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Performance Analysis of Optimal Scheduling Based Firefly algorithm in MIMO system

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Abstract: In MIMO system, there are several number of users to communicate in a network. This may include signal noise and traffic in that network in channel usage. For channel allocation, there are several methods to predict available channel and to select optimal usage of channel to users. For this process, optimization algorithms like, PSO, ACO, etc. were used for selection of channel to the user for communication. In this process, there are many users communicate at a time which can combine these signal by multiplexing it and demultiplexing at receiving. But while during communication process this may effect in mixing of signals. This may add noise at receiver stage and may result in BER rate and due to mismatching of sender and receiver state, throughput will be reduced. To improve the performance level in MIMO communication system algorithm is proposed to implement **optimization** technique for selection of antenna according to communication parameters.Hence various scheduling technique to increase through-put parameter by allocating sleeping time to communicate source and destination enabling time implement are. In this technique, spectrum management is implemented to handle minimum delay for communicating source with destination. By using both configuration of optimization of antenna selection and scheduling technique, level of performance rate is improved. This will result in enhancing our communication performance. This proposal method can be compare with existing system for the parameters of transmission time, Bit error rate, Through-put, MMSE value, CIR and SNR

Keywords: MIMO,FA, SNR, BER and Through-Put value

1. Introduction

In wireless communication, there are different types of transmission scheme to handle maximum throughput level and minimum error while transmitting data through air.Narrow band communication system,is classified in to different formation as Multi-Input and single-Output and Single-Input and Multi-Output system in a smart antenna technology and in FM transmitter and Receiver. This process is enhanced by including Multi-Input and Multi-Output system which include multiple data transmission system. MIMO techniques have quite large potential for future wireless communication systems, due to the ever increasing demand for high data rates and spectral efficiency [7].Quasi-Orthogonal Space-Time Block Code presents an up-to-date, comprehensive and in-depth discussion of an important emerging class of space-time codes, called the Quasi-Orthogonal STBC (QO-STBC). Used in Multiple-Input Multiple-Output (MIMO) communication systems, they provide transmit diversity with higher code rates than the well-known orthogonal STBC (O-STBC), yet at lower decoding complexity than non-orthogonal STBC.In order to achieve high peak rates in LTE downlink transmission, LTE adopts a method of using adaptive modulation schemes. Three modulation schemes are supported in 3GPP specification, QPSK, 16QAM and 64QAM. The channel coding scheme for transport blocks is turbo coding and a contention-free quadratic permutation polynomial (QPP) turbo code internal interleaved. OFDM gives LTE downlink some flexibility in assigning resources to UE. Resources can be assigned both in time and frequency domain. The basic LTE downlink physical resource can be explained as a time-frequency grid. The smallest element or basic unit in LTE is an OFDM symbol also called a resource element (RE). In the time domain the radio frame is 10 ms long and consists of 10 sub-frames of 1 ms each. Every sub-frame has 2 slots and each slot is 0.5 ms. The subcarrier spacing in the frequency domain is 15 kHz and 12 sub-carrier grouped together per slot is called a resource block (RB). An antenna-subset-selection-based MIMO system utilizes a number of RF chains, each of which is switched to operate numerous antennas. The throughput/reliability tradeoff can also be increased by antenna selection techniques along with reducing the system cost [13].In antenna subset selections, the number of RF chains is less than the actual number of antenna elements. The RF chains are connected to the "optimum" antenna elements, where "optimum" depends on the channel state (i.e., can vary with time).

This paper is structured as follows. Section II reviews the related work on the concept of scheduling and routing process in the cognitive radio network. Section III describes the explanation of the proposed optimization techniques Section IV evaluates the performance of the proposed methodology with the existing techniques. Section V summarizes with a brief conclusion.

