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Papr Reduction of MIMO-OFDM System Using SLM with ABC Algorithm

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Abstract: *For future wireless communications Multiple input multiple output and orthogonal frequency division multiplexing (MIMO-OFDM) is an originating technology for high speed data multi-carriers transmission. Because it combines both MIMO technology, which gives high data rates without need of additional bandwidth and OFDM technology, which gives good robustness in multipath environment, high spectral efficiency, so it is very beneficial. But the main drawback of this is peak to average power ratio (PAPR). This feature impact on power amplifier leading to non-linear distortion, and it is necessary to reduce PAPR as much as possible. So many methods to reduce PAPR. In those selective mapping (SLM) is one of the most important PAPR reduction technique proposed for MIMO-OFDM systems. But computational complexity is more for this scheme. In this paper artificial bee colony (ABC) algorithm, Modified ABC and parallel ABC (P-ABC) for SLM scheme are proposed which gives better PAPR reduction performance with less complexity. Alsoapplied the proposed ABC and P-ABC algorithms over a Stanford uniform interim (SUI) channel model. Simulation results shows that the proposed P-ABC algorithm is giving better PAPR reduction and bit error rate (BER) performances with less complexity, alsoshows that proposed algorithms are giving better results over SUI channel.*

Index Terms: *Multiple input multiple output, orthogonal frequency division multiplexing, peak to average power ratio (PAPR), parallel artificial bee colony algorithm (P-ABC), SUI.*

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I. Introduction

The modern day circumstance observed that there is increased strong desire for more information and an uncontrollable advancement of new multimedia wireless applications. As a result an increased demand for new technologies that support very high speed data transmission rates, mobility, flexibility, efficient utilization of available spectrum and efficient utilization of network resources. To achieve these requirements so many technologies are adopted in wireless communication standards, one of the most attractiveemerging technology is multiple-input multiple-output orthogonal frequency division multiplexing (MIMO-OFDM).As name indicates it is combination of both technologies i.e., multiple-input multiple-output technology and orthogonal frequency division multiplexing technology.

Orthogonal frequency division multiplexing (OFDM) is one of the best technique to achieve the requirements of wireless communication like high data rate transmissions, more speed, flexibility, best utilization of available spectrum and network resources. Multiple-input multiple-output (MIMO)technology is a method to increase the capacity of the system. MIMO, which means using multiple antennas at the transmitter and at the receiver. It has so many advantages like high capacity, achieving full diversity, increasing data transmission rates, reducing bit error rates and so on. These techniques have so many advantages, even though some disadvantages are present like sensitive to synchronization errors, high peak-to-average power ratio (PAPR), and sensitive to carrier off- sets.

Among these disadvantages high peak-to-average power ratio (PAPR) isone of the major drawback of the system [1]. Because high peak-to-average power ratio leads to the signal peaks move into the non-linear region of the radio frequency (RF) power amplifier, this will gives the non-linear distortions and spectral spreading.It also increases the complexity of the analog to digital and digital to analog converters. And handling these infrequent or rare large peaks edge to low power efficiency and then increase the cost of the radio frequency power amplifier. Because of these many disadvantages we have to reduce high peak-to-average power ratio (PAPR).

So many methods are proposed to reduce the high peak-to-average power ratio [2][3]. In these methods SLM is the better technique to reduce PAPR. But it has high computational complexity which also increases cost. So reducing the computational complexity is very important. So many techniques are proposed to reduce the computational complexity of the system.

One of the most important algorithm is Artificial Bee Colony (ABC) algorithm [4]. This ABC algorithm is recently proposed swarm based optimization algorithm. It is generally based on the intelligent behavior of honey bees. Basically this artificial bee colony algorithm is related to search strategies of the bees. In real world how honey bees behave intelligently, like that this ABC algorithm also give best results with search phases[5][6]. After, several modified search strategies are proposed to get the minimum PAPR with minimum number of search phases. These modified methods are global best ABC (ABC/best/1)[7] and modified ABC/best/1 (MABC/best/1)[8].

In this paper, a Stanford Uniform Interim (SUI) channel model is used. This channel modeled by IEEE 802.16 and Stanford University with the aim of WiMAX applications in suburban environments and BFWA (broad band fixed wireless applications) implementations. Now in this paper ABC and a parallel artificial bee colony algorithm (P-ABC) s are applied over a SUI channel model for both OFDM and MIMO-OFDM systems. A parallel ABC algorithm has modified search strategy, specifies improved-ABC (IABC).Mainly Parallel Artificial Bee Colony algorithm (P-ABC) has two improvements, one is good exploration and other one is good exploitation. In the IABC good exploration is done by search processes of each bee around the neighborhood of the current bee solution that has a mutation operator. Second one is to get the good exploitation, this is done by a number of H unconnected bees spread through the search space at the same time. To find out better solutions obtained best results are shared with the other swarm bee and new search directions are resulted. In this way best solutions for good exploration and exploitation are obtained in the proposed algorithms.

