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PERFORMANCE IMPROVEMENT OF OFDM

[1]Vishakha Kulkarni,[2]Vitthal Bhosale

[1,2]*Electronics And Telecommunication Department, Deogiri Institute Of Engineering And Management Studies*

Abstract - *In the paper the convolution coding and BCH coding is used to analyze the Bit Error Rate performance of OFDM system over the AWGN channel and only the adaptive modulation is considered. First we have used quadrature amplitude modulation (QAM) and phase shift keying (PSK) to study the OFDM system performance of uncoded adaptive modulation, for the further improvement of system the exploit convolution coding to OFDM system. In the OFDM system the estimation of Signal to noise ratio is done at the receiver and then the feedback channel is used to transmit it to the transmitter, and to maintain the constant bit error rate lower than requested BER the transmitter selects appropriate modulation scheme an coding rate based on estimated SNR. By demonstrating the superiority of adaptive modulation schemes compared to fixed transmission schemes the obtained result shows the enhancement in terms of bit error rate (BER) & throughput.*

Keywords- *BCH coding, Convolution coding, Bit Error Rate (BER), AWGN Channel coding, Orthogonal Frequency Division Multiplexing (OFDM), Adaptive Modulation.*

I. INTRODUCTION

The fulmination in wireless technology during the past few years, has opened a new dimension to future wireless communications whose ultimate goal is to provide universal personal and multimedia communication without regard to mobility or location with high data rates. To take the edge of ISI one of the promising candidates is Orthogonal Frequency Division Multiplexing (OFDM). The bandwidth of an OFDM signal is divided into narrowband channels. To eliminate the effect of delay spread each sub channel is typically chosen. To speed the adoption of OFDM equipments vendors are coming together as part of 4G set of standards. A low rate data stream share the transmission bandwidth for the each carrier being modulated from the many carriers in the orthogonal frequency division multiplexing OFDM which is the multicarrier transmission technique. The switching scheme can be decided by the BER which is at the receiver level, which is proposed by Dunlop and Pons. The adaption rate would be confined because BER estimation is complicated over short periods.

The balance between Bit Error Rate (BER) and SNR through the improvement of spectral efficiency is provided by adaptive modulation. In a slowly varying fading channel with noise based on SNR estimation possibly the adaptive modulation is effectively used. The main objective of this project is to measure the channel in OFDM system and as per the suitable channel, modulation and coding rate will be adapted. The computer simulation performed using MATLAB is used to show the performance of OFDM signal transmitted with and without adaptive modulation. The performance of OFDM signal with adaptive modulation and coding rate is extremely good than that of ordinary OFDM signal transmission without adaptive modulation and coding rate and also is used to maintain the bit error rate and spectrum efficiency.

II. OBJECTIVE

The assorted objectives are achieved by using the adaptive modulation and coding techniques. Therefore, essential objectives are mentioned below as follows

- To extract the Bit Error rate in OFDM system.
- To implement good protection against co channel interference and impulsive parasitic noise
- By allowing overlap the efficient use of spectrum can be made.
- The symbol lost due to frequency selectivity of the channel one can recover the lost symbols lost by using adequate channel coding and interleaving.

III. SYSTEM DEVELOPEMENT

In this system, to reduce the complexity, the sub- band adaptive transmission schemes are occupied. At the receiver the simulation of the instantaneous SNR of the subcarrier is measured. For the frequency selective channels the quality of the channel varies across the different subcarrier . The expression for the received signal at any subcarrier is as(1),

$R_N = H_N X_N + W_N$ (1)

Where Xn is the transmitted symbol, Hn is the channel coefficient at any subcarrier and Wn is the Gaussian noise sample. So the instantaneous SNR can be calculated using

$SNHn = Hn^2 / N_o$ (2)

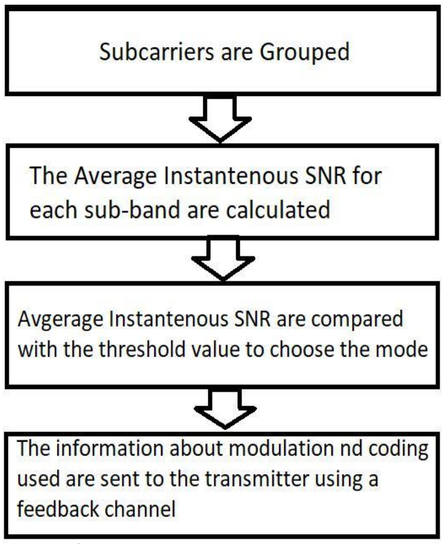

Figure 1 OFDM System

For controlling the adaptation algorithm the lowest quality subcarrier in each sub band for is used for the conservative approach in threshold based adaptation so that in mode selection the lowest value of SNR will be used. By using above method, for the single subband the overall BER is normally lower than that of BER target. For higher throughout of the system amore suitable modulation mode or code rate is selected to improve the performance of the OFDM system closer to that of the target BER, therefore the overall BER can be optimize adaptive coding technique.