2. Optimal Scheduling Based Firefly Algorithm

Several antenna selection algorithms and techniques have been proposed for solving the mentioned dilemma in the MIMO-QOSTBC system so far, yet the results of those algorithms were not satisfactory. More number of transmit antennas and receive antennas can increase the complexity of hardware in this system. This limitation is overcome by proposed work to bring out better throughput with decreasing in bit error rate. The proposed technique utilizes Firefly algorithm with LTE scheduling.This whole process comprises of following steps

- From that encoded result, antenna selection by analyzing parameters of antenna is performed to allocate data subcarrier among transmit antennas has been devised by means of Linear optimization
- From that selected antenna, then scheduling technique is provided to manage the through-put level in communication.
- For this scheduling process, LTE scheduler technique is implemented to manage time allocation during receiving of signal. This will give enhanced result in communication performance
- From this, comparison parameters like through-put, BER, SNR and throughput value is obtained

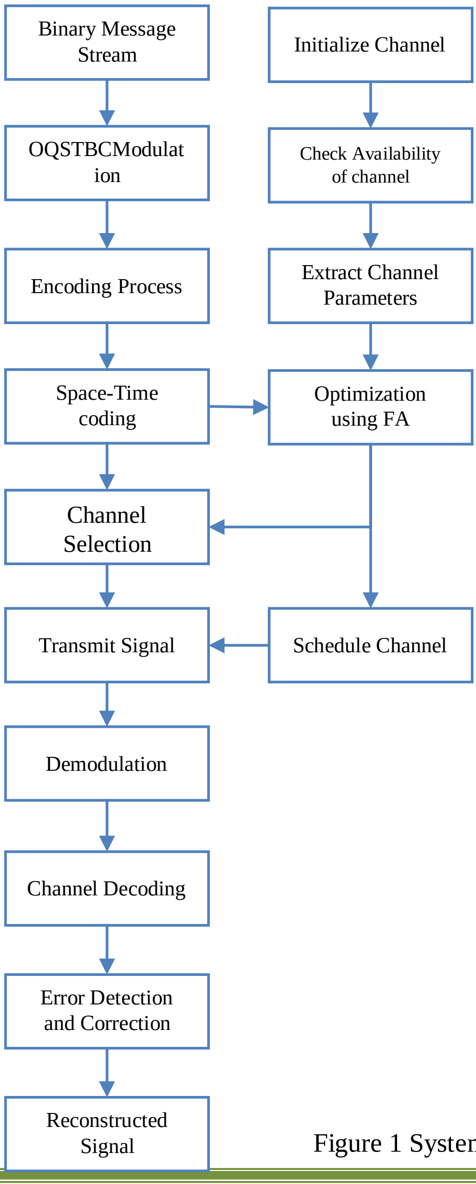

Figure 1 System Model

2.1 Operations in Firefly Algorithm

The firefly algorithm (FA) is a metaheuristic algorithm, inspired by the flashing behaviour of fireflies. The primary purpose for a firefly's flash is to act as a signal system to attract other fireflies. Xin-She Yang formulated this firefly algorithm by assuming

1. All fireflies are unisexual, so that one firefly will be attracted to all other fireflies;
2. Attractiveness is proportional to their brightness, and for any two fireflies, the less bright one will be attracted by (and thus move to) the brighter one; however, the brightness can decrease as their distance increases