In this P-ABC is compared with the basic ABC, MABC/best/1 and conventional-SLM methods for PAPR reduction performance and also compared computational complexity performance in both OFDM and MIMO-OFDM systems. And these techniques i.e., conventional-SLM, ABC, MABC/best/1 and P-ABC algorithms are applied over a SUI channel model also. Comparison results shows that our proposed algorithms are giving best results over a SUI channel model in the performance of computational complexity for both OFDM and MIMO-OFDM systems[9].

The remaining of this paper formulated as follows: in section **II** basic system model for OFDM and MIMO-OFDM is given. Section III explains basic ABC and P-ABC algorithms. Section IV describes about proposed SUI channel model. Section V shows the simulation results and finally conclusion is given in section VI.

II. System Model

In orthogonal frequency division multiplexing (OFDM) the entire channel is divided into many number of narrow band sub-channels. An input data block $Y_s = \{Y_k, k = 0,1, \dots \dots \dots., N-1\}$ is used for transmitting the signals parallel and OFDM system is described as

Y=$[Y_0, Y_1 \dots \dots \dots \dots \dots \dots \dots Y_{N-2}, Y_{N-1}]^T$(1)

Where N indicates the number of subcarriers and all subcarriers are orthogonal.$Y_k$is modulated phase shift keying (PSK) or quadrature amplitude modulation (QAM) symbols. The same input data block Y_s is applied for the MIMO-OFDM systems. Assuming with two transmitting antennas. Then MIMO-OFDM system is described as

$Y_1 = [Y_0, -Y_1^*, \dots \dots \dots \dots \dots, Y_{N-2}, -Y_{N-1}^*]^T,$
$Y_2 = [Y_1, -Y_0^*, \dots \dots \dots \dots \dots, Y_{N-1}, -Y_{N-2}^*]^T,$ (2)

Where $(\cdot)^*$ indicates the complex conjugate operation. After this is converted into time domain signal by using inverse fast Fourier transform (IFFT). Then the base band equivalent or time domain transmitted signal y_m =$[y_{m,0}, y_{m,1} \dots \dots \dots \dots \dots \dots \dots y_{m,N-2}, y_{m,N-1}]$ is given by

$y_m(n) = \frac{1}{\sqrt{N}} \sum_{n1}^{N-1} Y_m(k)\, e^{\frac{j2\pi kn}{N}}$, n=0, 1, 2……….N-1. (3)

Where n indicates discrete-time index.Here $y_m(n)$ equal to y (n) for general OFDM systems and y_1(n), y_2(n) for MIMO-OFDM signals.

The peak to average power ratio (PAPR) of the discrete time signal is defined as the ratio between the maximum peak powers of the signal to the average power of it.Fory_m the PAPR is defined as

$PAPR_{y_m} = \frac{\max_{0 \le n \le N-1} |y_m(n)|^2}{E[|y_m(n)|^2]}$(dB) (4)

Where E (.) indicates the expectation value. The performance of PAPR reduction can be illustrated by using complementary cumulative distribution function (CCDF).Therefore, for OFDM system the PAPR value can be expressed as

$PAPR_{OFDM} = PAPR_{y_{OFDM}} = PAPR_{y_m}$

In general the PAPR of the MIMO-OFDM system is defined as the maximum PAPR value of all transmit antennas. For MIMO-OFDM system the PAPR is expressed as

$PAPR_{MIMO}$ = max {$PAPR_{y_{1,MIMO}}$,$PAPR_{y_{2,MIMO}}$} (5)

For this PAPR reduction so many methods are proposed.in those methods selective mapping is one of the best attractive method. In this selective mapping (SLM) scheme, the output of serial to parallel converter is multipliedwith different phase sequences, that means the input parallel data signal $Y_s$is multiplied with U different alternative phase rotation sequences$b^v = [b_0^v, b_1^v, \dots\dots\dots\dots\dots, b_{N-1}^u]$,where b_n^v=$e^{j\varphi_n^v}$,$\varphi_n^v \epsilon[0,2\pi)$ for v=0,1,2……..U-1. This generates new data blockY_m^v=$[Y^v[1], Y^v[2], \dots\dots\dots\dots\dots\dots, Y^v[N-1]]$.

