Enhanced the Performance of 4G Communication Channel Allocation and Selection Process Using Adaptive CSIT Technique

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ABSTRACT
A cellular system consists of many cells with channels reused at spatially separate locations. Due to the fundamental nature of wireless propagation, transmissions in a cell are not limited to within that cell, and thus there is inter-cell interference between users and base stations, that use the same channels. The sharing of channel enhanced the capacity of user and subscriber. The sharing of channel increase the number of users block and increase the transmission capacity. The sharing of channel induced the effect of ping-pong and interference. In this dissertation reduces the effect of ping-pong and noise interference using the technique of CSIT. The modified concept of sharing of channel simulated in MATLAB software. The MATLAB software provides the communication block set and Simulink model for the simulation of 4G communication.

Keywords: LAN, LTE, MIMO, CSI, CSIT.

INTRODUCTION
A novel frame structure for dense outdoor networks is crucial to achieve the 5Gtarget of 1ms RTT latency, and to optimize the performance of the network. This is particularly important in using MIMO techniques with highly mobile users due to the required low CSI latency. The future data traffic in small-cell environments is expected to mainly consist of video streaming and website browsing. Furthermore, it has been noticed that the nature of traffics rather bursty. Hence, short sub-frames with flexible and low-latency scheduling would enable energy efficient DRX reception for bursty data traffic, where data bursts could be sent over a large bandwidth quickly in order to maximize the sleep time between bursts. In order to support mobility, the new frame structure should also allow for low-latency CSI, which facilitates multiuser spatial domain multiplexing techniques with coordinated beam-forming.[3]The most distinguishing and relevant feature of cellular networks compared to Wi-Fi is the support for mobility. The next generation of mobile networks is expected to ensure always-on connectivity of highly mobile users that have large throughput requirements. We expect to see a growing number of users that have such a demand in the next twenty years, particularly in densely populated urban areas. [3].It is commonly understood that highly mobile users should be supported by macro-cells. Large-scale antenna arrays (i.e. massive-MIMO) have been considered recently for providing macro-cell coverage. In fact, serving mobile users with small-cells typically leads to frequent handovers and probability of radio link failures as well as increased signaling and energy consumption in the user terminals. However, the fore mentioned limitations of small-cells can be overcome by appropriate design of the radio access network and related frame structure.LTE is designed for a frequency reuse of 1, meaning that every base station uses the whole system bandwidth for transmission and there is no frequency planning among cells to cope with interference from neighboring cells. Hence, LTE macro-cell deployments experience heavy interference at the boundaries of the cells. Multiple-input multiple-output (MIMO) transmission techniques have been widely studied over the past decade due to their advantages over single antenna systems such as improved data rate and energy efficiency. Spatial modulation (SM), which is based on the transmission of information bits by means of the indices of the active transmit antennas of a MIMO system, is one of the promising MIMO solutions towards spectral and energy-efficient next generation communications systems. SM has attracted significant attention by the researchers over the past few years and it is still a hot topic in wireless communications. [5]

In wireless communication, channel state information (CSI) simply represents the properties of a communication link between the transmitter and receiver. The CSI describes how a signal propagates from the transmitter to the receiver and represents the combined effect of, for example, scattering, fading, and power decay with distance. The CSI makes it possible to adapt transmissions to current channel conditions, which is crucial for achieving reliable communication with high data rates in multi antenna systems. The channel state information (CSI) at the transmitter is vital in MIMO systems in order to increase the transmission rate, to enhance coverage, to improve spectral efficiency and to reduce receiver complexity [4].The rest of paper discuss as in section 2 discuss the Link adaptive technique. In section 3 discuss the CSIT. In section 4 discuss proposed Work. In section 5 discuss the experimental result and analysis. finally discuss conclusion & future work in section 6.

