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Effective Solution of Peak-to-Average Power Ratio in OFDM Signals with optimal iterations

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Abstract. ***Reduce Peak average power ratio (PAPR) of orthogonal frequency division multiplexing (OFDM) was the care for many researcher ,many techniques solved this problem by care of parameter that others, The partial transmit sequences (PTS) method was one of these techniques and more than the others techniques, the problem exist in the partial transmit sequences (PTS) method is complexity, also many researchers worked in problem of complexity and solved by lot of optimizing techniques, Genetic Algorithm (GA) optimization was one of these methods , In this paper the simulation used WLAN in IEEE 802.11a system parameters, The simulation results show better values for PAPR arrive to1 dB with less numbers of iteration only 1or 2 iterations.***

Keywords: **Genetic Algorithm (GA) -orthogonal frequency division multiplexing (OFDM) -Peak average power ratio (PAPR)-partial transmit sequences (PTS)) -Bit Error Rate (BER). infrared (IR) - radio frequency (RF). - Direct Sequence Spread Spectrum (DSSS) -Frequency -Hopping Spread Spectrum (FHSS) the - (Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA).**

I. INTRODUCTION

Wireless Local Area Networks (WLANs) offer the obvious advantage of avoiding much of the time and cost associated with deploying wires and cables (Williams& Veronica, 1996) [1].Although there exist a number of nonstandard wireless LANs, this discussion focuses on standards - based versions from the IEEE 802.11 Working Group, which began its efforts in 1989. Those standards specify Layers 1 (Physical) and 2 (Data Link), as is the case with all LANs. With respect to transmission media, WLANs operate on infrared (IR) as well as radio frequency (RF) media. The RF specifications include both DSSS (Direct Sequence Spread Spectrum) and FHSS (Frequency -Hopping Spread Spectrum) and the Ethernet CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance) protocol. (Horak, 2007) [2].The issue of high Peak to Average Power Ratio (PAPR) and Bit Error Rate (BER). that weaken system performance is related to the sensitivity of OFDM transmitter devices such as DAC (Digital to Analogue Convertor) and HPA (High Power Amplifier) is very husky to the signal processing loop that induce spectral regrowth and detection efficiency degradation (Sutud U-thong et al, 2014)[3]. Several researchers independently developed three mainstream evolutionary algorithms, namely, genetic algorithms (Holland, 1975: Goldberg, 1989) [4][5], evolutionary programming (Fogel,1995)[6] and evolution strategies(Beyer and Schwefel, 2002)[7].

II. METHODOLOGY

A. Generating OFDM signal

Number of bits to process, n = 0, 1… N – 1,In IEEE 802.11a equal 48, The code generates an OFDM signal for IEEE 802.11 a randomly, Random binary data stream, Size of signal constellation M equal 64, evaluate number of bits per symbol from equationlog2(M);The collection of all data symbols Xn convert every symbol to decimal number then Convert the bits in x into k-bit symbols, Modulate using 64-QAM.total symbol duration equal useful symbol period Plus guard interval lengths=tu+tg; tu=3.2e-6; tg=0.8e-6,total number of subcarriers equal 8,the total symbol duration will divided by (1/ carrier frequency) from 0 to total number of subcarriers then Plotting OFDM Signal for 64-QAM modulation.

B. Implementation by conventional Partial transmit sequences PTS.

Is one of the most efficient techniques to decrease PAPR for OFDM Signal, First the OFDM signal data divided into blocks equal 14, In the code every block equal 128 with removing CP Noise equal 10bit and every sub-block converted to real and imaginary to be valid input for PTS algorithm then placed in transpose later collected again with placing in transpose As shown in figure (1), That mean in transmission need side information.

