INVESTIGATION OF PARTIAL TRANSMIT SEQUENCE FOR THE REDUCTION OF PEAK TO AVERAGE POWER RATIO (PAPR) BY OPTIMIZING SIDE INFORMATION IN MIMO_OFDM SYSTEM

Bisma Fayaz[1], Abita Devi[2], Harveen Kaur[3]

[1]M.Tech Scholar, Department of Electronics and Communication Engineering, kurukshetra university.
[2]Assistant Professor, Panchkula Engineering College.
[3]Assistant Professor, Panchkula Engineering College.
Panchkula, Haryana, India.

Abstract - *In the case of a MIMO-OFDM system, the output represents the process of multiple sub-carrier's superposition. In this type of approach, some of the immediate outputs of power might increase in the large amount and it becomes higher than the system-based mean power when the phases of such carriers are considered to be same. This also represents a large amount of PAPR i.e. Peak-to-Average Power Ratio. The high amount of PAPR level presents one a major issue in the case of MIMO-OFDM systems. For transmission of signals with the large (high) amount of PAPR, it needs to have power amplifiers (PAs) with a large cope of power. Such kinds of amplifiers have low cost-based efficiency and are very costly. If peak power is large (high), it could be out of scope from linearized power amplifiers. This generally provides increase distortion of the non-linear type which transforms the superposition of spectrum-based signal that further results in degradation of system-based performance. If the system under operation carries no such measures for reducing the high level of PAPR, then the system of MIMO-OFDM could face challenging limitations for the real (practical) applications. For combating high amount of PAPR, one of the possible impressive solutions is to adopt such kind of amplifiers that have a large range of trade-offs. Moreover, these amplifiers are usually very expensive having low cost-based efficiency. Therefore, such amplifiers are not used practically. On the other hand, several possible algorithms were introduced and have been proved to achieve better performance for the reduction of PAPR. Hence, the thesis work includes some of the presently promising methods of PAPR reduction. The research is further studied and compared with the existing approaches. The performance of such reduction schemes are observed and further evaluated using MATLAB simulation software.*

Key Words: **Peak to average power, Orthogonal frequency division multiplexing, Bit error rate, Signal to noise ratio, power amplifiers, algorithm, MATLAB.**

1. INTRODUCTION

The wireless applications have now grown much rapidly. There is a demand of high quality as well as high speed in wireless communication applications. So from recent years the communication has started focusing on 4G (fourth Generation) mobile communication system [1]. it is hope fully expected that 4G will provide very comprehensive and secure IP solution where users can be offered by voice data and multimedia at any time any place with higher data rates then previous generation. 4G requires well advanced communication techniques to be employed in order to improve spectrum and achieve as high as 100MBPS wireless transmission. Due to very superior performance MIMO OFDM has been adapted. As it offers a high tolerance to multipath signals and also is being spectracally efficient, OFDM is preferred for future wireless communication system. OFDM has been adopted by various high data rate standards for communication systems because of its spectral efficiency and immunity to ISI caused by multi path signal propagation. The spectral efficiency of OFDM is due to spectra overlapping of adjacent subcarriers and immunity to ISI is gained using the CP (cyclic prefix) as time domain guard bands because each sub carrier encounters a flat fading even though the overall channel response is frequency selective because the bandwidth of each sub carrier is much smaller than the coherence band width of the channel.

In addition to the advantages of OFDAM it also has a main disadvantage of PAPR (peak to average power ratio) that is it allows higher peak power to be transmitted at fixed average power (peak of the OFDM can be N times the average power. N being the number of carriers). These large peaks increases the inter modulation distortion resulting in the error rate. As a result of which certain subcarriers can be severely attenuated by deep fading and because of which OFDM signal do not offer any BER improvement over signal carrier system.

Also it is known samples with very high peak valve may be produced by coherent superposition of large number of sub carriers through IFFT (inverse fast Fourier transform) as compared to the average power symbols of OFDM [2][3]. As a result of which the system design would be challenging if a high power amplifier is used at the transmitter. As a result of which the elimination of the baneful effect of the peak to average power ratio (PAPR) results in additional high complexity, data rate loss, BER deterioration.