IV. OFDM SYSTEM BLOCK DIAGRAM

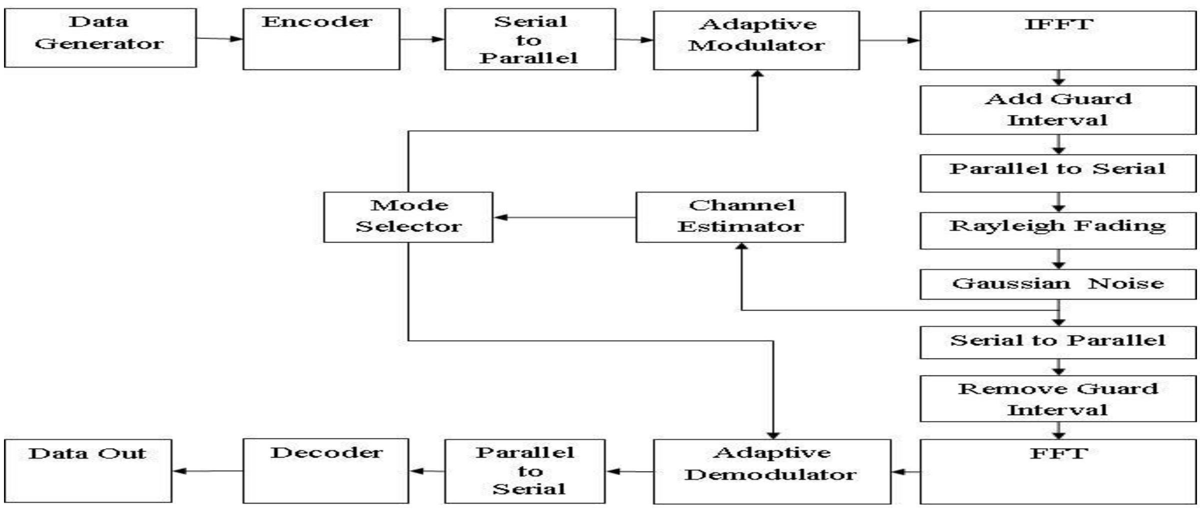

Figure 2 OFDM System

The figure is used to represent the system model for adaptive OFDM system. The data generator is used to generate the data which is represented by codeword which consists of specific number of code elements. The data is converted from serial stream to parallel sets using transmitter. For each subcarrier, the set of data is represented by Si, as [S0 S1 S2 S3]. If the information about the channel is sent over a return channel then the flexibility to rigorous channel conditions gets improved. The adaptive modulation & channel coding may be applied across all subcarriers or individually to each subcarrier based on the feedback information. The frequency domain data set is converted to samples of the corresponding time domain by using an inverse fourier transform (IFFT) which is used to maintain orthogonality between the subcarrier for OFDM. The guard interval is inserted between OFDM symbols as the symbol duration is long, which therefore eliminates intersymbol interference. The OFDM signal is created by sequentially outputting the time domain samples using parallel to serial block. The guard interval is removed at the receiver and frequency domain signals are created using FFT. The reverse of modulator is performed using adaptive modulator. The instantaneous SNR of received signal is estimated using channel estimator, therefore this is used to select best mode for next transmission frame, which is done by mode selector block. At the receiver side the channel estimation and mode selection is done & the feedback channel is used to transmit the information to the transmitter. The frame by frame adaptation is done in this model. The different modulation modes are implemented using various modulators from the adaptive modulator block at the transmitter. The instantaneous SNR is used to decide the switching between the modulators. The three types of modulation schemes BPSK, QPSK & QAM is represented in this model.

V. EXPERIMENTAL ANALYSIS

5.1 Convolutional Coding Result

The fig () shows the result for PSK and QAM signal are adaptive by using adaptive modulation. The Adaptive combination of Adaptive PSK and QAM is shown in fig (). The OFDM system shows simulated BER performance of M-ary PSK, 16-QAM, 64-QAM and adaptive modulation scheme over AWGN channel is shown in fig ().