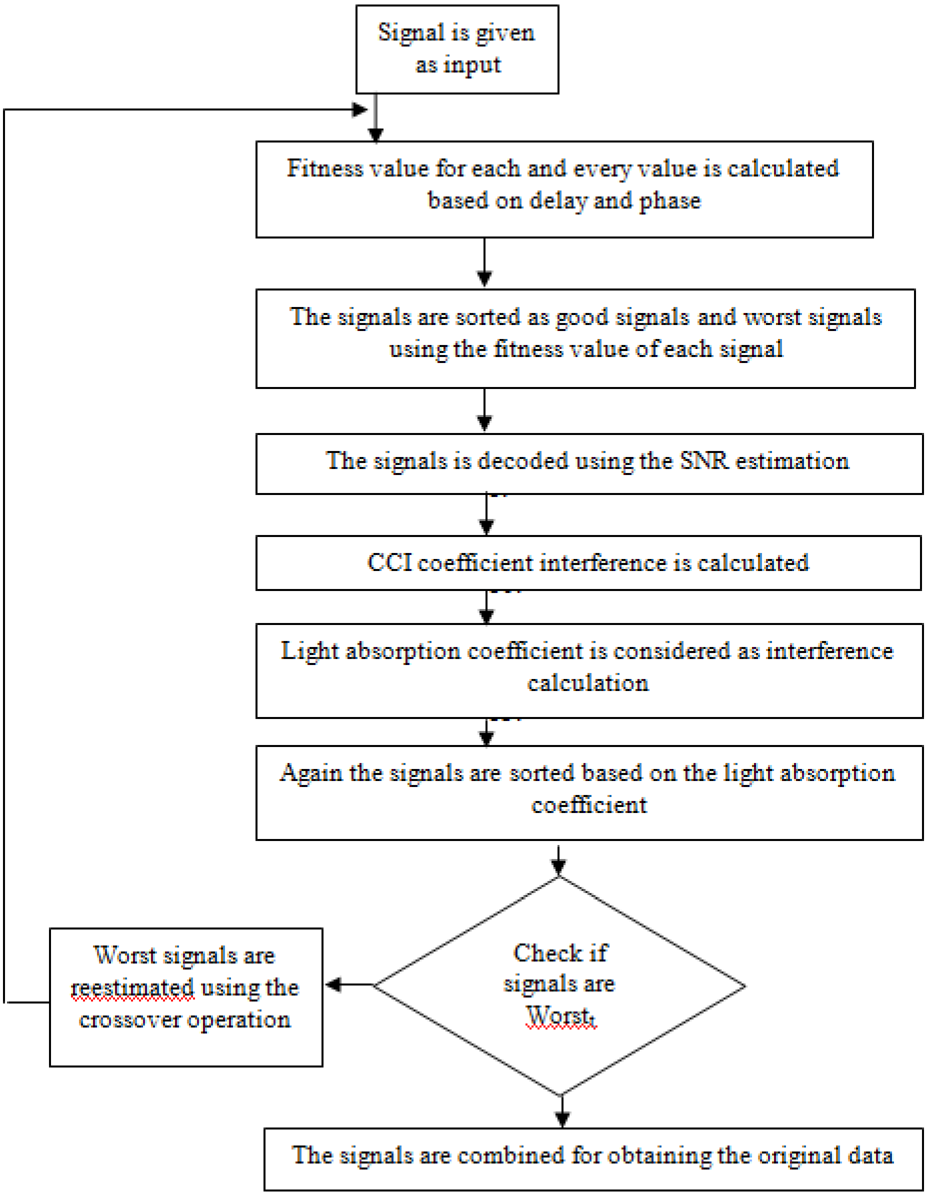

Figure 2 Flow Diagram of Firefly Algorithm

3.If there are no fireflies brighter than a given firefly, it will move randomly

The brightness should be associated with the objective function.
Mathematical
Firefly is a method used for solving optimization problems[14]. The initial population in the algorithm represents the solution for optimizing the problems within specified searching space. The ith solution Xi is represented as follows

$$Xi = [xi1(t), xi2(t), \ldots\ldots xid(t)] \; [1]$$

Xik is vector with K=1, 2,3, d. t is the time step. Initially the value of fitness function was evaluated. The solution that produced the best fitness value would be chosen as the current best solution in the population. Then, a sorting operation was performed. The newly founded solutions in these algorithms are used for solving the ranked based fitness and The group is formed using the fitness values. The fitness value of i and j population is compared with each other. If the fitness value of the neighboring solution was better, the distance between every solution would then be calculated using the standard Euclidean distance measure. The distance was used to compute the attractiveness, β

$$\beta=\beta 0e\text{-}\gamma r \; ij \; [2]$$

whereβ0, γ and rij are represented as a predefined attractiveness, light absorption coefficient, and distance between ith solution and its jth neighboring solution, respectively [14]. The new attractiveness value was used to update the position of the solution, as follows:

$$Xid=xid+(xjd-xid)+ \alpha(\delta\text{-}i/2) \; [3]$$

where α and δ are uniformly distributed random values between 0 to 1. Based on the new update positions, the solutions that produced best fitness value are obtained [14].