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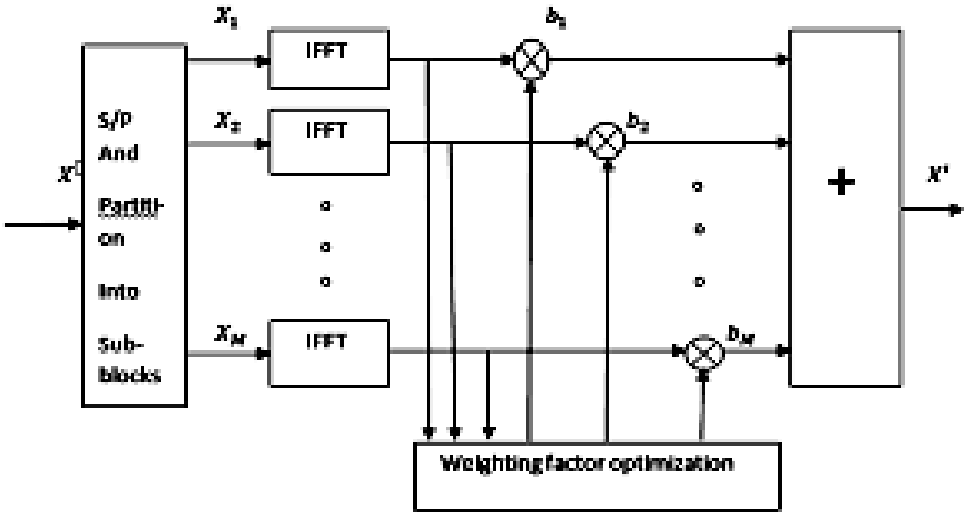

Fig.1. Block diagram of conventional PTS scheme *(GagandeepKaur., et.al.2012)* [8].

To calculate the PAPR of the OFDM signal and by using PTS apply the below equation Where x (n) is the original signal, max/x (n)/ ^{2} is the peak signal power and E [/x (n)/ ^{2}] is the average signal power, Where E [ ] is the anticipation operator, Doppler Frequency equal 20 hertz with Applying raylei distribution.

$$PAPR = \frac{\max_{0 \le t < NT} |x(t)|^2}{1/NT \cdot \int_0^{NT} |x(t)|^2 dt}. \qquad (1)$$

C. Variable to variable crossover in genetic algorithm

First ascending the values of the PAPR for PTS signal in 8 elements, every 8 elements called genes, so we have set of parents equal (total symbol duration/gene),gene here equal 8 element, the set of parents will divided to two sets, the above set called parent1and the down set called parent2.As shown in figure (2) for the flowchart, Now begin the loop firstly pick a cross-over point randomly and export number of row and column from this point this is a cross-over point, Secondly transferred data between the two parents from our reference point which is the crossover point ,then collect the all data again, Randomly flip all the elements in this matrix then put it in one row this is mutation process, Repeated the two above operation until the number of iteration finish but here i will make only one iteration or two iteration as the maximum, Then Computing new PAPR and plotting GA Graph.

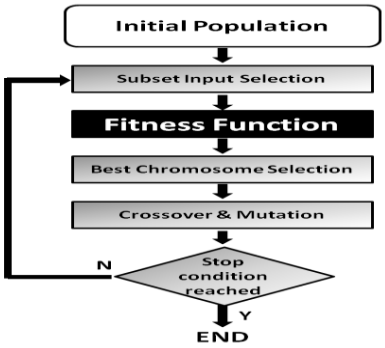

Fig 2. Flowchart for variable to variable crossover in genetic algorithm

III. SIMULATION RESULTS

Simulate all the based on the standard IEEE 802.11a in table (1): Evaluation PAPR and comparison the performance between OFDM, traditional PTS and (the variable to variable crossover in genetic algorithm to optimize PAPR reduction method for 1, 2 iteration to 50 rerun).

