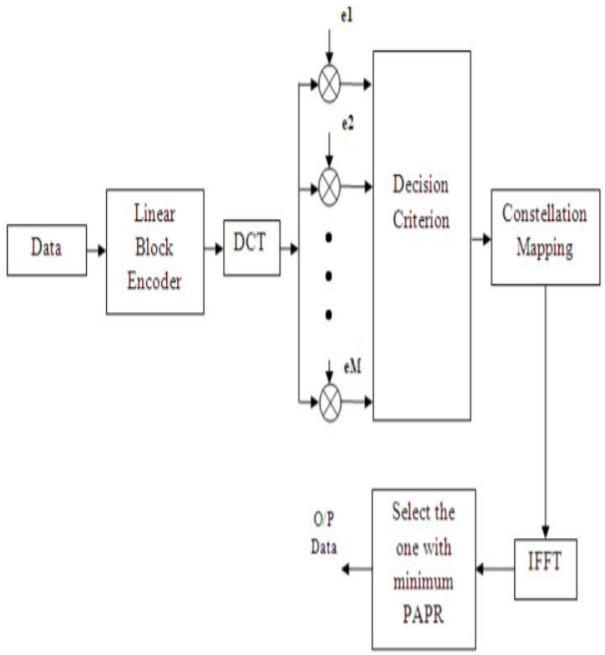

Figure 3 Modified SLM with IFFT

IV. SIMULATION RESULT

The CCDF is generally used to evaluate the performance of PAPR reduction on MIMO-OFDM system (IEEE 802.16e) signals for a statistical pair of view. The CCDF is defined as the probability that the PAPR as in equation and $PAPR_0$ as shown in the following:

$$PAPR\{Y\} = \arg \max_{k=1,2,3,.....N_T} (PAPR\{Y_k\})$$

Where Y_k, $k = 1.2.3.....N_T$ represents the time-domain transmitted signal of the k-th antenna

$$CCDF(PAPR_0) = \Pr(PAPR\{Y\} > \{PAPR_0\})$$

Figure 4 shows the graphical illustration of the performance of MIMO-OFDM 2×2 System with 256 FFT discussed in this research work in term of peak signal to noise ratio (PAPR). From the above graphical representation it can be inferred that the proposed PTS with modified SLM technique is implemented in different modulation technique i.e. BPSK, QPSK and QAM-16. The proposed algorithm gives the best performance for QAM-16 modulation technique.

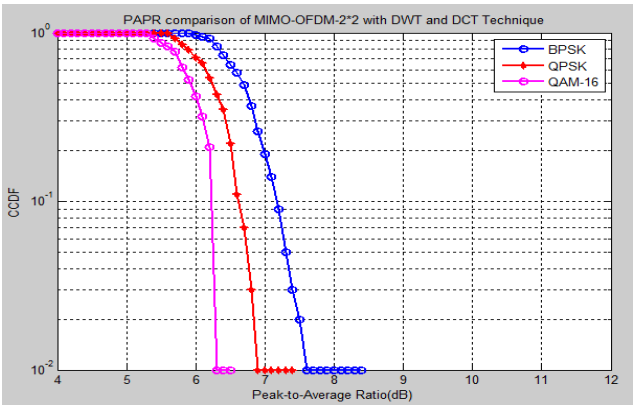

Figure 4: PAPR Performance of MIMO-OFDM 2×2 System with Modulation Technique

Figure 4 shows the graphical illustration of the performance of MIMO-OFDM 2×2 System with 512 FFT discussed in this research work in term of peak signal to noise ratio (PAPR).

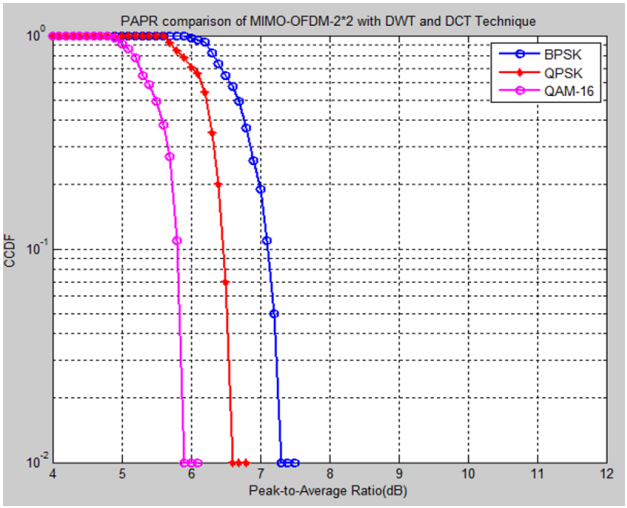

Figure 5: PAPR Performance of MIMO-OFDM 2×2 System with Different Modulation Technique

