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Performance Comparison of BPSO and BFO Algorithms of PTS Technique Used for PAPR Reduction in MC-CDMA

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Abstract:* PAPR *reduce the efficiency of system in MC-CDMA so we have to use PTS to recover from this. In this paper, Partial Transmit Sequence technique is used, which uses suboptimal algorithms & their performances are compared. For their performance evaluating PAPR reduction scheme is CCDF of the PAPR of transmitted continuous time signal. BPSO has better PAPR reduction capability than BFO Algorithm on the basis of performances using different modulation schemes.

Keywords: MC-CDMA, PTS, BPSO, BFO.

I. Introduction

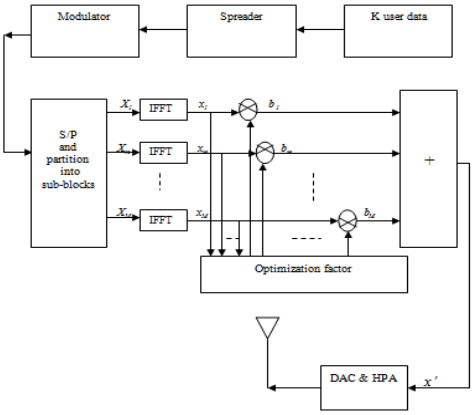
MC-CDMA is a combination of OFDM and CDMA. The CDMA part that provides both multiple access ability as well as spread each user signal over the frequency domain provide safety from the impact of fading due to frequency selective. The OFDM provides spreading across time domain of each spreading code's chip which decreases the effect of ISI. MC-CDMA is a powerful technique, it has mainly PAPR problem which largely limits its performance. Due to high PAPR efficiency performance of power amplifier decreases as PAPR increases. Peak-to-Average Power Ratio is defined as the ratio of the peak to average power value & their mathematical representation is as:

$$\mathrm{PAPR} = \max\left[p(t)^2\right] \div \mathrm{E}\left[p(t)^2\right]$$

The CCDF of the PAPR of the data block is desired is our case to compare outputs of various reduction techniques.

$$\mathrm{P}(\mathrm{PAPR} > Z) = 1 - \exp(Z)^{\mathrm{N}}$$

PTS is known for its less complexity so it is famous & mostly used technique for PAPR reduction. For each MC-CDMA symbol, the input data sequence is partitioned into a certain number of sub-blocks. The output signal is that which have smallest PAPR, is transmitted. In this process, data of varying sub-carrier is only transmitted which have all the information to be sent in the signal as a whole is named as Partial Transmit Sequence. The MC-CDMA with PTS is shown in figure.[xi]. It has K user data, Spreader, Modulator, Serial to parallel converter which partitioned into sub blocks, IFFT, again parallel to serial, and DAC & HPA at transmitter for the transmission purpose. After IFFT where we have to use the optimization process .With the help of this optimization process we have to chose that which have lowest PAPR.



MC-CDMA with PTS [i]

For PAPR reduction of an MC-CDMA system using PTS, which is investigated by using suboptimal combination algorithms BFO & BPFO.

II. BFO

Due to its biological motivation and graceful structure, BFO algorithm is widely used. BFO is global optimization mainly for the controlling purpose. BFO algorithm has already drawn the attention of researchers due to its the social foraging behavior. it is. used as a simple optimization. Bacteria search for nutrients in a manner to maximize energy obtained per unit time. Individual bacterium also communicates with others by sending signals. A bacterium takes foraging decisions after considering two previous factors. The process, in which a bacterium moves by taking small steps while searching for nutrients, is called chemotaxis and key idea of BFOA is mimicking chemotactic movement of virtual bacteria in the problem search space. When they get food in sufficient, they are increased in length and in presence of suitable temperature they break in the middle to from an exact replica of itself. This phenomenon inspired Passino to introduce an event of reproduction in BFOA [30]. Due to the occurrence of sudden environmental changes or attack, the chemotactic progress may be destroyed and a group of bacteria may move to some other places or some other may be introduced in the swarm of concern. This constitutes the event of elimination-dispersal in the real bacterial population, where all the bacteria in a region are killed or a group is dispersed into a new part of the environment. The information processing strategy of the algorithm is to allow cells to stochastically and collectively swarm toward optima.