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Table 1. Parameter for simulation

Modulation	64 QAM
No of FFT points	64
Channel model	18-path Rayleigh Fading
Number of bits to process	48
No of sub carrier	48
No of sub blocks	8
Doppler frequency	20 HZ
Multipath delay profile	50ns

Table 2. Comparison between two types with 1 iteration in genetic algorithm

OFDM in dB	Conventional PTS in dB	Variable to variable crossover in genetic algorithm in dB for 1 iteration to 50 rerun
17	15	11
37	32	19
26	37	55
13	18	27
6	7	36
24	23	4
9	7	17
5	9	19
13	26	9
23	18	4
12	21	45
7	14	25
14	12	19
20	27	6
11	13	11.5
41	22	20
3	16	8
9	6	34
34	29	28
7	9	16
9	13	12
8	14	12
33	18	23
10	12	22
21	26	33
35	32	22
4	4	19
11	11	8
7	8	9.5
11	10.2	7.5
1	18	10
23	34	16
25	25	15
14	8	8
15	27	12
5	10	10
12	16	8
14	19	20
10	15	55
18	23	33
25	27	38
35	20	15
9	19	12

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20	27	17
17	13	4
4	15	16
4	27	9
23	15	7
16	32	9
12	24	18

Table 3. Comparison between two types with 2 iteration in genetic algorithm

OFDM in dB	Conventional PTS in dB	Variable to variable crossover in genetic algorithm in dB for 2 iteration to 50 rerun
14	10	32
17	27	38
8	8	19
40	30	23
15	11	23
39	38	1.5
10	11	37
38	19	6
4	15	22
15	13	27
19	20	61
22	20	38
13	22	9
17	22	6
38	32	4
21	30	36
4	7	46
5	8	27
7	11	12
4	5	25
7	18	17
7	10	19
5	6	1
8	12	17
15	11	19
13	13	12
22	14	4
27	26	17
16	19	7
16	16	17
4	6	19
19	13	5
19	17	27
22	25	22
15	22	15
3	7	22
3	7	9
8	10	27
11	11	12
10	19	10
25	32	38
25	17	5
11	8	17
30	21	35
35	28	14
13	38	27
27	32	30

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5	6	32
25	20	15
5	20	51

PAPR performance

In Figure (3) PAPR performance for 1 iteration found that the PAPR for genetic algorithm equal to 4dB after 6 rerun as shown in table (2) when original signal gives 24dB and the conventional PTS gives near 23dB also the code give 42% good result, In Figure (4) PAPR performance for 2 iteration found that the PAPR for genetic algorithm equal 1dB from 23 rerun as shown in table (3) when original signal gives 5dB and the conventional PTS gives near 6dB also the code give 30% good results.