Table 1: Comparison of PAPR (dB) values for Hybrid, PTS and original PAPR signal for FFT Size 512

Hybrid PTS with Artificial Bee Colony Technique	PTS with modified SLM technique
6.8 dB	5.9 dB

V. CONCLUSION

MIMO-OFDM is a very agreeing method for the new wireless digital communication system. Along with the simplicity of equalization in Orthogonal Frequency Division Multiplexing (OFDM) modulation, it combines the capacity and diversity gain of MIMO systems for better performance. However, like conventional OFDM, MIMO-OFDM has a major challenge called high PAPR.

Hence, it requires high dynamic range power amplifier, which makes more cost of system and decreases the efficiency of power.

The adjusted SLM method is joined with DCT and IDCT is utilized in OFDM to improve the exhibition of PAPR decrease. Altered SLM procedure with DCT improves the exhibition of OFDM signal concerning PAPR.As there is an expanding interest for productive recurrence range usage. OFDM demonstrates important interest to cutting edge correspondence framework. It has been found from the reproduction result that the PAPR estimations of ordinary OFDM and altered SLM is 10.8dB and 9.5dB separately when 256subcarriers are utilized at CCDF of 10^{-3}. An improvement in PAPR decrease execution of around 35% is gotten for adjusted SLM with DCT based procedure contrasted with typical OFDM.

REFRENCES

1. Tanairat Mata, Pisit Boonsrimuang and Pitchaya Boontra, “A PAPR Reduction Scheme based on Improved PTS with ABC Algorithm for OFDM Signal”, 2018 15th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology.
2. Thana Udomsripaiboon, “Adjustable Dynamic Range for PAPR Clipping Technique in Large-Scale MIMO-OFDM Systems”, 15th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-NCON2018).
3. Ashna Kakkar, Sai Nitesh Garsha,Ojasvi Jain and Kritika, “Improvisation in BER and PAPR by using hybrid reduction techniques in MIMO-OFDM employing channel estimation techniques”, 7th International Advance Computing Conference, IEEE 2017.
4. Ho-Lung Hung, Yung-Fa Huang, Ching-Chuan and Rung-Ching Chen, “Performance of PTS-Based Firefly Algorithm Scheme for PAPR Reduction in SFBC MIMO-OFDM Communication Systems”, International Symposium on Computer, Consumer and Control, IEEE 2016.
5. P. Kothai and R. Prabhu M.E., “PAPR Reduction in MIMO OFDM Using Adaptive SLM Scheme”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Vol. 03, No. 05, pp. 729-735, May 2015.
6. Muhammet Nuri Seyman, Necmi Taspmar, "Channel estimation based on neural network in space time block coded MIMO-OFDM system", Digital Signal Processing, Vol. 23, No.1, pp. 275-280, Jan. 2013.
7. P. Mukunthan and, P Dananjayan," PAPR Reduction based on a Modified PTS with Interleaving and Pulse Shaping method for STBC MIMO-OFDM System", IEEE ICCCNT'12 , 26th _28th July 2012, Coimbatore, India.
8. L. Yang, K. K. Soo, S. li, and Y. M. SU, “PAPR Reduction Using Low Complexity PTS to Construct of OFDM Signals Without Side Information”, IEEE Transactions on Broadcasting, Vol. 57, No. 2, pp. 4532-4539, June 2011.
9. Anushree Neogi and Abhijit Mitra “MAP Estimation of CFO and STO for a Convolutionally Coded OFDM System” National Conference on Communications (NCC), pp. 01-05, IEEE 2011.
10. Chin-Liang Wang and Shun-Sheng Wang and Hsiao-Ling Chang, “A Low-Complexity SLM Based PAPR Reduction Scheme for SFBC MIMO-OFDM Systems”, 978-1-61284-254-7/11 IEEE 2011.
11. Li, M., Wang, X. and Guo, L.W. "The Research on the Performance of Iterative KALMAN Channel Estimation in MIMO-OFDM System", Journal of Hebei University of Science and Technology, Vol. 31, No.6, pp. 550-552, Dec. 2010.