Therefore, High PAPR is one of the most serious problems in MIMO-OFDM system. To transmit signals with high PAPR, it requires power amplifiers with very high power scope. These kinds of amplifiers are very expensive and have low efficiency-cost. If the peak power is too high, it could be out of the scope of the linear power amplifier. This gives rise to non-linear distortion which changes the superposition of the signal spectrum resulting in performance degradation. If there are no measures to reduce the high PAPR, MIMO-OFDM system could face serious restriction for practical applications.

To overcome high PAPR, one solution is to use amplifiers with larger trade-off range. However, these such of amplifiers are generally very expensive and have low efficiency, and hence have no practical use. Also various techniques and algorithms has been introduced to overcome the problem of PAPR. In this thesis, some already existing paper reduction methods are studied and compared. The performance of these schemes are evaluated by using simulation software, MATLAB.

2. PROPOSED WORK

From the literature survey it can be concluded that most of the work in communication system has been done to improve system performance, so as to get a robust system with least BER. OFDM is one of the most effective multiple access technique employed in wireless communication system. The OFDM based systems are more robust compared to OFDMA system. The performance of any multiple access technique depends on its channel estimation process. So in proposed algorithm OFDM technique is employed with improved performance. To improve performance of OFDM system its parameters are adaptively estimated using LMS (Linear Mean Square) technique. Adaptive estimation technique may acquire prior knowledge about channel BER. The knowledge about channel parameters is optimized by using Bayesian. This is done to achieve a system with reduced Bit Error Rate (BER).

2.1 PROPOSED WORK

The process of proposed technique is given as steps below:

Step 1: The initialization of protocol is deploying BS.

Step 2: After deploying, then start making cluster.

Step 3: Then each cluster has multiple queues, then define the priority.

Step 4: After definition, change priorities according to the data.

Step 5: Then select time stamp for every node.

Step 6: The next step is initializing the likelihood.

Step 7: After this, define the new threshold.

Step 8: Then the prediction of threshold is done using Bayesian Approach.

Bayesian Approach is a catalyst which boosts to use the instructions as a right path to establish energy minimization algorithm. It gives top most performance for the minimum consumption of energy by determining optimum parameters which are required for pre-deployment of sensor nodes and ensures best detection of fault [4].

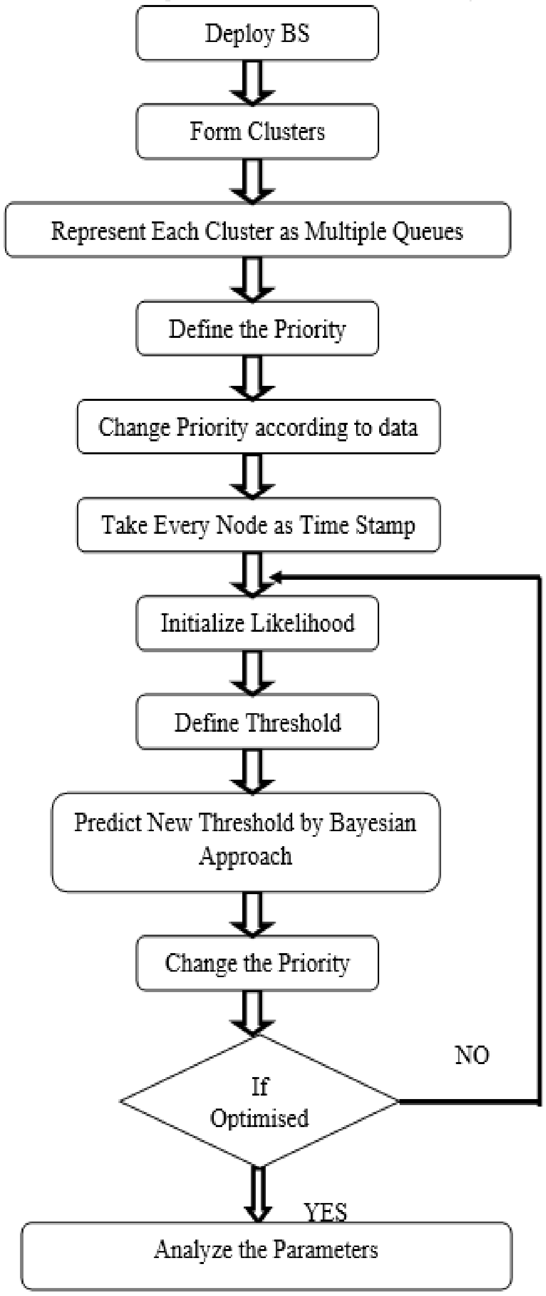
Step 9: Change the priorities.