2. LINK ADAPTIVE TECHNIQUE

Adaptive modulation or adaptive OFDM is a technique used in OFDM transmission that adapt bit and power allocation to the amplitude response of a frequency selective channel. The goal of this technique is to choose the appropriate modulation mode for transmission in each carrier, given the local signal-to-noise ratio (SNR) [3], [5]. Early simulation results showed that adaptive modulation showed significant benefits in terms of channel capacity (throughput) and BER for high-speed data transmission when OFDM is employed [2,35,15]. Nevertheless, implementing adaptive modulation for OFDM transmission systems is not a straight forward method. Channel state information: A schematic model of adaptive OFDM shown in Fig. 1 requires synchronization by signaling channel between the adaptive modulator and demodulator so that the transmitter knows which channel state information (CSI) is being fed by the receiver before deciding on the bits and power allocation for the next transmission. However, this would reduce bandwidth efficiency since some of the spectrum will be used for signaling, thus many works appeared in the literature that have disregarded the use of signaling by assuming ideal carrier and clock recovery at the expense of channel mismatch. A large gain is possible under perfect CSI over non-adaptive system as demonstrated in [10]. A few works, on the other hand, used multiple estimates to mitigate the effects of CSI delay [2, 3, 10] since greater impact on performance is due not to error in channel estimators, but to outdated adaptations that lead to channel mismatch [3]. For 802.11 wireless LAN applications, channel mismatch is not a problem because both Doppler spread and delay are small. However, if we are to extend the range of these high-speed wireless LANs to a wide-area high mobility outdoor environment, the resulting channel mismatch will cause significant performance degradation.
Loading algorithm: The use of loading algorithm in adaptive modulation is another important issue to ensure that the system is robust and yet less computationally intensive. A few bit and power loading algorithms currently available [16]. are, however, computationally complex and would require a high power consumption at the base station (BS). A simpler bit and power allocation proposed by [15] formed a faster and lesser complex algorithm that would not power-burden the BS and based mainly on the optimum power distribution and channel capacity given in [8]. Another approach that avoids the use of signaling would be to rank the received subcarrier amplitudes and decides on the basis of a priori knowledge on how many subcarriers are to be left out and which will be used in the next uplink frame [7]. Similarly at the base station, a ranking of the received amplitudes is performed, and the same allocation will be used for the downlink frame. In addition, the BS will transmit pilot symbols on the unused subcarrier, so that mobile station can gather information about samples of the channel’s transfer function on all subcarriers that will serve as a basis for a new allocation.

3. CSIT (CHANNEL STATE INFORMATION AT TRANSMITTER)

In wireless communication, channel state information (CSI) simply represents the properties of a communication link between the transmitter and receiver. The CSI describes how a signal propagates from the transmitter to the receiver and represents the combined effect of, for example, scattering, fading, and power decay with distance. The CSI makes it possible to adapt transmissions to current channel conditions, which is crucial for achieving reliable communication with high data rates in multi antenna systems. The channel state information (CSI) at the transmitter is vital in MIMO systems in order to increase the transmission rate, to enhance coverage, to improve spectral efficiency and to reduce receiver complexity [3].

The CSI is usually estimated at the receiving end and then quantized and fed back to the transmitting side. Basically there are two ways that the transmitter can obtain CSI from the receiving end. The transmitter and receiver can have different CSI. There are basically two levels of CSI, namely instantaneous CSI and statistical CSI. The following section describes both, the instantaneous and statistical CSI. Instantaneous CSI is also known as short-term CSI. Instantaneous CSI means that the current conditions of the channel are known, which can be viewed as knowing the impulse response of a digital filter [16]. This gives an opportunity to adapt the transmitted signal to the impulse response and thereby optimize the received signal for spatial multiplexing or to achieve low bit error rates. Statistical CSI is also known as long-term CSI. Statistical CSI means that a statistical characterization of the channel is known. This description can include the type of fading distribution, the average channel gain, the line-of-sight component, and the spatial correlation [6]. As with instantaneous CSI, this information can be used for transmission optimization. The CSI acquisition is practically limited by how fast the channel conditions are changing. In fast fading systems where channel conditions vary rapidly under the transmission of a single information symbol, only statistical CSI is reasonable. On the other hand, in slow fading systems instantaneous CSI can be estimated with reasonable accuracy and used for transmission adaptation for some time before being outdated. In practical systems, the available CSI often lies in between these two levels; instantaneous CSI with some estimation/quantization error is combined with statistical information. The capacity of a MIMO (multi-input multi-output) channel is influenced by the degree of CSI (channel-state information) available to both transmitter and receiver [2].