Thus,$Y_m^v$for OFDM and MIMO-OFDM systems can be denoted as

Y_{OFDM}^v= $[b_0^v Y_0, b_1^v Y_1, \dots\dots\dots\dots\dots, b_{N-2}^v Y_{N-2}, b_{N-1}^v Y_{N-1}]^T$, and (6)

Y_1^v=$[b_0^v Y_0, -b_1^{v^*} Y_1^*, \dots\dots\dots\dots\dots\dots, b_{N-2}^{v^*} Y_{N-2}^*, b_{N-1}^{v^*} Y_{N-1}^*]^T$, (7)

Y_2^v = $[b_1^v Y_1, -b_0^{v^*} Y_0^*, \dots\dots\dots\dots\dots\dots, b_{N-1}^{v^*} Y_{N-1}^*, b_{N-2}^{v^*} Y_{N-2}^*]^T$ respectively.

After IFFT operation the modified data that is in discrete domain are achieved. In all those values which have minimum PAPR that value is selected for transmission. Here U number of candidate signals (Y_m^v) are obtained. Finally, the minimum PAPR (Y_m^l) value is selected for the transmission for both OFDM and MIMO-OFDM signal. And to recover the original signal at the receiver this value is transmitted as side information. The transmitted signal is

Y_m^l= arg $\min_{Y_m^v, 0 \le v \le U-1}$\{ $PAPR_{OFDM}$ or $PAPR_{MIMO}$(8)

III. Standard ABC, Modified ABC AND P-ABC Algorithms For SLM Scheme

A.ABC BASED SLM ALGORITHM:

Artificial bee colony (ABC) algorithm is an efficient bee swarm optimization algorithm proposed by Karaboga for numerical optimization problems. In ABC algorithm each colony consists of mainly three types of bees. Those are employed bees, onlooker bees and scout bees. The purpose of these three bees is to find out the best or optimum food source positions and initially food sources are selected randomly. If we apply this ABC algorithm in PAPR reduction problem, food sources are equivalent to phase vectors i.e.b^v for the SLM method and fitness value is related withthe$PAPR_{Y_m^v}$.

In ABC algorithm each bee search for best food source positions. For each cycle the search process consists of three main steps.

1. Positioning the employed bees onto the food sources and then find out their nectar amounts
2. Now employed bees will share the information with the onlooker bees. Then select the foodsources by onlooker

bees and then find out the nectar amounts of the food sources.

3. Finding the scout bees and putting them onto the randomly resolved food sources.

The standard ABC algorithm mostly suitable for continuous case numerical optimization problems. In order to apply ABC algorithm to search the best combination of phase factor solution for SLM scheme some modifications are required for original ABC algorithm. Continuous case is changed into discrete case by taking phase sequences as follows

$$b_i^v = \begin{cases} -1, & \text{if(binary}(trunc(b_i^v)) = 1) \\ +1, & \text{if(binary}(trunc(b_i^v)) = 0) \end{cases} \qquad (9)$$

Where b_i^v= $[b_{i,0}^v, b_{i,1}^v, \dots\dots\dots\dots\dots\dots, b_{i,N-1}^v]$, i=1, 2 …S, where S indicates the size of the initial population. Total Number of employed bees and onlooker bees collectively gives the population size.

In the ABC based SLM algorithm, initially phase sequences (b_i^v) are created randomly. Each bee searches for new food sources, searching for the neighborhood solution is calculated by using cycling bit flipping method [10], which is based on the hamming distance.After random creation ofb_i^v,fitness value of each solution or nectar amount of food source in the population can be find out by using the following formula

$$\text{Fitness}\,(b_i^v) = \frac{1}{1+f(b_i^v)} \;, \qquad (10)$$

Here $f(b_i^v)$ represents the signal PAPR value, and this PAPR value should be minimum. Clearly the fitness value should be maximum.

Employed bees look for new food sources to find the better qualified food sources within the neighborhood of the current source. Then new food sources (or new phase factors) are given by

b_i^l = b_i^v + $\phi_i(b_i^v - b_k^v)$ (11)

Where ϕ_i is the random number in the range of [-1, 1] and b_k^v is a result within the neighborhood of the b_i^v. Then by using equation (10) fitness value can be calculated for b_i^l i.e. Fitness (b_i^l). Now these two fitness values are compared, if Fitness (b_i^l)>Fitness (b_i^v) then the bee remembers the new food source position as b_i^l and forgets the old food source position that isb_i^v. If search process is completed by employed bees then they share the information with the onlooker bees regarding fitness value of nectar amount and food source positions.