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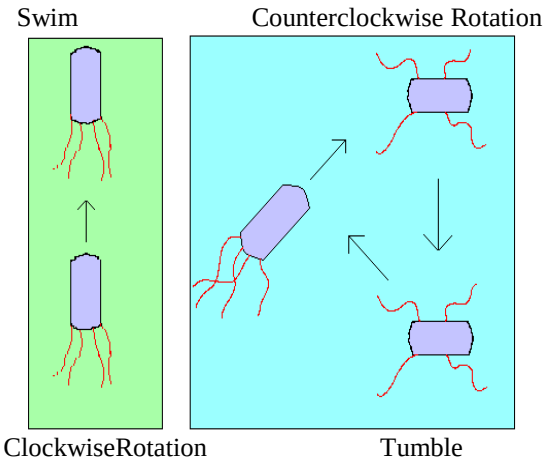
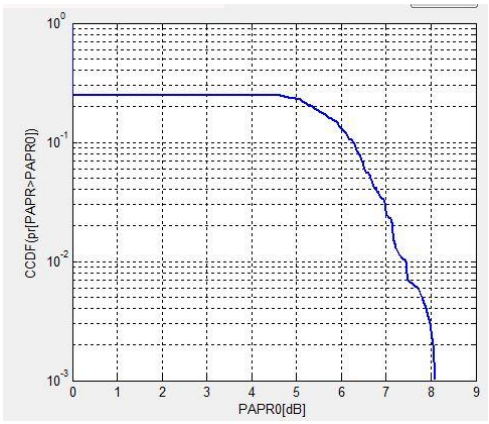


This is achieved through a series of three processes on a population of simulated cells:
1) 'Chemotaxis' where the cost of cells is derated by the proximity to other cells and cells move along the
manipulated cost surface one at a time (the majority of the work of the algorithm),
2) 'Reproduction' where only those cells that performed well over their lifetime may contribute to the next
generation, and
3) 'Elimination-dispersal' where cells are discarded and new random samples is inserted with a low probability.



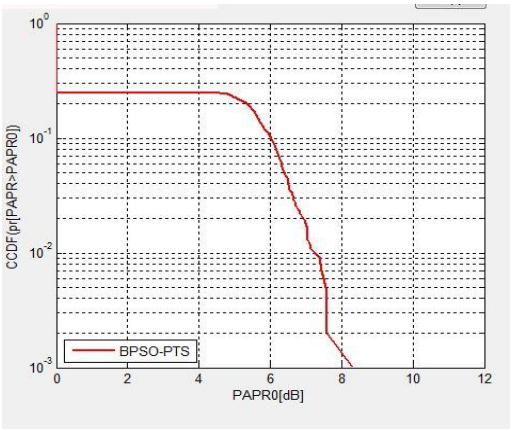
BFO (Bacterial Foraging Optimization)

III.BPSO

BPSO is a hybrid optimization technique, which synergistically couples the BFOA with the PSO. The later is a very popular optimization algorithm these days and it draws inspiration from the group behaviour of bird flock or school of fish etc. The proposed algorithm performs local search through the chemotactic movement operation of BFOA whereas the global search over the entire search space is accomplished by a PSO operator. In this way it balances between exploration and exploitation enjoying best of both the worlds. The following performance metrics were used in the comparative study:

1. 1.Quality of the final solution
2. Convergence speed
3. Robustness and
4. Scalability.

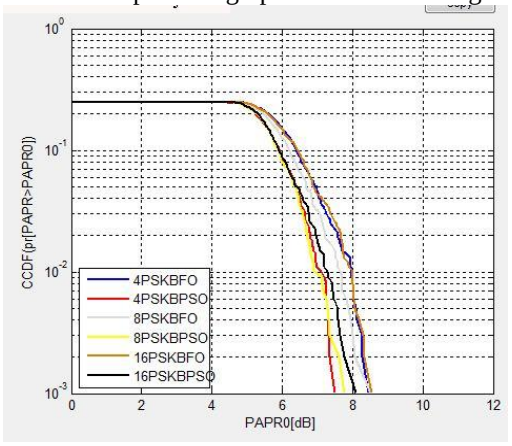
Such comparison reflects the superiority of the proposed approach.



BPSO (Bacterial Parallel Swarming Optimization)

IV. Comparison of BFO and BPSO

For comparision ,we have to compare the performances of BFO and BPSO. The comparision graphs are as following:



BPSO & BFO having different modulation schemes

Table: PAPR for Different Modulation Schemes

Modulation Scheme	PAPR of BFO	PAPR of BPSO	Improvement
4	8.3	7.4	0.9
8	8.4	7.8	0.6
16	8.6	8.2	0.4

Table shows the final PAPR value for different modulation scheme which will provide a crisp comparison of PAPR

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improvement. in case of BPSO . Through with the help of these values we came to know that when we have to use 4PSK it gives best result & PAPR reduction our motive achieves in a successful manner.

V. Conclusion

The paper illustrates the comparison of traditional MC-CDMA using BPSO and BFO algorithms using different modulation schemes. PAPR reduction performance continuously increases in case of BPSO using different modulation schemes.as compared to BFO using different modulation schemes. Higher PAPR reduction performance is achieved when 4PSK is used as a modulation technique than 8 PSK and 16 PSK. The results showed that BPSO is more effective when 4PSK is used as modulation scheme and as well as great reduction performance than BFO .

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