4. PROPOSED ALGORITHM

In this paper modified the process of channel selection based on adaptive model based on optimization technique. The process of optimization technique reduces the error and noise interference value during the selection of channel. In the continuity of chapter discuss the link adaptive technique, CSIT, adaptive model, and finally discuss the proposed method.

Multiple diversity adaptive FFT arrays have been considered for enhancing the number of simultaneous users accessing networks. It is suggested that each user is tracked in azimuth by a narrow signal for both user-to-receiver and receiver-to-user transmissions. The directive nature of the signal ensures that in a given system the mean interference power experienced by any one user, due to other active users, would be much less than that experienced using conventional wide coverage receiver-station FFTs. It has already been stressed that high capacity cellular networks are designed to be interference limited, so the adaptive FFT would considerably increase the potential user capacity. This increase in system capacity of the new receiver-transmitter FFT architecture of an FFT array[16]. The results show that this type of receiver – transmitter FFT could increase the spectral efficiency of the network by a factor of 30 or more. These results were obtained for a hypothetical fast frequency hopping code division multiple network, assuming uniform user distribution and complete frequency reuse for the omni directional FFT case, i.e., adjacent cells are co-channel cells. Complete frequency reuse is then assumed for each of the signal formed by the adaptive array ,i.e., adjacent beams are co-channel. Further, it was shown that a similar enhancement of efficiency can be obtained for either an idealized multi signal FFT.

At the receiver the signal vector from m^{th} receive antenna is given by Where $N_m(k)$ is complex Gaussian noise vector with zero mean and equal variance for each receive antenna elements. $S_f(k)$ is original transmitted signal and $H_{m,f}$ is the channel matrix coefficients. We can collect M receive signal vectors and form an NxM receive signal matrix as

$R(k)=R_0(k)R_1(k)\ldots\ldots\ldots\ldots R_{M-1}(k)\ldots\ldots\ldots\ldots\ldots(5)$

To reduce the noise among different subcarriers for FFT in balanced STTC the optimization will be

$p_n=w^H h_n h_n^H w\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$

This equation represents the signal power of the nth subcarrier after diversity combining. The idea behind these criteria is to optimize the SNR performance of worst subcarrier. The SNR from diversity combining will be $\gamma=P_n/w^H R_n w$. Corresponding to the maximum given value of channel matrix. For optimum value of SNR $w^H w$ should be minimum subject to $w^H w=1$