Now onlooker bees search the new food sources with the information collected by the employed bees. Then onlooker bees select the new food sources with the probability of

$p_i = \frac{Fitness(b_i^v)}{\sum_{i=1}^{S} Fitness(b_i^v)}$ (12)

By using equation (10) and equation (11) bees can be calculate the fitness values and new food source positions. And the above processes is repeated until maximum number of cycles and the limit value. If the fitness values are not improved with in the limit value then the employed bees becomes scout bees. Now scout bees look for new food source positions randomly with the help of the following equation

b_i^l=min (b_i^v) +rand (0, 1). (Max (b_i^v) – min (b_i^v)) (13)

Where min (b_i^v) and max (b_i^v) are the phase rotation sequences for lower and upper bounds respectively.So ABC based SLM algorithm for PAPR reduction can be summarized as follows:

1. **Input:** Take Y_m as OFDM signal or MIMO-OFDM signal
2. **Initialization:** Initialize the food source positions and set the Maximum cycle number MCN), Population size (S), limit value (LV) and b_i^v randomly
3. By using equation (10) calculate the fitness value
4. **Repeat**
5. Employed bees: search food sources and calculate $b_i^l$and fitness values by using equations (11) and (10) respectively
6. Onlooker bees: by using equation (12) select the new food sources, then find the fitness value and new b_i^l by using equations (11) and (10)
7. If the limit value does not satisfy then go to step 6, otherwise, continue
8. Scout bees: Now find the new b_i^l by searching randomly by using equation (13)
9. Remember the best or optimum phase sequence b_{best}
10. Stopthis processes **until** cycle= MCN.

If we observe the above ABC algorithm there are mainly three control parameters are present. Those are limit value (which responsible to analyze new areas of the search space), number of food sources and φ_i which uniformly distributed random variable in the range [1, -1].

B. Proposed MABC/BEST/1 Based SLM Algorithm:

ABC algorithm has better performance for different problems like PAPR reduction, computational complexity. Anyhow this algorithm has limitations with respect to search strategy [11]. It gives best results at exploration but giving poor results at exploitation. In generally for optimization algorithms these two are defined as follows. Exploration is defined as the capability to find out the global minimum. And exploitation is defined as the giving better results compared with the current results. So to improve exploitation so many methods are introduced like ABC/best1 and modified ABC (MABC/best /1) and so on.

In this modified ABC algorithm bees will find out the better solution compared to the previous iteration with the search process that has highest fitness value. In this ABC/best/1 algorithm andmodified ABC algorithm searching of new food sources is done by using the below equations

$b_i^l = b_{best} + \phi_i (b_{r1}^v - b_{r2}^v)$ (14)

$b_i^l = b_{best} + \phi_i (b_{best}^v - b_k^v)$ (15)

Where r1 and r2 are randomly selected mutually exclusive integers taken from the list 1, 2… S. Here b_{best} is the good or better phase sequences of the previous iteration that gives the minimum PAPR value.

C. Parallel ABC Algorithm With SLM Scheme:

As seen in the above modified ABC algorithms will give good exploitation by using equations (14), (15) but poor exploration. In order to give best solutions both global best and local best should be well balanced. In the above algorithms the current best solutions are created depending on the previous solutions, therefore the probability of choosing 'good '(or best) solution and 'bad' solution is equal. So still some inefficiency is present in the ABC algorithms. To overcome these problems, a new algorithm is proposed i.e. Parallel ABC algorithm. This P-ABC is performed based on the improved ABC (IABC) algorithm means multiple IABC structures are connected parallel [12] [13].

In this approach, mutation operator of genetic algorithm is used and this is integrated with b_{best} which is obtained from the modified ABC algorithm. Let b_i^l is the new phase solution in the neighborhood of present or existing phase solution. This can be expressed as

$b_i^l = b_{bestm} + \phi_i (b_{bestm} - b_k^v)$(16)

Here b_{bestm} represents mutation operator best phase sequence. For b_{best} mutation operator is applied accordingly consecutive bit inversions, and this can be expressed as

$b_{bestm} = b_{best} [b_0^v, \ldots\ldots, b_{lb-1}^v, (-1)b_{lb}^v, \ldots\ldots (-1)b_{ub}^v, b_{ub+1}^v, \ldots\ldots b_{N-1}^v]$, ub-lb=mr=0, 1, 2…..

Where the difference between upper bound and lower bound is called the mutation rate (MR),b_{ub}^{v} is the upper bound of the mutation phase factor , b_{lb}^{v} is the lower bound of the mutation phase factor ,these are selected randomly. Now fitness values are calculated by using equation (10). If fitness (b_{bestm}) >fitness (b_{best}) then b_{bestm} is stored as a new optimum solution, otherwise it keeps the old one is the optimum value.

