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Performance Evaluation of MIMO System using AMC Technique

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Abstract: *The core idea of AMC is to dynamically change the Modulation and Coding Scheme (MCS) in subsequent frames with the objective of adapting the overall spectral efficiency to the channel condition. The decision about selecting the appropriate MCS is performed at the receiver side according to the observed channel condition with the information fed back to the transmitter in each frame. Many AMC techniques have been presented in the literature. While there has been significant progress on understanding the theoretical aspects of time adaptation in AMC protocols, new challenges surface when dynamic transmission techniques are employed in broadband wireless networks with multiple signaling dimensions. The performance analysis is done using evaluation of LTE. In this work The performance of AMC is evaluated by calculating probability of Bit Error Rate (BER) under the AWGN wireless channel models. For this work Evaluation of LTE under AMC we will construct the AMC model in MATLAB under Gaussian (AWGN) to analyze performance that is in BER, Data Delay and Throughput.*

Key Words:-*AMC, AWGN, Delay, LTE*

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I. Introduction

MIMO systems make use of multiple antennas at the transmitter and receiver so as to increase the data rates by means of spatial diversity. So MIMO systems are well-known in wireless communications for high data rates. [1] The capacity of wireless systems can be increased by varying the number of antennas. The two primary reasons for using wireless communication over wired communication: • First is multi-path fading i.e. the variation of the signal strengths due to the various obstacles like buildings, path loss due to attenuation and shadowing [2]. Second, for the wireless users, the transmission media is air as compared to the wired communication where each transmitter–receiver pair is considered as an isolated point-to point link. MIMO system utilizes the feature of spatial diversity by using spatial antennas in a dense multipath fading environment which are separated by some distance [3]. MIMO systems are implemented to obtain diversity gain or capacity gain to avoid signal fading. The idea to improve the link quality (BER) or data rate (bps) is the basic consideration behind the development of MIMO systems by using multiple TX/RX antennas [4]. The core scheme of MIMO is space-time coding (STC). The two main functions of STC: diversity & multiplexing. The maximum performance needs tradeoffs between diversity and multiplexing.

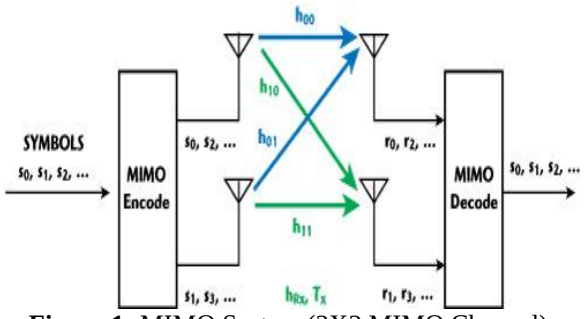

Figure 1: MIMO System (2X2 MIMO Channel)

MIMO system employs various coding techniques for multiple antenna transmissions have become one of the desirable means in order to obtain high data rates over wireless channels [5]. However, of considerable concern is the increased complexity incurred in the implementation of such systems. MIMO antenna systems are used in recent wireless communications like WiMAX, IEEE 802.11n and 3GPP LTE etc.

II. Literature Survey

AliyuBuba Abdullahi et.al told that orthogonal Frequency Division Multiplexing(OFDM) is the transmission scheme adopted for downlink of the popular Long Term Evolution (LTE) technology. In this paper, the Physical Downlink Shared Channel (PDSCH) performance of MIMO system based on LTE specification, is evaluated using linear and non-linear receiver's decoder in ITU defined channel models with different modulations.

Emmanuel Migabo et.al told about LTE standard uses three different modulation n schemes to adapt to various channel conditions in order to improve achievable data rates. These modulation schemes are the QPSK, 16-QAM and 64-QAM. This paper presents an overview of a LTE digital communication system Simulink model, designed in order to study the effects of the QPSK, 16-QAM and 64-QAM modulation schemes on the BER performance with an AWGN channel model.

AnjithaViswanath et.al told that atmospheric turbulence causes severe degradation in the performance of free space optical (FSO) communication links. Among the various techniques used to mitigate the effect of turbulence, aperture averaging is one of the simplest. Also, the link performance improves with aperture averaging for all the modulation schemes with the improvement more pronounced in the case PPM scheme. Thus PPM becomes the preferred modulation scheme in designing a FSO communication link.

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Swati Sharma et.al In this paper there is comparison of all the modulation techniques which are possible to be used in LTE systems in OFDM AWGN channel. , BPSK, QPSK, 16QAM and 64QAM, so as to get the best one out of them on the basis of comparison parameters, bit error rate and signal to noise ratio

Makarand N. Patil et.al represented analysis Bit Error Rate (BER) performance of various modulation techniques. There are various modulation schemes such as Binary Phase Shit Keying (BPSK) and Quadrature Phase Shift Keying (QPSK). The performance in between these modulation techniques is analyzed and best suited with respect to low Bit Error Rate (BER) is transmitted. Simulation is carried out on the software named MATLAB

Leila Nasraoui et.al In this paper, a robust technique for non-coherent synchronization in MIMO-OFDM systems employing space time coding was presented and applied to the IEEE 802.11n WLAN standard. The proposed scheme aims to detect the preamble start and to estimate the fractional part of the frequency offset. In this Paper, author used Wang scheme. He analyzed CDR (Correct Detection Rate) & MSE (Mean Square Error).In this paper, he proposed the use of differential space-time block coding to improve the synchronization for Wireless Local Area Networks (WLAN) without any channel estimation requirement.

