Bit Error Rate Improvement in Mimo Using Software Defined Radio

Vaghela Bhoomikaben K[1] Prof Hetal G Bhatt[2]
[1]M.E [2]Assistant Professor
[1,2]Department of Electrical Communication Engineering
[1,2]SPCE, Visnagar,Gujarat,India

Abstract— MIMO systems have recently combining as one of the most promising technology in wireless communication systems in achieving high data rates and improve system performance. We aim at the study of a communication system that employs MIMO-SDR and adaptive modulation technologies. Error performance and spectral efficiency can be improved by different modulation techniques with MIMO system. The simulation result have been obtain in MATLAB platform. The BER performance has been analyzed for BPSK, QPSK, 8QAM, 16 QAM and 32 QAM.Software Defined Radio (SDR) to implement the radio communication process simply with software. Software Defined Radio (SDR) used in MATLAB to work as switching for different modulation techniques. Software Defined Radio (SDR) can easily to sophisticated coding and modulation techniques.

Key words: MIMO, MIMO-SDR, BER, SDR

I. INTRODUCTION

Bit error rate (BER) is the ratio of bits in errors and total number of bits received in a transmission. Multiple Input Multiple Output (MIMO) systems as one of the most promising technology in wireless communication systems. In this paper bit error rate (BER) improvement in MIMO using different modulation techniques. The aims at improvement in spectral efficiency and coverage area with reliable performance. MIMO is a promising technology of modern wireless communication that uses multiple antennas at both Transmitter and Receiver and provides improved performance compared to conventional communication systems. The main idea behind MIMO is that the transmit antennas and the receive antennas are connected and combined in such a way that, the bit error rate (BER), or the data rate for each user is improved. MIMO has salient features which offers significant increases in data throughput and link range without additional bandwidth or increased transmit power. MIMO communications is one of the emerging technologies that can efficiently boost data transmission rate through spatial multiplexing, improve system coverage due to less interference and enhance link reliability through spatial diversity. MIMO systems [2, 3] provide diversity to mitigate fading, which can be realized by providing the receiver with multiple copies of the transmitted signal in space, frequency or time. Thus, by increasing signal replicas, probability of getting least faded signal is increased. This can be achieved by employing more number of transmitting and receive antennas. On the other hand, spatial multiplexing provides significant gain in transmission data rate by exploiting the multi-path effects and random fading of the wireless channel. When transmit antennas of MIMO systems transmits different symbols simultaneously, at that time receiver antenna signals are summed up. Afterwards, receiver has to separate them in order to detect signals from a particular transmitter. If we consider each transmit antenna dedicated to a particular user, then such systems can be thought of as a multiple access system. Multi-user detection techniques can be employed for such multiple access systems. Considering the case when the modulated symbol time is of the same order as that of channel delay spread, it leads to ISI. ISI is a major limitation of any wireless communication systems, which can cause an irreducible error floor which degrades the system performance significantly.

II. ADAPTIVE MODULATION & ENCODER

A modulation & encoding scheme - A system is adapt according to the SNR[6].Adaptive modulation is increases spectral efficiency (SE), low Bit Error Rate (BER)[6].Adaptive modulation (AM) is based on linear prediction[6]. When spectral efficiency (SE) decreases, prediction error increases[6]. Adaptive coding refers to variants of entropy encoding methods of lossless data compression[5].The process of converting from familiar symbols or numbers to a coded format is called encoding[5].

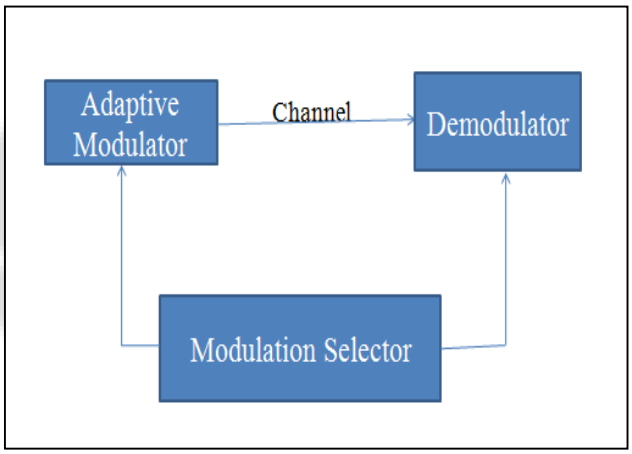

Fig. 1: Adaptive Modulation Scheme

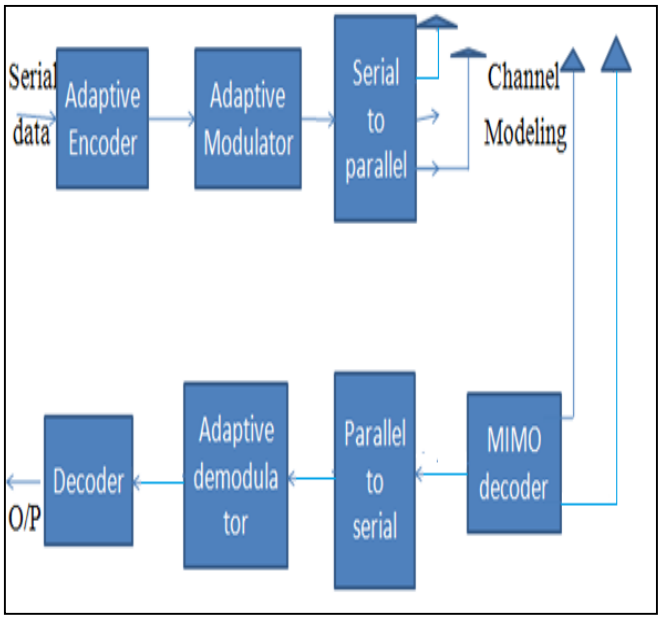

Fig. 2: System Block Diagram

III. SPATIAL MODULATION

Spatial multiplexing (SM) refers to transmitting multiple data streams over a multipath channel by exploiting multipath[7]. In SM, multiple signals are assigned to different spatial channels instead of time or frequency slots, so the signal are transmitted at the same time over the same bandwidth[7]