After this improvement of PABC is done by using multiple IABC structure, is shown in figure. Parallel improved ABC and number of H unconnected are chosen from the initial population by selecting randomly. Obtained best results of each IABC, s=1, 2, 3… H, H=S/2, are then shared with another IABC and this has s employed bees. Each employed bee look for new phase sequences around the neighborhood of each b_{best}^{s} .so, good exploration is possible for the search space.

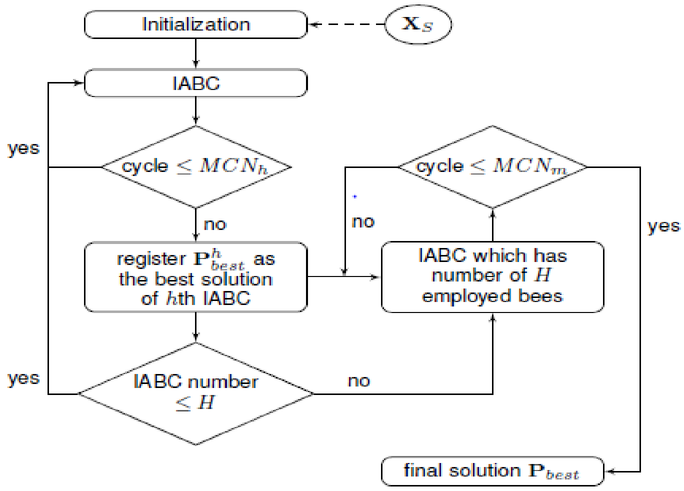

Fig. 1. Flowchart of the proposed P-ABC with SLM optimization.

IV. Proposed Sui Channel Model

In wireless communication a channel is defined as the medium between the transmitting antenna and the receiving antenna. If the channel is modeled accurately then easy to obtain the received signal from the transmitted one accurately.so many channel models are present, among those Stanford uniform interim (SUI) channel models is excellent.

Here introducing a Stanford uniform interim (SUI) channel model [14]. This model is proposed by IEEE 802.16 group and Stanford University. They both comb inly done extensive work for WiMAX applications in suburban environments. This is a propagation loss model and is more suitable for implementation of many applications like Broadband Fixed Wireless applications (BFWA) and WiMAX applications. This Sui model is expressed a set of six channel models in three type of terrain types. For these three terrain types six Sui models consists of different Doppler spreads, delay spread and line-of-sight/non-line-of-siteconditions shown in table1.

Table 1 Terrain Type and Doppler Spread for SUI Channel Models

CHANNEL	TERRAIN TYPE	DOPPLER SPREAD	SPREAD	LOS
SUI-1	C	low	low	high
SUI-2	C	low	low	high
SUI-3	B	low	low	low
SUI-4	B	high	moderate	low
SUI-5	A	low	high	low
SUI-6	A	high	high	low

The three terrain types are defined as follows.

- Type A: It is hilly terrain by means of reasonable to heavy tree densities. And these type consists maximum path loss.
- Type B: This category is define two ways. One is infrequent vegetation in hilly terrain, another is high vegetation in flat terrains. These consists moderate path loss.
- Type C: In this type light tree densities in flat terrain and have less path loss conditions.

Basic Structure Of SUI Channel Model:

The following figure2 shows the block diagram of SUI channel. It consists of mainly three blocks.Input mixing matrix, when more number of transmitting antennas are present then it gives correlation between inputs. As same way output mixing matrix will give correlation between output signals when multiple receive antennas are present.

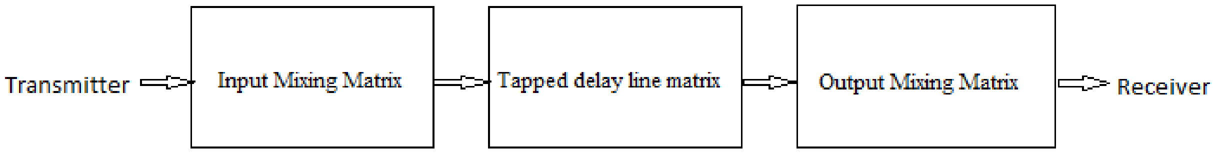

Fig 2 Generic Structure of SUI Channel Models

And most important block is tapped delay line. This models the multipath fading of the channel. This tapped delay line consists three taps with non-uniform delays. Each tap gain is characterized by distribution function.We applied proposed ABC and PABC algorithms over this channel.