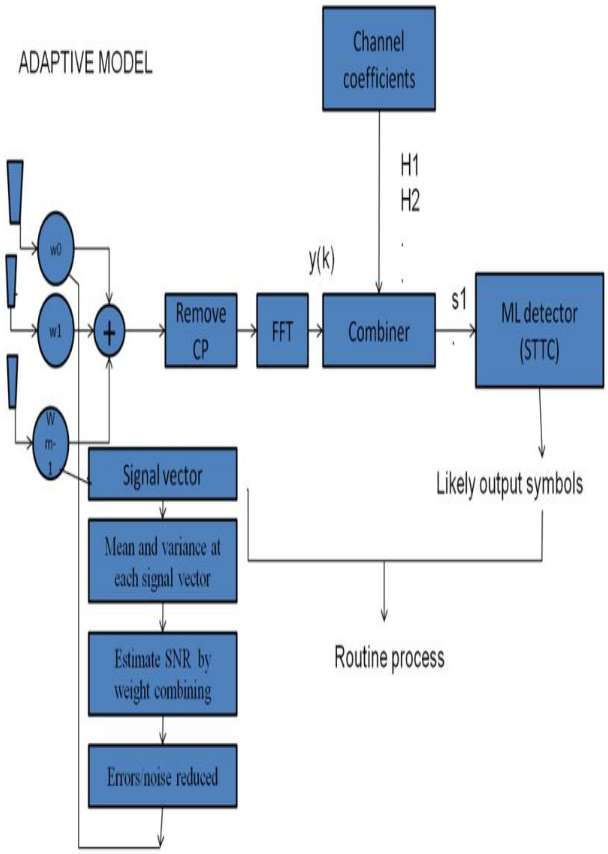

Figure 1: Shows that model of FFT adaptive.

This dissertation we proposed a adaptive model for power reduction channel state information at the transmitter (CSIT) in MIMO system. If number of antenna and frequency selective channel are increase the rate of noise also increase, increasing rate of noise degraded the performance of mimo system. We consider the system where the transmitter has n_t antennas and the receiver has n_r antennas. For practical purposes, it is commend to model the channel as frequency flat whenever the bandwidth of the system is smaller than the inverse of the delay spread of the channel; hence wideband system operating where the delay spread is fairly small may sometimes also be considered as frequency flat. Now we describe all phase step given below

1. Let $h_{m,n}$ be a complex number corresponding to the channel gain between transmit antenna *n* and the receive antenna *m*. If at a certain time instant adaptive signals $\{x_1, x_2, \ldots, x_{nt}\}$ are transmitted via the n_t antennas, the received signals at antenna *m* can be expressed as

$$y_m = \sum_{n=1}^{n_t} h_{m,n} x_n + e_m$$ where e_m is a noise term.

The relation in is easily expressed in a matrix framework. Let *x* and *y* be n_t and n_r vectors containing the transmitted and receiver data, respectively. Define the following n_r x n_t adaptive channel gain matrix:

$$H = \begin{bmatrix} h_{1,1}\ldots\ldots\ldots h_{1,nt} \\ \ldots\ldots\ldots\ldots\ldots\ldots \\ . \\ h_{nr,1}\ldots\ldots. h_{nr,nt} \end{bmatrix}$$

2. Then we have y = Hx + e where e = $[e_1 \ldots\ldots. e_{nr}]^T$ is a vector of noise samples. If several consecutive vectors $\{x_1,..,x_N\}$ are transmitted, the corresponding received data can be arranged in a matrix

3. We can expressed as adaptive signal as Y = [y_1 ...... y_N]

4. We can write asY = HX + E

5. We can characterize channel selective as adaptive channel as follows:

$$H\,(z^{-1}) = \sum_{l=0}^{L} H_l z^{-l}$$

Where, H_l are the n_r x n_t adaptive channel matrices corresponding to the time delays$l$ = 0, ..,L. Here the channel is assumed to have (L+1) number of taps. Also, L = 0 corresponds to channel fading model.

6.Now we can define selective of adaptive channel are

$$y = GX + e)$$

where, $x = [x^T(-\,L)\ \ldots\ x^T(N_0 + L\,-1)]^T$

$$y = [y^T(0)\ \ldots\ y^T(N_0 + L\,-1)]^T$$

$$e = [e^T(0)\ \ldots\ e^T(N_0 + L\,-1)]^T$$

and

$$G = \begin{bmatrix} H_L H_{L-1}\ldots.. H_1 H_0 0\ldots\ldots\ldots\ldots\ldots..0 \\ 0 H_L H_{L-1}\ldots\ldots. H_1 H_0\ldots\ldots\ldots\ldots\ldots.. \\ \ldots\ldots. \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..0 \\ 0\ldots\ldots\ldots\ldots. H_L H_{L-1}\ldots\ldots\ldots\ldots. H_1 H_0 \end{bmatrix}$$

6. Finally select the transmitted signal
Find the value of BER in consideration of SNR value.

5. EXPERIMENTAL RESULT ANALYSIS

In this paper,we perform experimental process of modified 4G communication model. The proposed method implements in mat lab 7.14.0 and tested with very standard modulation technique.