3. Results and Discussion

Proposed FA with optimal scheduling is run for a particular SNR to provide lesser BER. It is observed that the error rate during the transmission of the data for proposed algorithm is lesser Hence, with the aid of the proposed technique for transmit antenna subset selection; a good system throughput with reduced hardware complexity with decreased BER and undisturbed data rate is accomplished in the MIMO-QOSTBC system. Proposed work for the selection antenna in MIMO-OFDM system using Firefly Algorithm with optimal scheduling is implemented in the Matlab.

3.1 Evaluation of MIMO-QOSTBC system with Firefly algorithm

Table -1: Parameters and their specification used in implementation of Firefly algorithm

Parameter	Specification
Total Bandwidth (B) 1MHZ	1MHZ
Modulation Technique	QPSK
Number of subcarriers	128,256
Number of transmitter antennas	4
Number of receiver antennas	4
Number of users	50.100
FFT Size	2048
Channel	Rayleigh

In other words, proposed algorithm has time synchronization and low interference suppression for each transmitted data stream. The proposed algorithm requires much lower design and much smaller size.

FA can provide robust multiuser detection performance, with the increase of user number, the FA detection performance is better. The parameter of the multiuser detection is chooses based on the objective function and precision of optimization. The performance evaluation of the proposed algorithm is based on BER and SNR. Figure 15 clearly shows the SNR vs BER graphical representation. The bit error rate is the ratio of error rate to the total number of data transferred from the transmitter. It is clearly observed from the figure that the proposed FA provides lesser BER.It is observed that the error rate during the transmission of the data for proposed algorithm is lesser.