V. Simulation Results

In this, performance of PAPR reduction, BER and computational complexity are compared for exiting SLM techniques and ABC based SLM schemes. For the purpose of simulation, total number of carriers selected with number of samples N=16, to modulate this data phase shift keying (PSK) is used and to evolve the complementary cumulative distribution (CCDF= Pr[PAPR>$PAPR_0$]) of PAPR,10^3 data blocks Y_s are created randomly for both OFDM and MIMO-OFDM systems. The phase sequences for SLM scheme are $b_i^v \epsilon$ {+1,-1}. In this solid state power amplifier (SSPA) [15] is used with input back offs IBO = 3, 6 db.

1. Computational Complexity Analysis:

Table 2shows the computational complexity of all schemes including with PAPR values. In P-ABC, H parallel and one main IABC algorithm is present. The search processes is done until maximum cycle number (MCN) and population size S. In this simulation, parallel and main IABC have distinct MCN and$MCN_m = 2MCN_s$. So, the search complexity of P-ABC is given by H (MCN_s. S) + MCN_m .S. For simulation, H selected as 2, S=4 for all number of U, MCN_s =1 for U=16. Search complexity for SLM and ABC are given as U=MCN.S, where S=4 and MCN=1, 2, 4 for U=4, 8, 16. Comparison of P-ABC and C-SLM PAPR values for different U values gives that the computational complexity of P-ABC is lower than the C-SLM.

Table 2 comparison of computational complexity for different SLM schemes for OFDMand MIMO-OFDM systems

METODS	NUMBER OF SEARCHES(U)	PAPR (dB)	
		OFDM	MIMO
ORIGINAL	0	11.25	11.32
C-SLM	Number of randomly selected P^v	5.43	5.83
ABC	MCN.S	5.07	5.42
P-ABC	H (MCN_s. S) + MCN_m .S	4.36	5.27

2. Papr Reduction Performance:

Fig 3 and Fig 4 shows the PAPR reduction performances of the different SLM schemes for OFDM and MIMO-OFDM systems, respectively. This is performed for different phase sequences U=4, 6, 8, 16.For all SLM schemes PAPR values are compared for different U values. Comparison values from low PAPR value to high PAPR are given i.e.-ABC, M-ABC, ABC and C-SLM are 4.5, 4.93, 5.09 and 5.77 respectively for CCDF=10^{-3}in OFDM system. This gives P-ABC has best PAPR reduction compared to all SLM schemes for different U values. In case of MIMO-OFDM PAPR value for P-ABC is 5.02 for U=16. Comparison of this gives MIMO-OFDM has high PAPR values compared to OFDM systems because of the fact that the MIMO-OFDM system has two transmitted signals, and PAPR value for MIMO-OFDM system is higher PAPR value of those two signals.

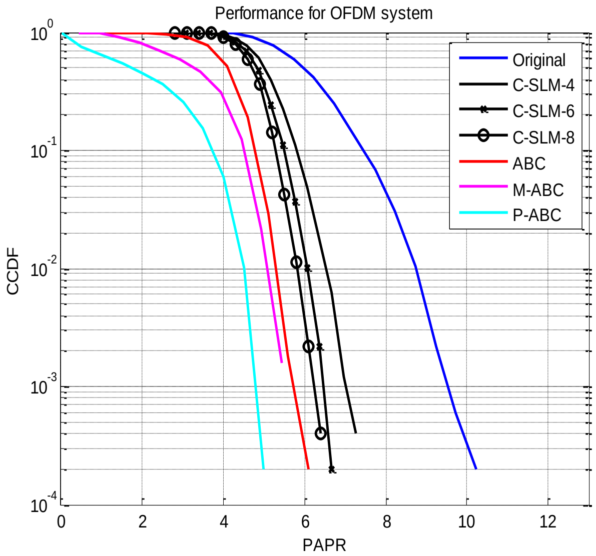

Fig3 Comparison of PAPR reduction performance of various SLM schemes for OFDM system.

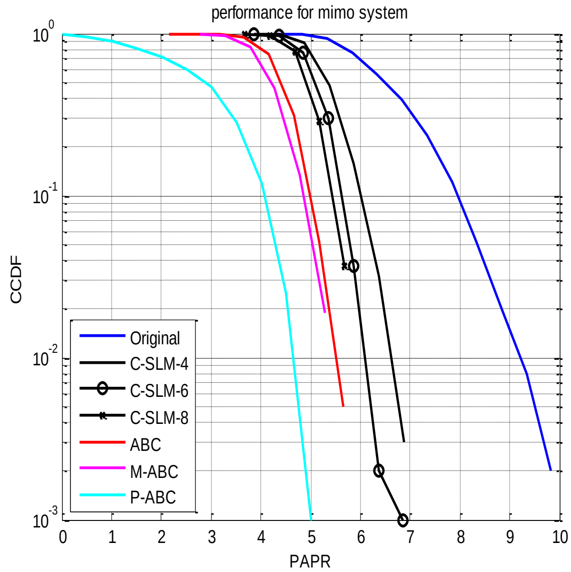

Fig 4 Comparison of PAPR reduction performance of various SLM schemes for MIMO-OFDM system.

