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PERFORMANCE IMPROVEMENT OF OFDM TRANSMISSION USING AMC AND DIFFERENT MIMO TECHNIQUE

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ABSTRACT

In the rapid growing field of wireless communications, there is an increasing demand of higher rates with longer transmission ranges for new broadband applications. It was a big challenge for modern wireless communications networks to provide services like video, voice, data including mobility. The project presents the analysis of Space-Time Block Codes used for Multiple-Input Multiple-output MIMO-OFDM technology is a combination of multiple-input multiple-output antenna technology with orthogonal frequency division multiplexing.

Adaptive modulation schemes for fading channels are usually required to fulfill certain long-term average error rate targets. The error rate level is depend on the modulation type, SNR value and channel behavior. To transmit the faithful data over these systems the error rate performance is further improved using forward error correction codes (FEC). Error rate performance is evaluated for these codes under different modulation schemes like QPSK, BPSK, and QAM techniques.

KEYWORDS: *MIMO, OFDM, STBC, SM, M-QAM, AMC, BPSK., etc.*

INTRODUCTION

Wireless communication operations, such as long-range communications that are impossible or impractical to implement with the use of wires. In the term is commonly used in the telecommunications industry to refer to telecommunications systems which use some form of energy to transfer information without the use of wires. Information is transferred in this manner over both short distances and long distances communication.

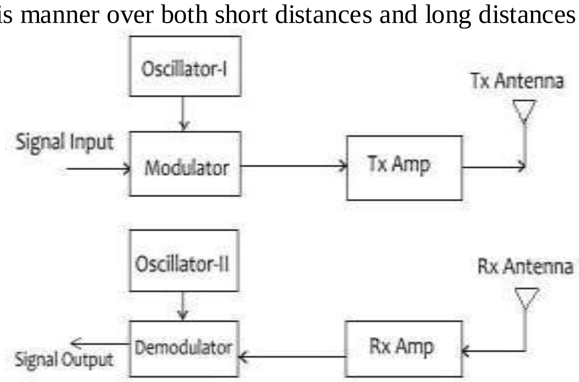

Fig: 1 Block diagram of wireless communication

The growth in the use of the information networks lead to the need for new communication networks with higher data rates. The lecommunication industry is also changing, with a demand for a greater range of services, such as video conferences, or applications with multimedia contents. The increased reliance on computer networking and the Internet has resulted in a wider demand for connectivity to be provided "any where, any time", leading to a rise in the requirements for higher capacity and high reliability broadband wireless access Broadband wireless Access telecommunication systems.

OFDM has become a popular technique for transmission of signals over wireless channels. OFDM has been adopted in several wireless standards such as digital audio broadcasting (DAB), digital video broadcasting (DVB-T), the IEEE 802.11a LAN standard and the IEEE 802.16a MAN standard.

MIMO SYSTEM MODEL
Multi-antenna systems can be classified into three main categories. For Multiple antennas at the transmitter side are usually applicable for beam forming purposes. In Transmitter or receiver side multiple antennas for realizing different (frequency, space) diversity schemes. The third class includes systems with multiple transmitter and receiver antennas realizing spatial multiplexing (often referred as MIMO by itself).

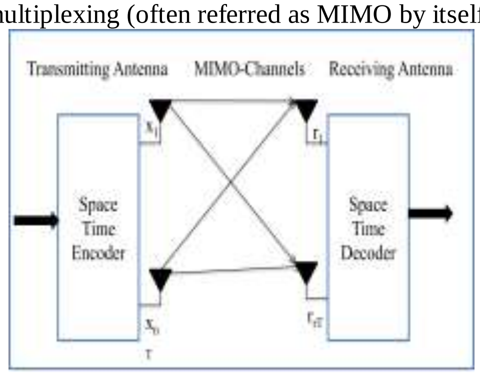

Fig. 2 MIMO syste

Space Time Processing Techniques
Space time processing technique for MIMO generally has two objectives one is to increase the data rate and next is to achieve maximum possible diversity. The space time processing techniques are:

- Spatial Multiplexing
- Space Time Coding

Spatial Multiplexing
Spatial multiplexing is a transmission technique to transmit several different data bits called streams through an independent spatial channel to achieve the greater throughput. Typically there are four kinds of spatial multiplexing schemes V-BLAST, diagonal blast, horizontal blast and turbo blast. Among them V-BLAST is the most promising scheme to apply