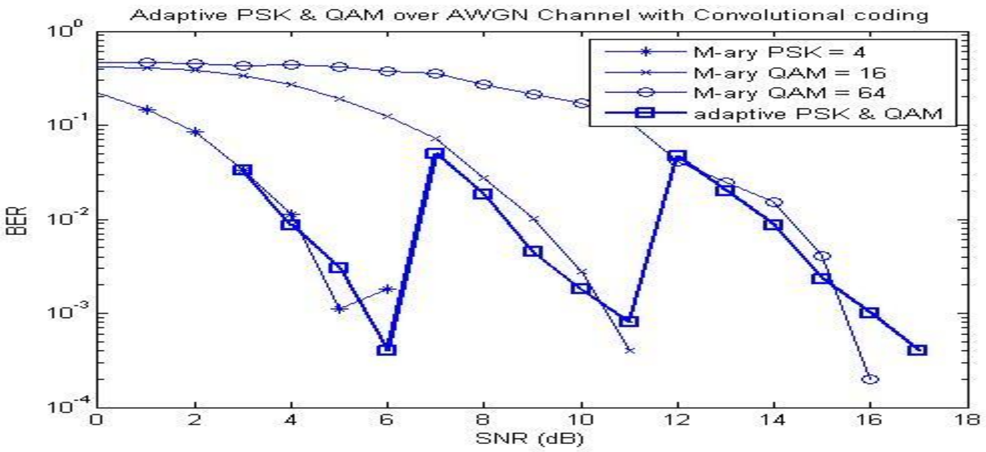

Figure 3 Adaptive PSK & QAM over AWGN Channel with Convolutional coding.

5.2 BCH Coding Result

The result of Adaptive PSK & QAM over AWGN Channel with BCH Coding is shown in figure (). The Adaptive combination of Adaptive PSK and QAM is indicated in figure.

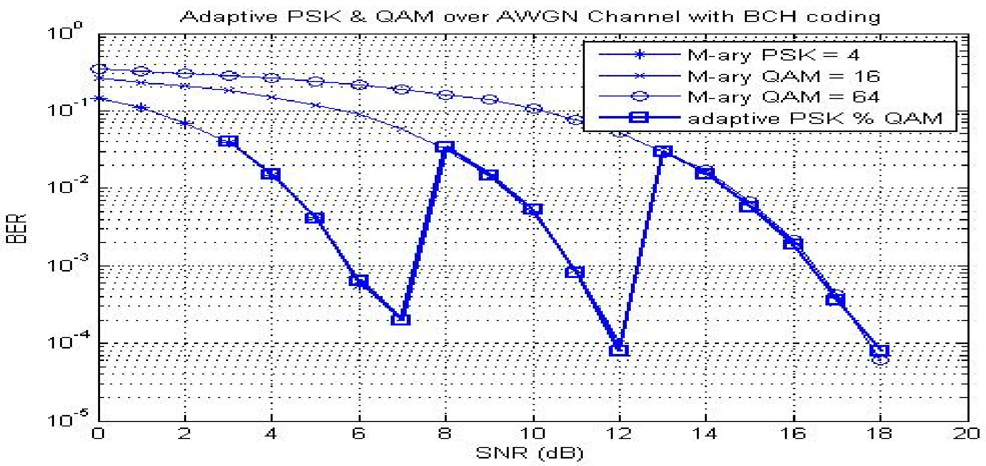

Figure 4 Adaptive PSK & QAM over AWGN Channel with BCH Coding.

VI. CONCLUSION

Spectral Efficiency, Throughput performance of uncoded OFDM & the uncoded adaptive OFDM, Bit Error Rate (BER), Mean Square Error (MSE) with BPSK,QPSK & QAM modulation over AWGN channel. The suitable modulation scheme is employed according to the instantaneous SNR in the uncoded adaptive OFDM. The uncoded OFDM is inferior to that of the BER performance of uncoded adaptive OFDM. For the SNR value from 0dB to 18dB the MSE of the uncoded adaptive OFDM increases from 0.1 to 0.47 and after that it decreases & becomes 0 at & above SNR 21dB as no transmission. The spectral efficiency about 64% is better for the SNR between 0dB to 6dB & spectral efficiency decreases as the SNR is still increasing. The SNR upto 12dB is less for the uncoded AOFDM. The throughput increases as the SNR increases above 12dB & for the SNR value 18dB the throughput becomes maximum as 54.47, similarly the throughput becomes minimum i.e. 0 for the SNR value in between 21dB to 27dB. Thus a good tradeoff between spectral efficiency and overall BER is achieved for the adaptive modulation.

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