Step 10: After changing priorities, optimization process is started. If optimization is successful, then drop the packet collision else go to the step 6.

These steps are graphically represented in flowchart

As shown in the flow chart hyper parameter tuning is a kind of Bayesian optimization: minimize a function f (θ), but you only get to query values, not compute gradients Input θ: a configuration of hyper parameters Function value f (θ): error on the validation set Each evaluation is expensive. Given a fixed adaptive buffer of evaluations, the performance of an optimizer is quantified by the improvement obtained at the end of the optimization, i.e., when the evaluation buffer is consumed. Thus, at each iteration n, the best Bayesian optimization algorithm evaluates the buffer leading, at the end of the optimization, to the maximum expected feasible improvement. To define this optimal Bayesian optimization algorithm, it is first necessary to characterize how a design evaluated at iteration n is likely to affect the following iterations under an optimization policy. An optimization policy is a mapping from a training set D to a design to evaluate x. Using GPs as generative models. Combined with an optimization policy, this defines a mechanism that simulates the possible future steps of the optimization. Each possible buffer has a known probability of occurrence characterized by the statistical model. Thus, for a given optimization policy, the expected improvement obtained at the end of the optimization can be quantified with this simulation machinery. The optimal Bayesian optimization algorithm corresponds to the (unknown) best optimization policy which is the solution of an intractable dynamic programming (DP) problem.

FLOWCHART OF PROPOSED PROTOCOL



3. RESEARCH METHODOLOGY

In the proposed methodology, pre-scrambling of bit-blocks takes place before IFFT and the process of descrambling occurs after FFT with the help of a special sequence. The process of scrambling and descrambling is performed by multiplication of parallel blocks arranged bit-by-bit by the processing sequence and it also occurs by a large number of parallel block-based decisions with the help of swarm intelligence method. Both the processes of scrambling and descrambling uses a feedback approach using a polynomial function.

Step1: Scrambling the in-phase is divided into an optimization approach using swarm intelligence method. Two of the phases are assumed, where, the first is scrambled N/2 signal and the second involves N/2 signal using the process of random order.

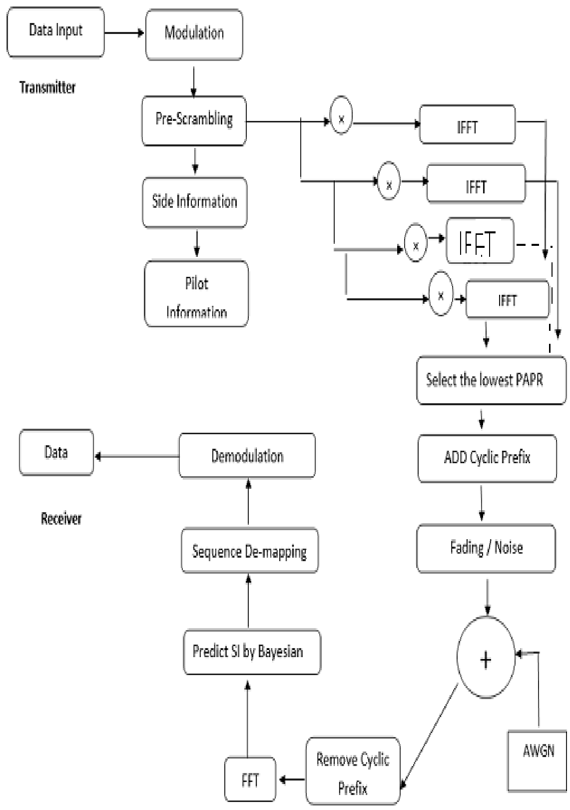
Step2: Each of the subcodes uses a parallel block code that depends on a decision in the context of the first step.

Step3: Scrambling and descrambling self-feedback process using a polynomial method for the purpose of error reduction.

New work:

1. Parallel block bits take dynamic values which reduce the BER because of its adaptive behavior.
2.
3. The self-feedback process is used before partial scrambling process which we will use further in full scrambling process.
4.
5. Use of adaptive phase decision.