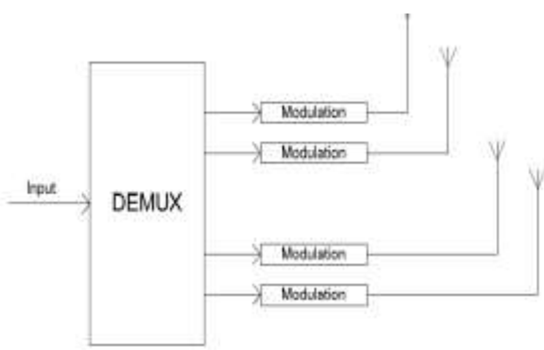

Fig: 3 Simple example of spatial multiplexing.

The above simple example illustrated the idea behind spatial multiplexing. The input bits stream is divided into N independent substreams using serial to parallel demultiplexer, and each stream is transmitted from several different antennas with output N symbol per channel. So the throughput increases N times and therefore, spatial multiplexing becomes the better candidate for high data rate.

Space-Time Coding

Space -time coding is specially designed for use with multiple transmits antennas. Space- time codes provide coding and diversity gain without sacrificing the bandwidth. Space-time coding is illustrated in Figure 4.

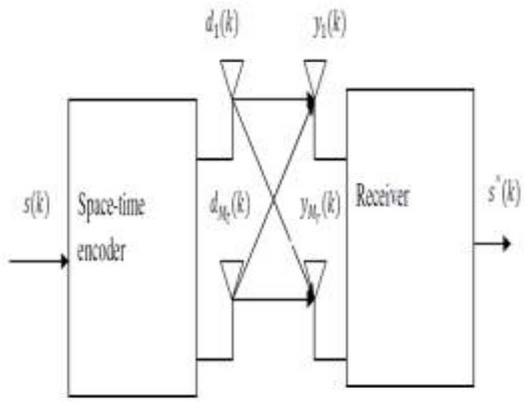

Fig: 4 Space-time coding system

ADAPTIVE MODULATION AND CODING (AMC)

In order to improve system capacity, coverage reliability and peak data rate, the transmitted signal is subject to variation of interfering base stations, path loss, and noise and fading that affects the quality of received signal. The transmitted signal is modified through a process commonly referred to as link adaptation. Adaptive Modulation Coding (AMC) provides the flexibility to dynamically match the modulation-coding scheme (MCS) to the average channel conditions for each user. It is a user is close to the base station (BS), a higher modulation order (eg: 64QAM) with higher code rate is assigned. In contrast, modulation order (eg: 16QAM) will decrease, which a user is far from the base station (BS).

Different order modulation can allow to the transmitter to send more bits per symbol and thus achieve higher throughputs or better spectral efficiencies. When using a modulation technique such as 64-QAM, better signal-to-noise ratios (SNRs) are needed to overcome any interference and maintain a certain bit error ratio (BER). The different variants of QAM modulation are used in various communication scenarios, for to meet specific data rate performance. With AMC, the power of the transmitted signal is held constant over a frame interval, the modulation and coding format is changed to match the current received signal quality or channel conditions. In the system with AMC, users close to the Node B are typically assigned higher order modulation with higher code rates, but the modulation-order and/or code rate will decrease as the distance from Node B increases. AMC is most effective when combined with fat-pipe scheduling techniques such as those enabled by the Downlink Shared Channel. AMC combined with time domain scheduling offers the opportunity to take advantage of short term variations in a UE's fading envelope so that a UE is always being served on a constructive fade. It Rayleigh fading envelope correlation vs. time delay for different values of Doppler frequency. In the figure suggests that for lower Doppler frequencies it is possible to schedule a user on a constructive fade provided that the scheduling interval (i.e. frame size) is small and the measurement reports are timely (i.e. distributed scheduling). To take advantage of in this technique, both a smaller frame size and distributed scheduling have been proposed as part of the High Speed Downlink Packet Access (HSDPA) study item. The implementation of AMC offers several challenges. In order to select the appropriate modulation and the scheduler must be aware of the channel quality.