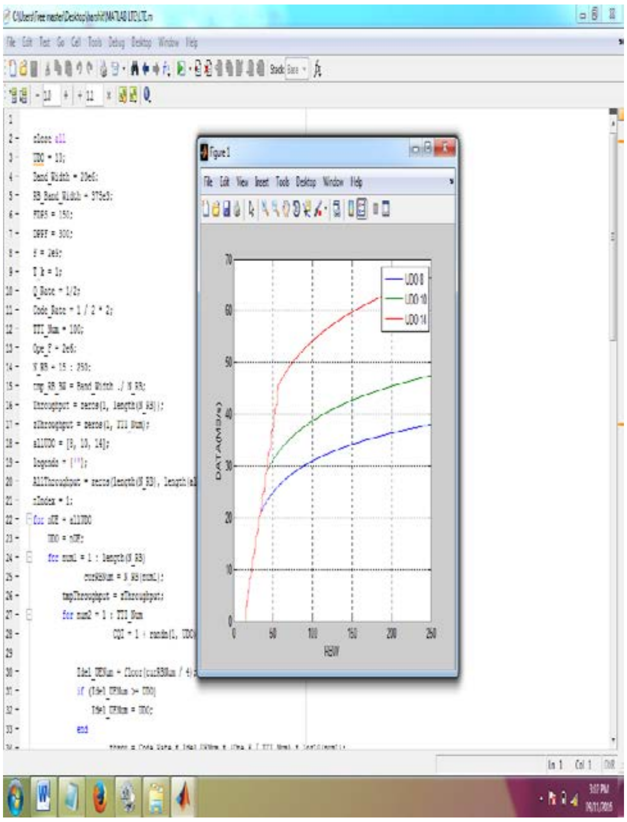

Figure 2: Starting 1st output window of LTE figure 2 between data and RBW.

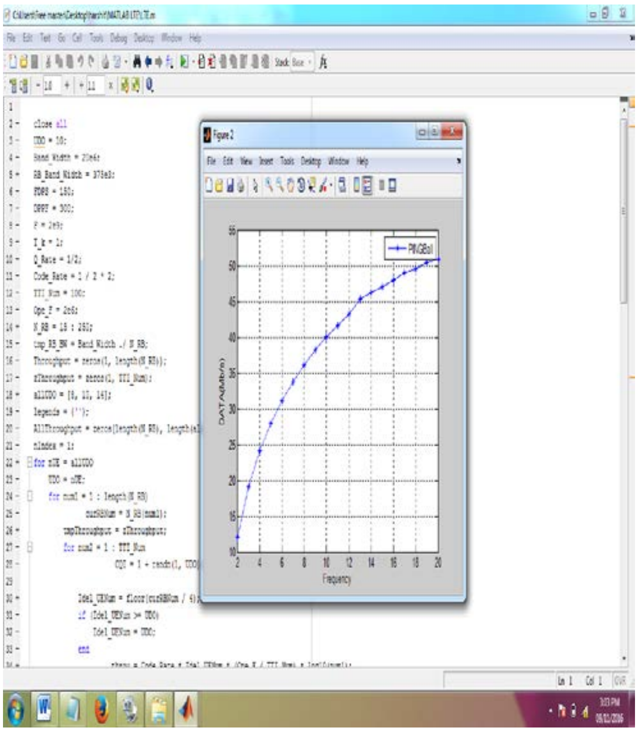

Figure 3: Starting 1st output window of LTE figure 3 between data and Frequency.