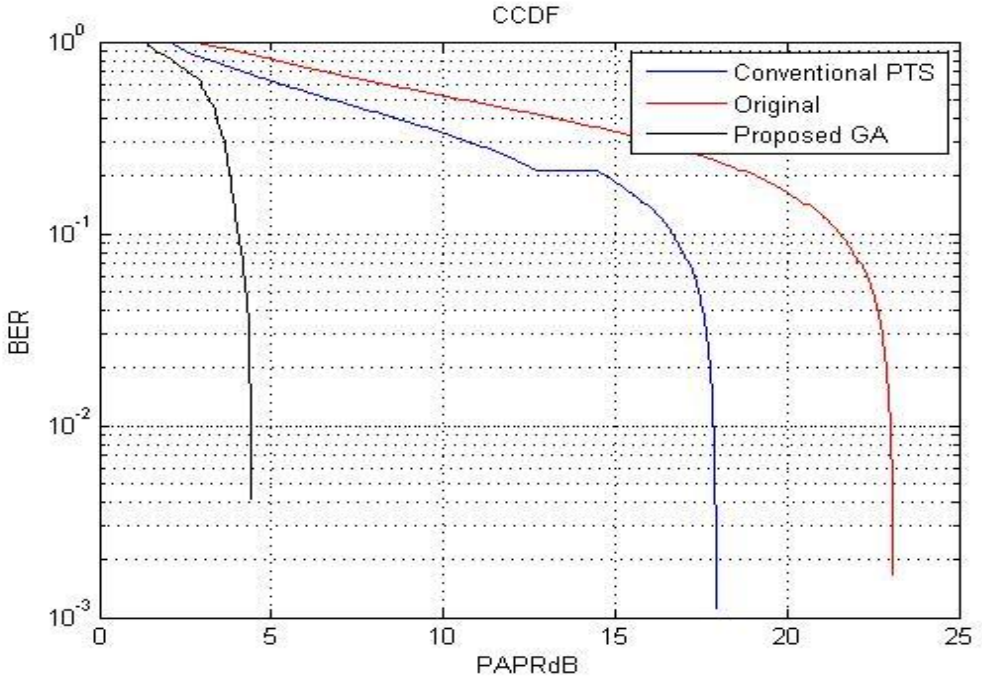

Fig 3. PAPR performance for 1 iterations

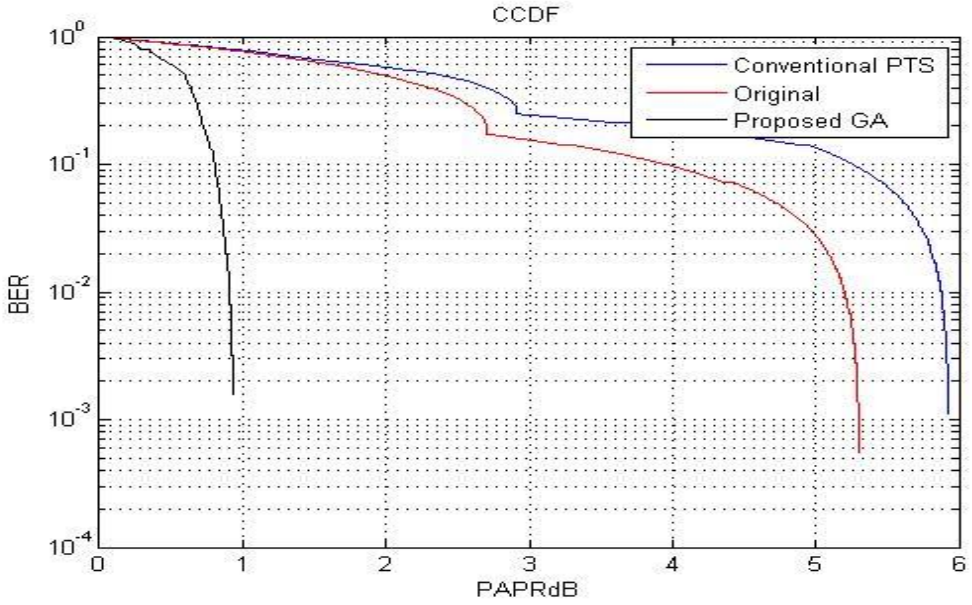

Fig. 4. PAPR performance for 2 iterations

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IV. DISCUSSION

Some other papers (Y. Wang ,2012: Mohamed S. El-Mahallawy ,2014)[9][10]work on optimization for the candidate vectors of phase rotation, also many paper made comparison between different techniques to solve problems of optimization(Sung-Soo Kim et al, 2008: CHEN Zhi et al, 2014: Jenn-Kaie Lain et al, 2011: Yang Zhang et al, 2009: Zehra Gülru Çam et al, 2015)[11][12][13][14][15],In our research in genetic algorithm display different number of iteration , And different value for PAPR reduction for everyone with percentage of good code .With single-point crossover and boundary mutation for 8 sub-blocks ,When plotting if there is consecutive (10) output PAPR are (0) then the code will change these values randomly with another PAPR result as not to be ten values equal 0 consecutive so my work care only for PAPR reduction values.