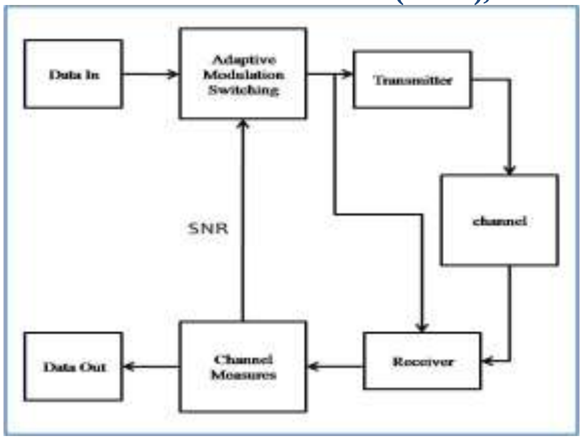

Fig.5 Adaptive Modulation System.

RESULTS AND DISCUSSION

The simulation system is shown in figure below, the system will be developed the MIMO system using MATLAB. The adaptive modulation controller is receiving signal number of transmission and number of receiver and SNR, in control OFDM transmission and OFDM receiver signal. The graphs shown in simulation & result section of the thesis clarify the process shown in the system model.

Table: 1 Simulation parameter

S.No.	Parameter	Specification Value
1.	Channel	Rayleigh channel
2.	Modulation	BPSK. QPSK, QAM 8, QAM 16, QAM 32
3.	User standard	IEEE 802.11 g
4.	Number of sample	52
5.	FFT Size	64
6.	Cyclic preifix	¼ (16)
7.	Performance SM	BER, Spectral efficiency
8.	Number of Symbols	1000

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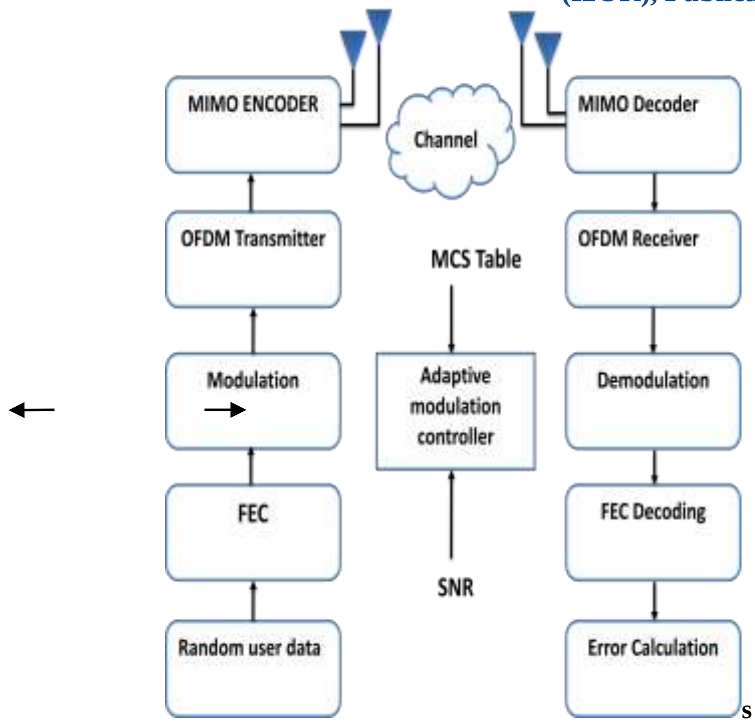

Fig: 6 System block diagram of MIMO-OFDM With AMC

Threshold table of AMC

Table: 2 Using MIMO techniques

Modulation Type	**No. of receivers =1 (2*1)**	**No. of receivers =2 (2*2)**	**No. of receivers =4 (2*4)**
BPSK	**≤10**	**≤8**	**≤5**
QPSK	**≤14**	**≤11**	**≤8**
QAM 8	**≤16**	**≤13**	**≤10**
QAM 16	**≤19**	**≤16**	**≤13**
QAM 32	**>19**	**>16**	**>13**

Table: 3 Using MIMO and spatial multiplexing

Modulation Type	No. of receivers =1 (2*1)	No. of receivers =2 (2*2)	No. of receivers =4 (2*4)
BPSK	≤10	≤8	≤5
QPSK	≤14	≤11	≤8
QAM 8	≤16	≤13	≤10
QAM 16	≤19	≤19	≤13
QAM 32	>19	>19	>13