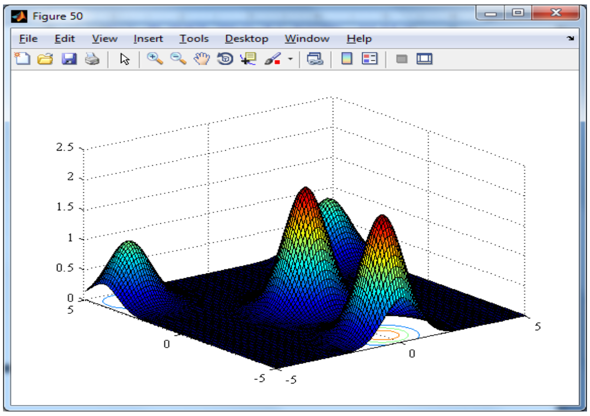

Figure 3mesh grid for firefly algorithm

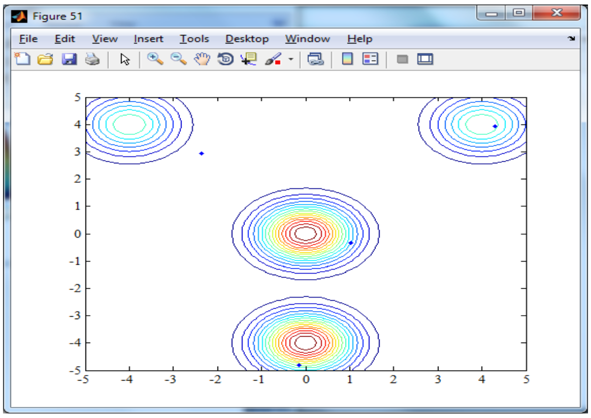

Figure 4 contour plots for firefly algorithm

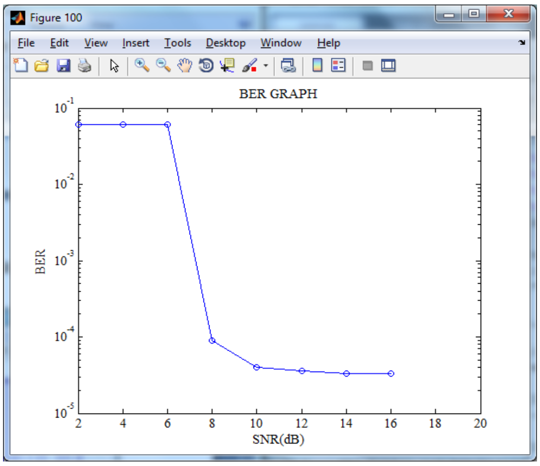

Figure 5SNR Vs BER graphical representation

Figure 3 and figure 4 shows the mesh grid and contour plots for firefly algorithm.The performance results of optimal transmit antenna selection using our proposed FA-adaptive is evaluated with the 4 total number of transmit antennas and. From the graph values in figure 5, we can identify the performance of FA-adaptive mutation results. At the first iteration, the value of BER is 10-1. After that, from the second iteration onwards, BER value moves to the lower values and finally it reaches the value between 10-4 to 10-5. From these results, it is easily observable that the BER is lowest for all iterations except the 1st iteration and thus our proposed work facilitates lower BER The parameter of the antenna selection is based on the objective function and precision of optimization. The performance evaluation of the proposed algorithm is based on BER and the propagation of delay estimation error. Figure 5 clearly shows the SNR Vs BER graphical representation. The bit error rate is the ratio of error data to the total number of data transferred from the transmitter. It is clearly observed from the figure that the proposed FA provides lesser BER.

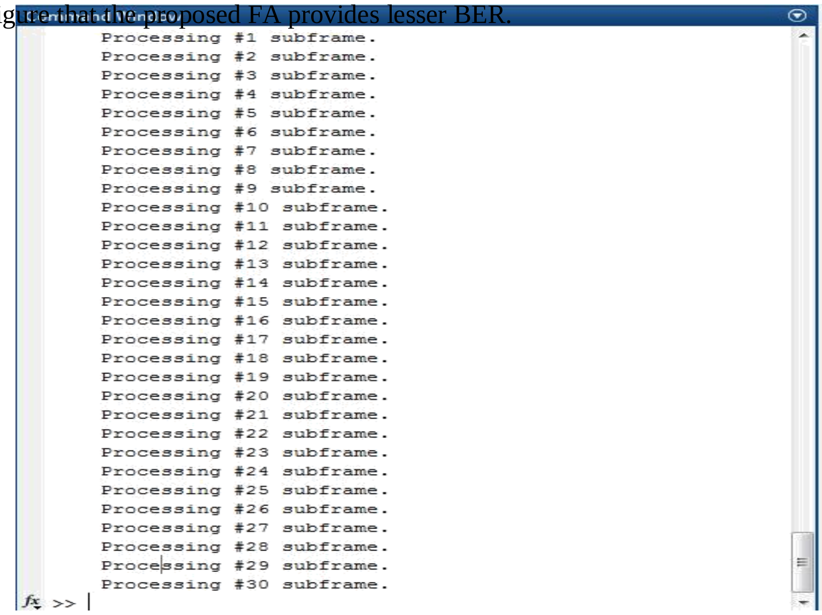

Figure 6 Command Window for scheduling Process

Scheduling technique, aim to promote an improved perceived experience for the end user providing higher data rates and lower latencies.Scheduling is applied on 30 subframes as shown in figure 6