3 BER Performance:

Fig 5 and Fig 6 compare the BER performances of the PABC, ABC and C-SLM schemes for OFDM and MIMO-OFDM systems over the AWGN channel, respectively. And also compared the bit error rates over SUI channel model and are shown in figure 7. As it can be shown in Figures, PAPR reduction is very important for the BER performance of both systems because of using nonlinear devices such as SSPA. From results it is clear that P-ABC giving best BER performance. This P-ABC gives better performance over SUI channel model also.

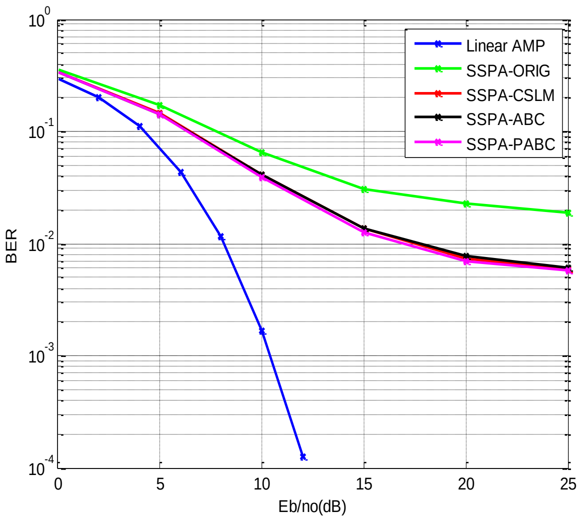

Fig 5 Comparison of BER performance of various SLM schemes over AWGN channel for OFDM systems

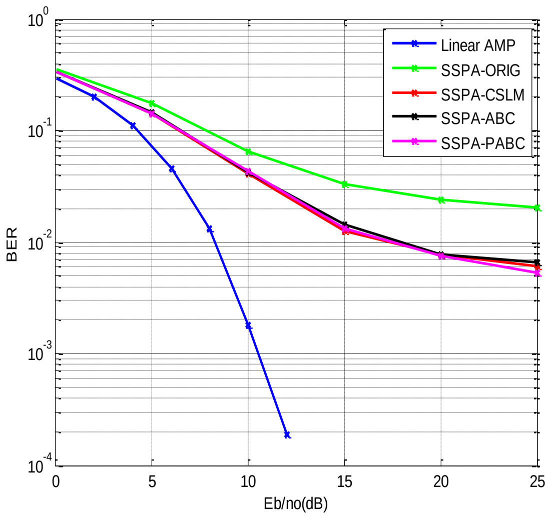

Fig 6 Comparison of BER performance of various SLM schemes over AWGN channel for MIMO-OFDM systems

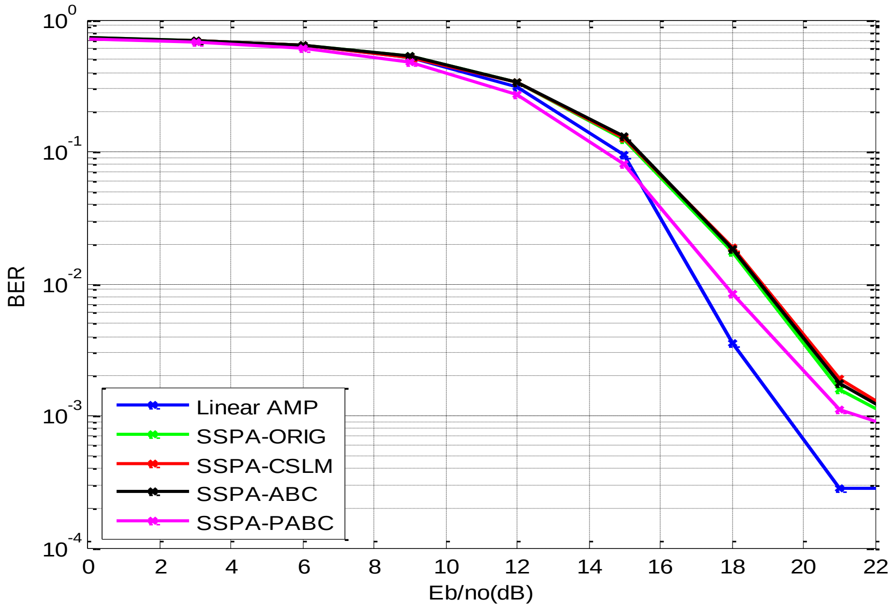

Fig 7 Comparison of BER performance of various SLM schemes over SUI channel for MIMO-OFDM systems