Tx Error Rate	Rx Error Rate
5.5	2.87
3.77	2.87
3.84	2.87
4.22	4.73
6.77	1.77
6.25	2.87
3.88	6.14

Table 1: Shows that the performance evaluation of Tx Error Rate and Rx Error Rate with GMSK modulator, AWGK Channel and GMSK demodulator.

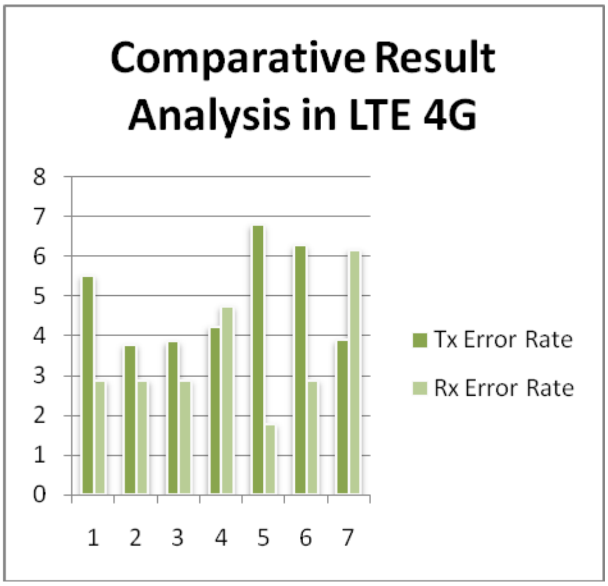

Figure 4: Shows that the comparative performance evaluation graphs for Tx Error Rate and Rx Error Rate.

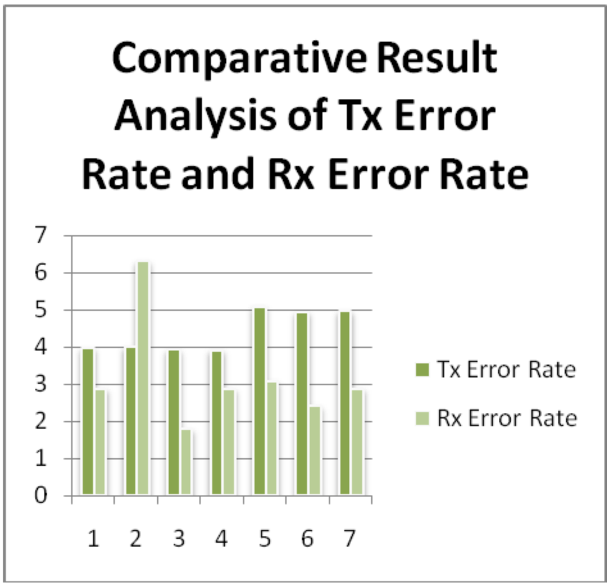

Figure 5: Shows that the comparative performance evaluation graphs for Tx Error Rate and Rx Error Rate.

6.CONCLUSION AND FUTURE WORK

In this paper, we proposed a new methodology PSO average weighted for improvement of BER and reduction of noise interference. Our proposed methodology performs on MIMO STBC-OFDM system model for balanced and unbalanced combination of multiuser system. The evaluation of parameters used three conditions ZF, MMSE, TLBO average weighted. PSO average weighted shows better result in comparison of Pre FFT combination of STBC OFDM with PSO fair Condition. The most important fact for adaptive is that it requires channel state information (CSI) at transmitter end to properly serves the spatially multiplexed users. In adaptive, CSI not only helps in achieving high SNR at the desired receiver but also reduces the interference produced at other point in the network by the desired user's signal [11]. But the challenge lies on whether and what type of CSI can be made practically available to the transmitter in an adaptive OFDM systems, where fading channels are randomly varying.

Another challenge related to adaptive model cross-layer design lies in the complexity of the scheduling procedure associated with the selection of a group of users that will be served simultaneously. Optimal scheduling involves exhaustive search whose complexity is exponential in the group size, and depends on the choice of preceding, decoding, and channel state feedback technique.

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