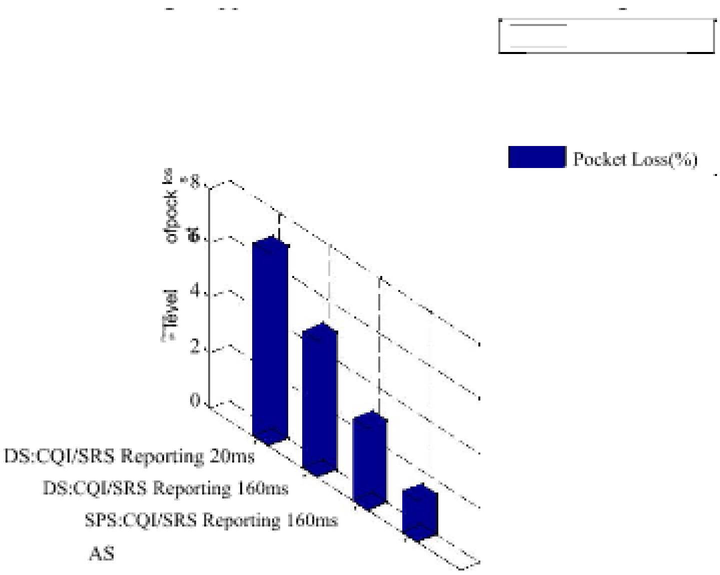

Figure 7 Performance Analysis of Packet loss v/s antenna selection

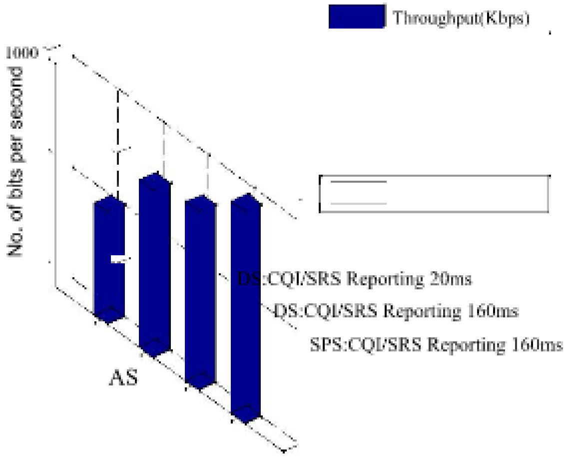

Figure 8 Performance Analysis of Throughput v/s antenna selection

The figure shows that the graphical representation no of bits transmitted per second for proposed firefly algorithm with LTE scheduling. From the figure 8 it can be shown that the proposed algorithm gives more throughput with increase in the no of antennas. Better performance is achived with the integration of LTE in to Firefly algorithm

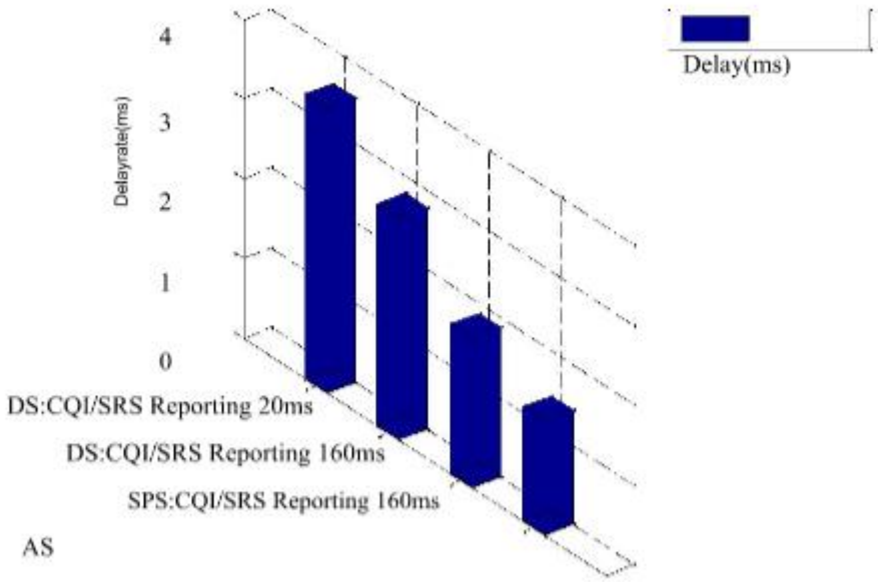

Figure 9 Performance Analysis of Delay rate v/s antenna selection

The figure shows that the graphical representation propagation of delay rate estimation for proposed firefly algorithm. From the figure 9, it can be shown that the proposed algorithm gives better performance with low delay rate with increase in the no of antennas.

Conclusion

Antenna selection in MIMO-QOSTBC one of the active research areas in the communication. In this progress report, there is development of straightforward and efficient method using FA for the selection of an optimal subset from an array of antennas. The main aspect of the proposed method is the integration of scheduling approaches into the firefly operator, fitness. The results of the proposed method have shown that the MIMO-QOSTBC system attains good throughput by selecting transmit antenna subset. The simulated results are implemented in the working platform Matlab and the results have demonstrated that their fast convergence to the best possible solution. The proposed algorithm is used for solving the noise and interference problems in original data.The proposed work of FA with adaptive scheduling facilitates 10-5 of minimum BER value. Thus the vital plan of reducing the hardware complexity with decreasing BER in the MIMO-QOSTBC system has been proficiently achieved by the proposed antenna selection method scheduling based.

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