Performance of MIMO 2x4 using AMC technique

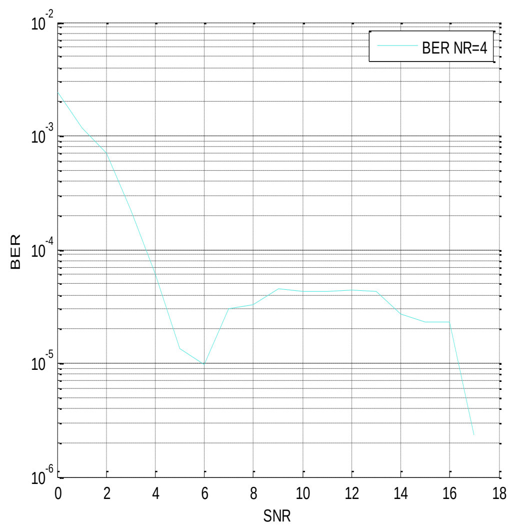

Fig:7 Performance of SNR to BER, No. of receiver 4

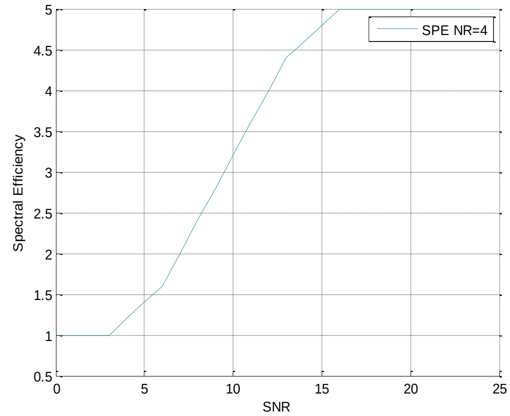

Fig: 8Performance of SNR Vs Spectral efficiency

Adaptive modulation and coding with MIMO 2x4 using spatial multiplexing

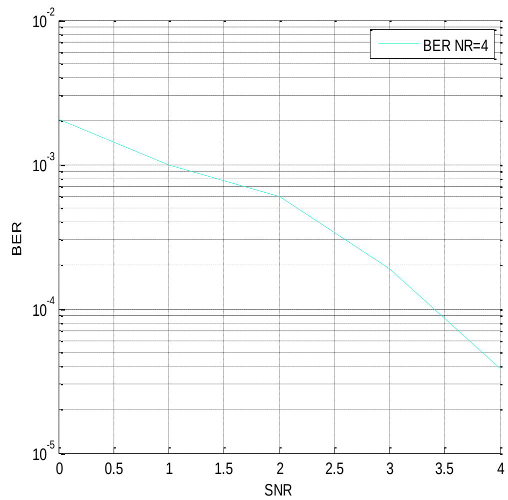

Fig: 9 Performance of SNR to BER

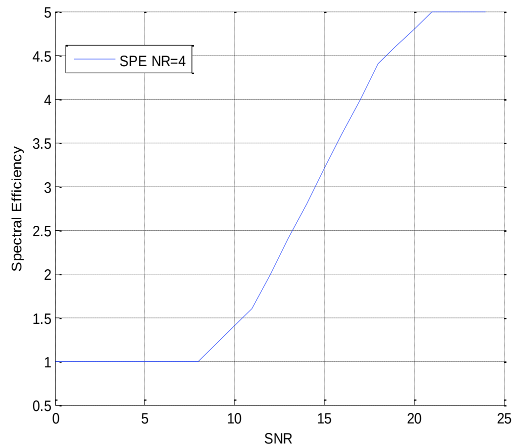

Fig: 10 Performance of SNR Vs Spectral efficiency

CONCLUSION

This paper has presented comparative the analysis of Space-Time Block Codes (STBC) and Spatial multiplexing (SM) used in MIMO-OFDM technology. This techniques have shown its importance to support high data rate and high performance in different noise levels.

This simulation study of various modulation schemes which support the high data rate may be used for performance enhancement with different receiver diversity,same has been demonstrated here. It is found that with increase of modulation order the capacity enhancement with maintain the BER.

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