V. CONCLUSION

The parameters of the simulation are determined by IEEE 802.11a the simulation result shows that the variable to variable crossover in genetic algorithm has better PAPR for 1,2 iteration than OFDM and conventional PTS methods but with different percentage good result for the code when rerun. With 1 iteration only give 4dB at 6 reruns and the code give 42% good result, For 2 iteration give 1dB at 23 reruns and the code give 30% good result while OFDM method 5dB and PTS method gives 6dB, these results are the best result to solve the problem of PAPR with less iteration only 1 iteration and specially 2 iteration also with good percentage in good results and the future work will be in the implementation of the percentage of the good results ,these results are good than paper Variable to variable crossover in GA to solve PAPR reduction in OFDM systems***(S. U-Thong, et al. 2014)***[16], which the propose method for the paper reduce PAPR more than the original OFDMsignal,2-CAPPR and conventional PTS by 6.12dB ,4.98dB and 1.78dB at the 3 iteration ,respectively also this paper did not get any figure for this result.

REFERENCES

[1] Williams& Veronica A. Wireless Computing Primer . M & T Books , 1996.

[2] RAY HORAK. TELECOMMUNICATIONS AND DATA COMMUNICATIONS HANDBOOK,wily2007.chapter 8:p355:422.

[3] Sutud U-thong et al, Variable to variable Crossover in GA to Solve PAPR Reduction in OFDM Systems, APSIPA 2014.

[4] Holland J. H. Adaptation in natural and artificial systems. Ann Arbor: The University of Michigan Press;1975.

[5] Goldberg D. E. Genetic algorithms in search, optimization and machine learning. New York: Addison Wesley;1989.

[6] Fogel D. B. Evolutionary computation: Toward a new philosophy of machine intelligence.IEEE Press, Piscataway, NJ;1995.

[7] Beyer H. G. and Schwefel H. P. Evolution strategies: A comprehensive introduction. Natural Computing 2002;1 (1) 3-52.

[8] GagandeepKaur.,et.al.2012.Compare SLM (selective mapping) and PTS (partial transmit) technique for PAPR reduction of an MC-CDMA (multi-carrier complex division multiple access).IJERA.2(4): 779-784.

[9] Y. Wang, W. Chen, and C. Tellambura, "Genetic algorithm based nearly optimal peak reduction tone set selection for adaptive amplitude clipping PAPR reduction," IEEE Trans. on Broadcast., vol. 58, no. 3, pp. 462– 471, Sept. 2012.

[10] Mohamed S. El-Mahallawy, Genetic Algorithm for PAPR Reduction in SLM Wavelet-OFDM Systems, 2014 International Conference on Computer, Control, Informatics and Its Applications.

[11] Sung-Soo Kim et al, PAPR reduction of OFDM signals using genetic algorithm PTS technique, IEICE Transactions on Communications (Impact Factor: 0.23). 04/2008; 91-B(4):1194-1197. DOI: 10.1093/ietcom/e91-b.4.1194.

[12] CHEN Zhi et al, Optimal phase searching of PTS using modified genetic algorithm for PAPR reduction in OFDM systems Science China Information Sciences :June 2014, Volume 57, Issue 6, pp 1-11.

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 8, Issue 6, November 2019

[13] Jenn-Kaie Lain et al, PAPR reduction of OFDM signals using PTS: a real-valued genetic approach, Lain et al. EURASIP Journal on Wireless Communications and Networking 2011, 2011:126.

[14] Yang Zhang et al, An Intelligent Genetic Algorithm for PAPR Reduction in a Multi-Carrier CDMA Wireless System, Authorized licensed use limited to: Brunel University. Downloaded on August 6, 2009 at 09:38 from IEEE Xplore.

[15] Zehra Gülru Çam et al, Learning Parameter Optimization of Multi-Layer Perceptron Using Artificial Bee Colony, Genetic Algorithm and Particle Swarm Optimization, SAMI 2015 • IEEE 13th International Symposium on Applied Machine Intelligence and Informatics • January 22-24, 2015 • Herl'any, Slovakia .

[16] S. U-Thong., et al. 2014.Variable to variable crossover in GA to solve PAPR reduction in OFDM systems. Asia. 10.