VI. Conclusion

In this paper, we have proposed a method for PAPR reduction in OFDM systems with low complexity. We describe a parallel ABC algorithm named P-ABC, and its performance is evaluated for the PAPR reduction using SLM scheme. Furthermore, ABC and MABC/best1 algorithms are proposed for the SLM scheme. And also applied our proposed ABC and P-ABC algorithms over a SUI channel model and comparison results shows proposed methods are giving better results over SUI channel also. Simulation results show that the P-ABC provides significant PAPR reduction and BER performances with low computational complexity in OFDM and MIMO-OFDM systems.

References

[1]. Y. Rahmatallah and S. Mohan, "Peak-to-average power ratio reduction in OFDM systems: A survey and taxonomy," IEEE Commun. Surveys Tuts., vol. 15, no. 4, pp. 1567–1592, 2013.

[2]. J.-C. Chen and C.-K. Wen, "A low-complexity scheme to reduce the PAPR of an OFDM signal using sign-selection algorithms," IEEE Signal Process. Lett., vol. 17, no. 2, pp. 189–192, Feb. 2010.

[3]. S. H. Wang and C. P. Li, "A low-complexity PAPR reduction scheme for SFBC MIMO-OFDM systems," IEEE Signal Process. Lett., vol. 16, no. 11, pp. 941–944, Nov. 2009.

[4]. D. Karaboˇga and B. Basturk, "A powerful and efficient algorithm for numerical function optimization: artificial bee colony (ABC) lgorithm," Journal of Global Optimization, vol. 39, no. 3, pp. 459–471, Nov. 2007.

[5]. Y. Wang, W. Chen, and C. Tellambura, "A PAPR reduction method based on artificial bee colony algorithm for OFDM signals," IEEE Trans. Wireless Commun., vol. 9, no. 10, pp. 2994–2999, Oct. 2010.

[6]. N. Tas¸pınar, D. Karaboˇga, M.Yıldırım, and B. Akay, "Partial transmit sequences based on artificial bee colony algorithm for peak-to-average power ratio reduction in multicarrier code division multiple access systems," IET Commun., vol. 5, no. 8, pp. 1155–1162, May. 2011.

[7]. W.-F. Gao and S.-Y. Liu, "A modified artificial bee colony algorithm," Computers & Operations Research., vol. 39, no. 3, pp. 687–697, Mar. 2012.

[8]. H. Wang, Z. Wu, S. Rahnamayan, H. Sun, Y. Liu, and J.-S. Pan, "Multistrategy ensemble artificial bee colony algorithm," Information Sciences, vol. 279, pp. 587–603, Sep. 2014.

[9]. S. M. Alamouti, "A simple transmit diversity technique for wireless communications," IEEE J. Sel. Areas Commun., vol. 16, no. 8, pp. 1451–1458, Oct. 1998.

[10]. L. J. Cimini and N. R. Sollenberger, "Peak-to-average power ratio reduction of an OFDM signal using partial transmit sequences," IEEE Commun. Lett., vol. 4, no. 3, pp. 86–88, Mar. 2000.

[11]. Jagdish Chand Bansal, "Artificial bee colony algorithm: a survey", Int. J. Advanced Intelligence Paradigms, Vol. 5, Nos. 1/2, 2013

[12]. Yajun Wang, Wen Chen, Member, IEEE, and ChinthaTellambura, Senior Member, IEEE"A PAPR Reduction Method Based on Artificial Bee Colony Algorithm for OFDM Signals", IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 9, NO. 10, OCTOBER 2010

[13]. Xiangyu Yu* ,ShuaiLiSouth China University of Technology, "An improved artificial bee colony-partial transmit sequence algorithm for PAPR reduction in OFDM systems", Int. J. Wireless and Mobile Computing, Vol. 6, No. 5, 2013.

[14]. Channel ModelsA Tutorial1",V1.0February 21, 2007

[15]. H. Ryu, J. S. Park, and J. Park, "Threshold IBO of HPA in the predistorted OFDM communication system," IEEE Trans. Broadcast., vol. 50, no. 4, pp. 425–428, Dec. 2004.

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