3.1 RESEARCH DESIGN



4. SIMULATIONS RESULTS AND DISCUSSIONS

With the goal of channel models, different modeling approaches are applied depending on the target system and its intended use with the same conditions as in the previous graph, but with a fixed number of antennas of 64 and varying number of users, the result became as shown in

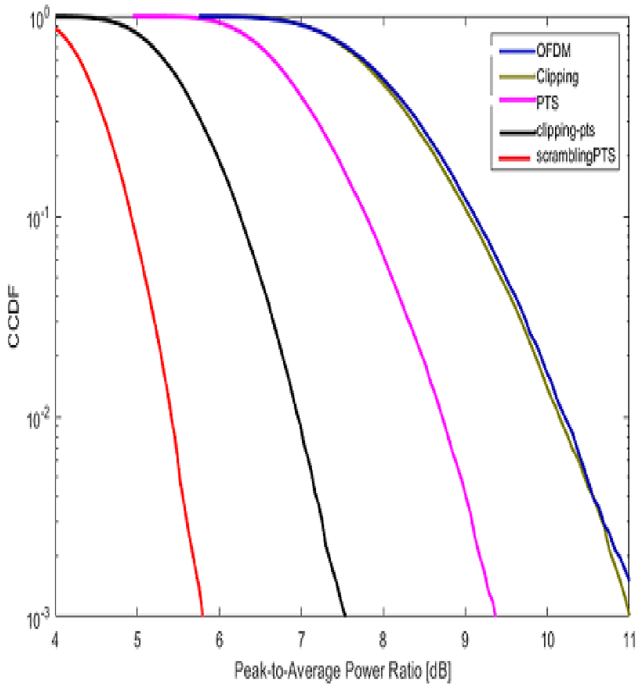


Figure 4.1: Comparison of proposed work and different approaches

Figure 4.1 shows a classification of the general approaches for MIMO channel modeling. The two main categories are deterministic and stochastic modeling approaches. Deterministic models are typically based on propagation mechanisms in a specific environment using, e.g., ray tracing or electromagnetic-wave theory. The site-specific feature of deterministic models makes them suitable for simulating systems in a specific environment. On the other hand, a physical model containing geographical and morphological information about the environment is required, which can be very complex depending on the environment and the desired modeling accuracy. Further, simulation factors such as the number of launched rays and the order of reflections will determine modeling accuracy and computational complexity. Stochastic models aim at reproducing essential channel behavior in a statistical sense. Correlation First, an error case with only slight errors was considered and simulated in order to assess the performance loss.

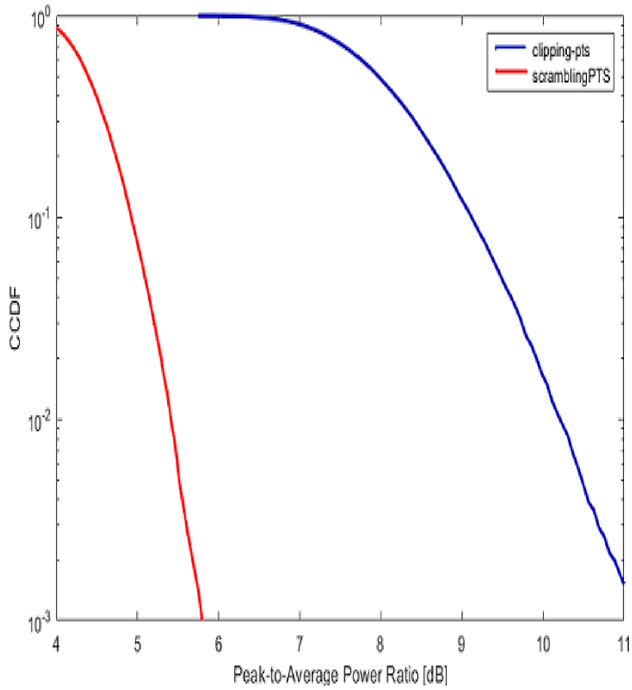


Figure 4.2: Graph between CCDF and PAPR with scrambling PTS and clipping PTS of MIMO OFDM system.