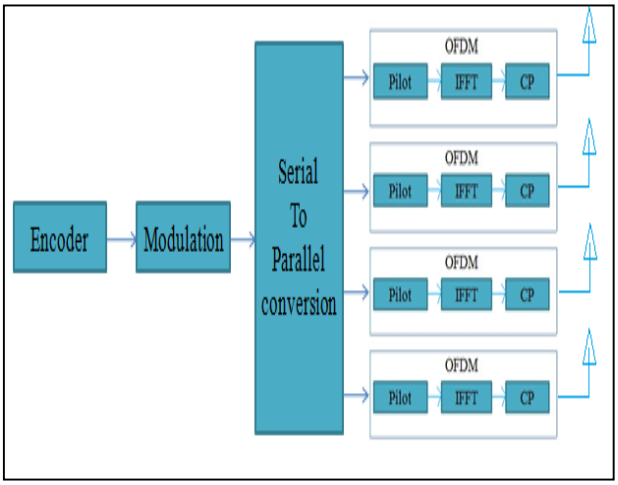

Fig. 3: MIMO System transmitter flow

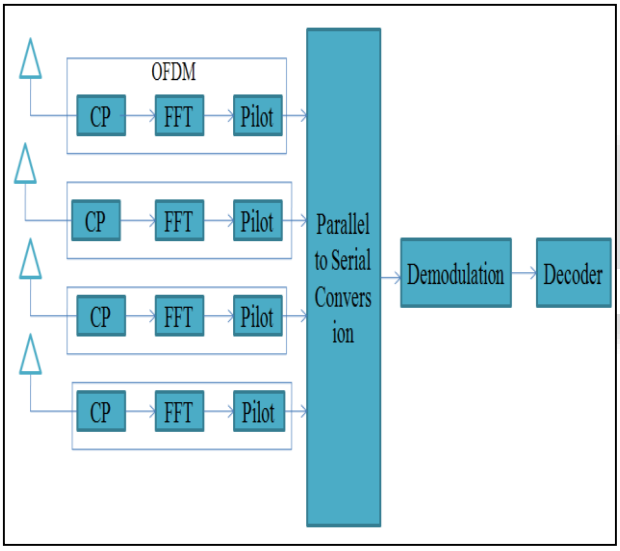

Fig. 4: MIMO system receiver flow

IV. SIMULATION RESULTS

FFT size	128
Guard interval	32
MIMO antennas	2 x 2
MIMO functionality	Spatial multiplexing
Constellation mapping	8QAM,16QAM, 32QAM
Bandwidth	20 MHz→40 MHz

Table 1.simulation parameters

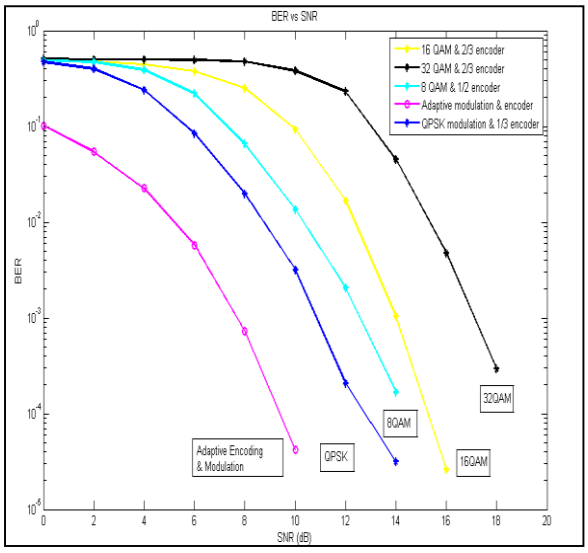

Fig. 5: Adaptive Modulation & Encoder

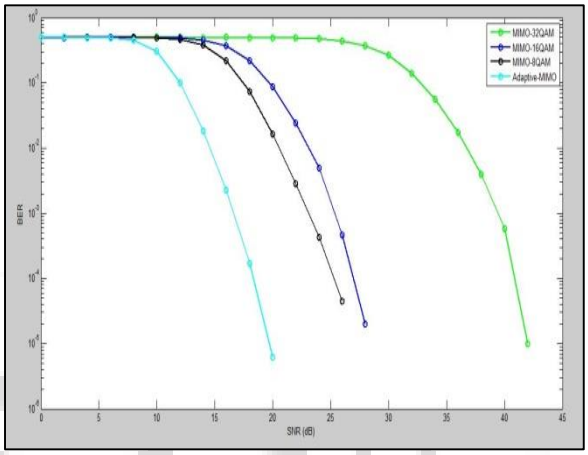

Fig. 6: 2x 2 MIMO System with adaptive MIMO

V. CONCLUSION

The main concern of my topics is BER improvement with the help different modulation & encoding techniques.The BER performance has been analyzed for (BPSK, QPSK, 8QAM, 16 QAM ,32 QAM) modulation and (1/2,1/3,2/3) encoder. Adaptive modulation improved result for BER in comparison to individual modulation & encoding techniques.

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