Amir Hossein et.al told about new channel estimation has been proposed for MIMO systems. Investigations of STBC-MIMO were first conducted and simulations results for different number of transmit and receive antennas were obtained. This work describes space-time coding for MISO and MIMO systems for use in wireless environment. The performance of space-time codes for wireless multiple-antenna systems with and without diversity in Rayleigh faded channel has been studied.

Akansha Gautam et.al analyzed for channel estimation by applying Alamouti STBC code in MIMO. The system is performed and implemented with 16-PSK modulation. The system is configured and tested for 4xM and 2xM, where M is number of receivers. The 2xM and 4xM configuration giving better BER for higher signal power range keeping number of receivers (M) lower or equal to number of transmitters.

Mahdi Abdul Hadi et.al recovered the transmitted information accurately, the channel effect must be known at the receiver. In this paper channel estimation for STBC-MIMO-OFDM system has been investigated by implementing the most popular channel estimators least Square (LS) and Minimum Mean Error Square (MMSE) both based on comb type pilot arrangement to estimate the channel effect at pilot locations, and channel interpolation between pilot locations was done using linear interpolation.

Azlina Idris et.al had simulated three types of diversity techniques; STBC, SFBC and STFBC in MIMO-OFDM system. STFBC technique has been proposed. The main objective is achieved where the evaluation of BER performance in presence diversity technique using fast-time varying channel with ICI-SC scheme give the maximum diversity order.

Parismita Gogoi et.al has been proposed based on two different Artificial Neural network (ANN) structures, namely MLP and RNNs for use in STBC MIMO system in Rayleigh Faded channel. Estimate of the channel is calculated in terms of synaptic weights and bias values of the neural network.

Azlina Idris et.al proposed a new data conjugate subcarrier mapping technique that combines ICI self-cancellation method using data allocation in space time frequency block codes (STFBC) MIMO-OFDM system. It aims to achieve maximum diversity order and to compensate integrated effect of FO for ICI reduction in the system.

A. I. Sulyman et.al examined the impact of antenna selection on the performance of multiple input-multiple output (MIMO) systems over nonlinear communication channels. Results show that the performance degradation due to nonlinearity in the channel reduces as less numbers of antennas are selected at the receiver, representing some savings in SNR penalty due to nonlinearity for the reduced-complexity system.

C. Wang et.al told by employing spatial multiplexing, Multiple-Input Multiple-Output (MIMO) wireless antenna systems provide increases in capacity without the need for additional spectrum or power. Zero-Forcing (ZF) detection is a simple and effective technique for retrieving multiple transmitted data streams at the receiver. However the detection requires knowledge of the channel state information (CSI) and in practice accurate CSI may not be available.

Gerhard Bauch et.al analyzed the suitability of orthogonal space-time block codes and space-frequency block codes in a 4G OFDM system. While even for high vehicular speed channel variations in time do not significantly degrade the performance of space time block codes, severe frequency-selectivity is shown to limit the performance of space-frequency block codes unless. In wireless broadband systems the available time, frequency and spatial diversity can he exploited using complex space-time-frequency codes.

III. Adaptive Modulation

The general principle of AMC is to:

- Define a channel quality indicator, or socalled channel state information (CSI), that provides some knowledge on the channel
- Adjust a number of signal transmission parameters to the variations of that indicator over the signaling dimensions explored (time, frequency, space, or combination thereof)

There are various metrics that may be used as CSI. Typically, SNR or signal-to-noise-plus-interference ratio (SINR) may be available from the physical layer (e.g., by exploiting power measurements in slots without intended transmit data). At the link layer, packet error rates (PERs) are normally extracted from the cyclic redundancy check (CRC) information. BERs are sometimes available. In this section we review the respective use of this type of CSI in the design of the AMC protocol, with emphasis on time adaptation and for an error-rate-constrained system. We first consider the traditional example of AMC using SNR measurement with the perfect instantaneous feedback introduced earlier. We show the

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limitations of this scheme, and move on to more sophisticated types of adaptation.

Adaptation Based on Mean SNR — To implement adaptive transmission, the CSI must be available at either the transmitter or receiver. Often, such information consists of the SNR measured at the receiver. In this case, a possible solution for AMC is as follows:

1 Measure the SNR at the receiver.

2 Convert the SNR information into BER information for each mode candidate.

3 Based on a target BER, select for each SNR measurement the mode that yields the largest throughput while remaining within the BER target bounds.

4 Feedback the selected mode to the transmitter.

IV. Result Analysis

Different parameters are used. The total no. of transmit antennas. Total no of subcarrier are 128. The different modulation schemes are used to achieve maximum throughput & min BER. Table 1 represents adaptive Modulation parameters. The parameter are used to achieve max throughput & min BER. These parameter are used to optimized the different values. On the behalf of these values , the simulation performance is measure.