In figure4.2 such modeling approaches do not attempt to predict the propagation in a specific environment, but rather to represent the statistical behavior of important propagation properties. A simple example is the Rayleigh fading model. In MIMO channel modeling, two approaches are often used. Even for slight errors it is possible to save 43% power which makes it reasonable to look closer into. With the observation that the word length in the filter could be pushed further than in the IFFT, further assessment of the filter was done. Fixing the number of antennas at 64, but varying the number of users between 4, 8, 16 and 32 leads to results for how different system loads affects the number of needed bits

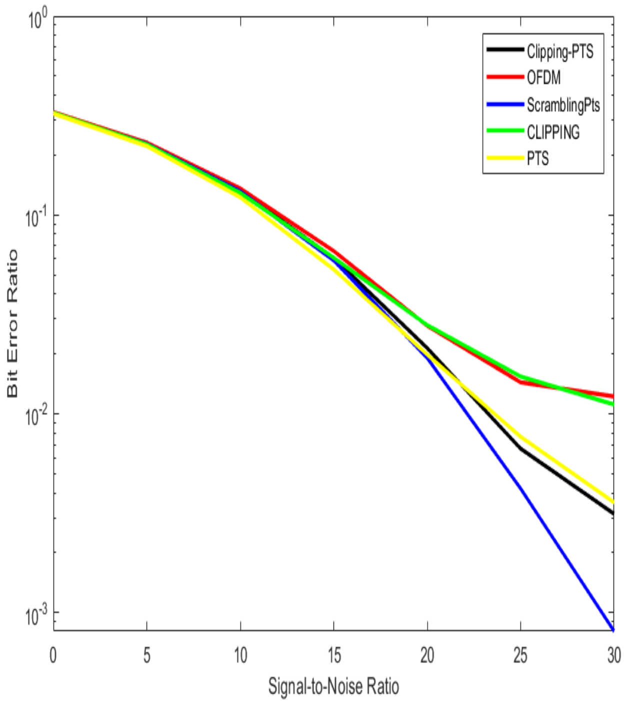


Figure 4.3: Graph between BER and SNR with scrambling PTS and different approaches of MIMO OFDM system.

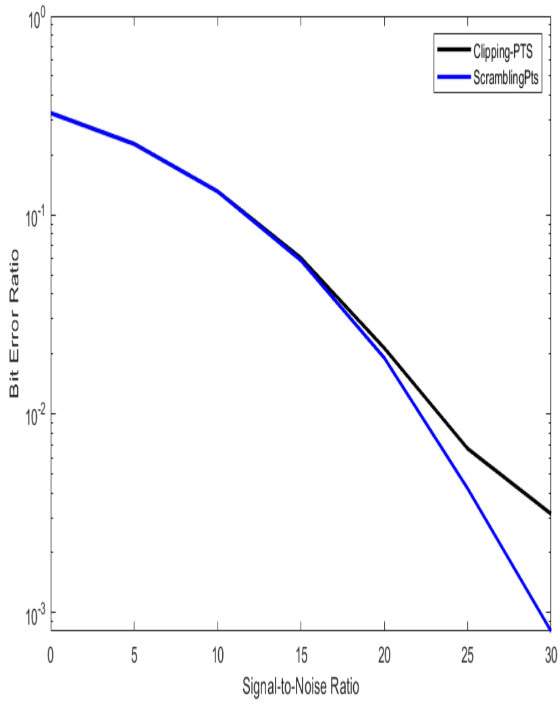


Figure 4.4: Graph between BER AND SNR with scrambling PTS and clipping pts approach only of MIMO OFDM

In figure 4.3 performance can be lost if the number of chosen bits representing the signal and filter coefficients are not enough to get a result similar to the floating point case in Figure 4.3 the floating point case is compared to the fixed-point case. For the lower SNR values the curves are basically the same, but the difference gets bigger for higher SNR values. For a BER at 10−3 the SNR degradation is about one dB. Though, it might be beneficial to increase the number of bits representing the signal with just one or two bits to get a better accuracy and a smaller SNR degradation compared to the floating point case. The remarkable power saving due to using low accuracy hardware will still be present, but the SNR degradation would probably be smaller.

In fig 4.4 different modulation is generally not an option in cellular networks, due to the inter-cell interference and unfavorable cell edge conditions. Numerical simulations can, however, predict the practically achievable spectral efficiency. The figure below shows the uplink spectral efficiency for a base station with 200 antennas that serves a varying number of users. Interference from many tiers of neighboring cells is considered. Zero-forcing detection, pilot-based channel estimation, and power control that gives every user 0 dB SNR are assumed. Different curves are shown for different values of τ_c, which is the number of symbols per channel coherence interval. The curves have several peaks, since the results are optimized over different pilot reuse factors.