Table 1: Adaptive Modulation Simulation Parameters

Parameter	Description	Value
Nt	The number of transmit antennas.	2-4
Nr	The number of receive antennas.	2-4
N	The number of subcarriers.	128
GI	CP length.	32
Nframes	The number of frames to simulate.	1000-10000
minSNR	Minimum SNR in dB to simulate begin with.	0
maxSNR	Maximum SNR in dB to simulate end with.	30
stepSNR	SNR step in dB to increment.	4
MF	Modulation format	Adaptive, 16QAM, 64QAM

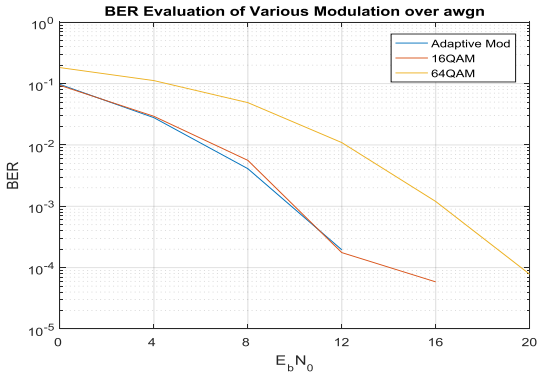

Figure 2: BER Evaluation of Adaptive Modulation, 16-QAM, 64-QAM over AWGN channel SNR = [0:4:30] Simulation Frames 100, AMC outperforms all other modulation techniques

BER evaluation of Adaptive Modulation of 16-QAM , 64-QAM over AWGN Channel for 100 frames is shown in fig. 2.

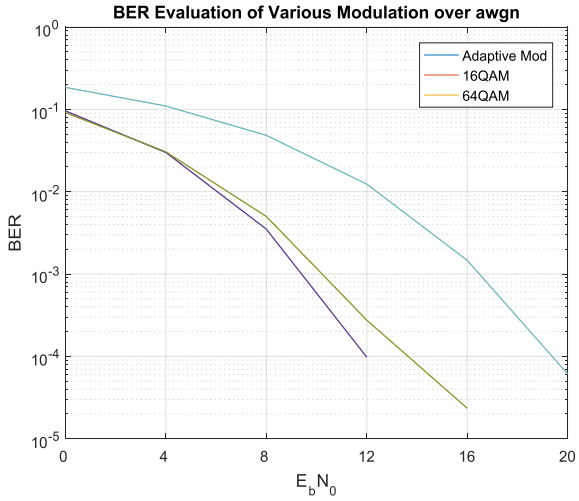

Figure 3: BER Evaluation of Adaptive Modulation, 16-QAM, 64-QAM over AWGN channel SNR = [0:4:30] Simulation Frames 1000, AMC outperforms all other modulation techniques

BER evaluation of Adaptive Modulation of 16-QAM , 64-QAM over AWGN Channel for 1000 frames is shown in fig 3

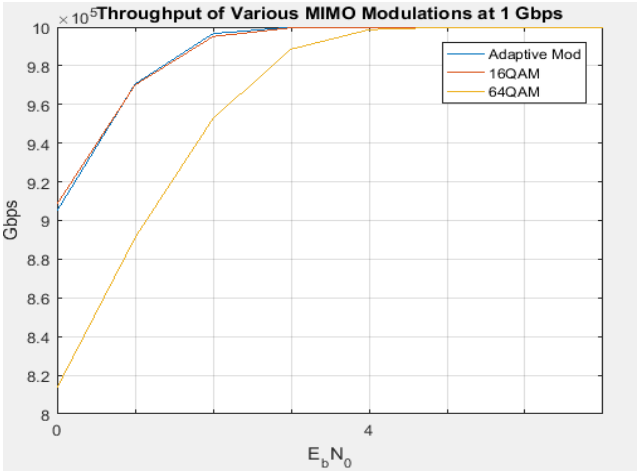

Figure 4: Throughput Evaluation of Adaptive Modulation, 16-QAM, 64-QAM over AWGN channel SNR = [0:4:30] Simulation Frames 1000, AMC outperforms all other modulation techniques

Throughput is achieved maximum using AMC algorithm. Throughput Evaluation of Adaptive Modulation, 16-QAM, 64-QAM over AWGN channel for 1000 frames is given by Fig 4.

V. Conclusion

We explored various ways to capture channel information and provide some guidelines on the design of sensible solutions for AMC. Implementing optimum AMC is challenging due to practical limitations, but simulated performance of a realistic

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broadband wireless MIMO-OFDM based system using AMC were very encouraging. In this work The performance of AMC is evaluated by calculating probability of Bit Error Rate (BER) under the AWGN wireless channel models. For this work Evaluation of LTE under AMC was constructed the AMC model in MATLAB under Gaussian(AWGN) to analyze performance that is in BER, Data Delay And Throughput. It is clear from the Results that AMC outperforms 16 QAM and 64 QAM in BER for all simulation orders. It can also be noted that AMC posses maximum Throughput of all.

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