5. Conclusion

First of all, this thesis provides an overview of Multiple-Input-Multiple-Output (MIMO) technology and Orthogonal-Frequency-Division-Multiplexing (OFDM). At the same time, the advantages and disadvantages of OFDM system are concluded by analyzing and comparing it with other traditional modulation schemes. The focus of thesis is that we investigate one of the bottleneck problems that exist in OFDM wireless communication system – high peak average power ratio (PAPR) of OFDM signal, and discuss how to reduce it by different effective algorithms. The main contributions of this thesis are listed below:

1. The comprehensive research mainly focuses on the signal scrambling technology, and verify the theoretical analysis by observing the MATLAB simulation results. At the same time, some meaningful guidance and conclusions are obtained through the comparative analysis of these simulation results as well.

2. In the signal scrambling technology, we study the method of selected mapping and partial transmit sequence. A series of detailed comparison results were obtained of these two schemes from the angle of PAPR reduction performance, redundancy of auxiliary information, as well as complexity of system. Summed up the advantages and disadvantages of two

algorithms and pointed out that the occasions of their respective adaptation. For the inherent defect of traditional PTS algorithm – complex computing, a very effective iterative method is introduced to determine sub-optimal weighting factor for each sub-block instead of conducting an ergodic searching so as to reduce the calculation complexity significantly. This sub-optimal algorithm gives a better approach. At last, we also compare these two schemes under the same conditions in general, and some conclusions were drawn which are constructive to practical work.

S0 an efficient design of channel estimation technique for OFDM system is presented and this design has been optimised using Particle Swarm optimisation technique. The design is simulated using MATLAB. This particle swarm optimized LMS channel estimation technique can estimate channel dynamics and support multiple access. In this scheme weighting coefficients are updated by the algorithm dynamically without any information regarding channel statistics. Consistently, throughout this report, the results are based on a signal with a 16-QAM constellation. Two reasons why the results for the simulated VOS and antenna outage did not get better is partly that the fixed-point word length for the signal could have needed one or a few more bits and partly that 16-QAM is more sensitive to errors than smaller signal constellations. The conclusions from this is that 16-QAM represented with these fixed-point word lengths is a bit too sensitive to sufficiently recover from errors and antenna outage. Furthermore, simulations have shown that it can be better with more extreme errors where the error rate on the eight MSBs is 50% than having a 25% probability on the MSB. This is an interesting result but unfortunately a clear explanation for this has not been found. A preliminary explanation is that it is caused by the power control in the transmitter, which is the power scaling in this model. Another conclusion drawn is that large power saving are possible for the digital signal processing in massive MIMO systems. More specifically 97% can be saved when using the fixed-point word lengths five for the signal and six for the filter coefficients and allowing slight errors on two antennas. For a BER of 10−3 this would mean a SNR degradation of about two dB. The signals while travelling through noise channel keep on fluctuating, these fluctuations are nullified using this algorithm. The given algorithm converges towards the accurate channel coefficients. This advantage of convergence of channel coefficients towards the true channel coefficient as well as BER performance could be of relevant use in future mobile communication.

6. Future Scope

This work will help to realize an OFDM system having optimal performance under both Rayleigh and AWGN channel. This estimation technique can be employed in pilot based OFDM system to have accurate estimation of channel for uplink signal transmission.

REFERENCES

[1] Young Kyun Kim, Ramjee Prasad, "What is 4G," in 4G Roadmap and Emerging Communication Technologies, Artech House, 2006, pp. 12–13.

[2] Shinsuke Hara, Ramjee, "Principle and history of MCM/OFDM," in Multicarrier techniqu -es for 4G mobile communication, Artech House, 2003, pp. 39.

[3] E. Telatar, "Capacity of multi-antenna Gaussian channels," European Transactions on Telecommunications, vol. 10, no 3, Dec 1999, pp. 585–595.

[4] Sanjana T and Suma M N, "Comparison of channel estimation and equalization techniques for ofdm systems", Circuits and Systems: An International Journal (CSIJ), Vol. 1, No. 1, pp 1-10, January 2014