Performance Analysis of Bit Error Rate by using Different Fading Path Channels in LDPC based OFDM System

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Abstract— *The OFDM technique can be implemented using Low Density Parity Check (LDPC) Codes because of their ability to reaching near Shannon limit performance. In this work we are presenting the effect of Bit Error Rate (BER) with Signal to Noise Ratio (SNR) in OFDM system which is based on LDPC over Additive White Gaussian Noise (AWGN), Rician and Rayliegh Fading Channel using MATLAB. The results are then compared with Conventional based OFDM system. The OFDM communication is very much inspired from the channel frequencies over the network. In such a network some kind of orthogonal distortion occurs over the channel called Inter Carrier Interference.*

Keywords— OFDM Techniques, Bit Error Rate, Fading Path Channels, QCM Techniques, Raician channels, Raileigh channels.

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is a digital multicarrier modulation technique. It seems to be an attractive choice for fourth generation (4G) wireless communication systems. The multicarrier technique can be implemented in multiple ways, including vector coding and OFDM [1]. OFDM offers high spectral efficiency, immunity to the multipath delay; low inter symbol interference (ISI), immunity to frequency selective fading and high power efficiency. Due to these advantages OFDM is chosen in high data rate communication systems such as Digital Video Broadcasting (DVB) and based mobile worldwide interoperability for microwave access (mobile Wi-MAX). However OFDM system suffers from serious problem of high PAPR. In OFDM system output is superposition of multiple sub-carriers. In this case, some instantaneous power output may increase to a large extent and may become far higher than the mean power of the system. To transmit signals with such high PAPR, it requires power amplifiers with very high power scope. These kinds of amplifiers are very expensive and have low efficiency.

II. OFDM MODULATION SCHEMES

Digital data is transferred in an OFDM link by using a modulation scheme on each sub carrier. A modulation scheme is a mapping of data words to a real (In phase) and imaginary (Quadrature) constellation, also known as an IQ constellation. For example 256-QAM (Quadrature Amplitude Modulation) has 256 IQ points in the constellation, constructed in a square with 16 evenly spaced columns in the real axis and 16 rows in the imaginary axis. The number of bits that can be transferred using a single symbol corresponds to $\log_2(M)$, where M is the number of points in the constellation, thus 256-QAM transfers 8 bits per symbol. Each data word is mapped to one unique IQ location in the constellation. Increasing the number of points in the constellation does not change the bandwidth of the transmission, thus using a modulation scheme with a large number of constellation points, allows for improved spectral efficiency. For example 256-QAM has a spectral efficiency of 8 b/s/Hz, compared with only 1 b/s/Hz for BPSK. However, the greater the number of points in the modulation constellation, the harder they are to resolve at the receiver.

This results in a direct trade off between noise tolerance and the spectral efficiency of the modulation scheme and was summarized by Shannon's Information Theory, which states that the maximum capacity of a channel of bandwidth W, with a signal power of S, perturbed by white noise of average power N, is given by

$$C = W \log_2\left(1 + \frac{S}{N}\right)$$

The spectral efficiency of a channel is a measure of the number of bits transferred per second for each Hz of bandwidth and thus the Spectral Efficiency (SE) is given by

$$S_E = \frac{C}{W} = \log_2\left(1 + \frac{S}{N}\right)$$

Where both the signal and noise are linear scale and the spectral efficiency is measured in b/s/Hz. If the SNR is significantly higher than one then each doubling of the signal power (3 dB increase) the ideal spectral efficiency increases by 1 b/s/Hz [2].

III. FADING PATH CHANNELS

3.1 AWGN Channel

ADDITIVE WHITE GAUSSIAN noise (AWGN) channel is a universal channel model for analyzing modulation schemes. In this model, the channel does nothing but add a white Gaussian noise to the signal passing through it.

3.2 RAYLEIGH Channel

The effects of multipath embrace constructive and destructive interference, and phase shifting of the signal. This causes Rayleigh fading. There is no line of sight (NLOS) path means no direct path between transmitter and receiver in Rayleigh fading channel.

3.3 RICIAN Channel

In environments where there is a dominant Line-of-Sight (LOS) path between the transmitter and the receiver, the complex Gaussian distributed fading coefficient should be modelled with a non-zero mean, giving rise to the Rician fading. Or also say that, Rayleigh fading with strong line of sight (LOS) content is said to have a Rician distribution, or to be Rician fading.

3.4 Bit Error Rate (BER)

In digital transmission, the no. of bit errors is the number of receiving bits of a signal data over a communication channel that has been changed because of noise, noise, distortion, interference or bit synchronization redundancy. The bit error rate or bit error ratio (BER) is defined as the rate at which errors occur in a transmission system during a studied time interval. BER is a unit less quantity, often expressed as a percentage or 10 to the negative power.

BER = number of errors / total number of bits sent

IV. SIMULATIONS AND RESULTS

Using MATLAB Figure 1 shows the BER Vs SNR of the LDPC Based OFDM system in RICIAN channel using QAM modulation scheme. This figure shows the relationship between BER and SNR. The values of SNR are from – 30 db to 0 db and the scale of SNR is linear. The values of BER are from 0.1 to 0.5 and scale of BER is log

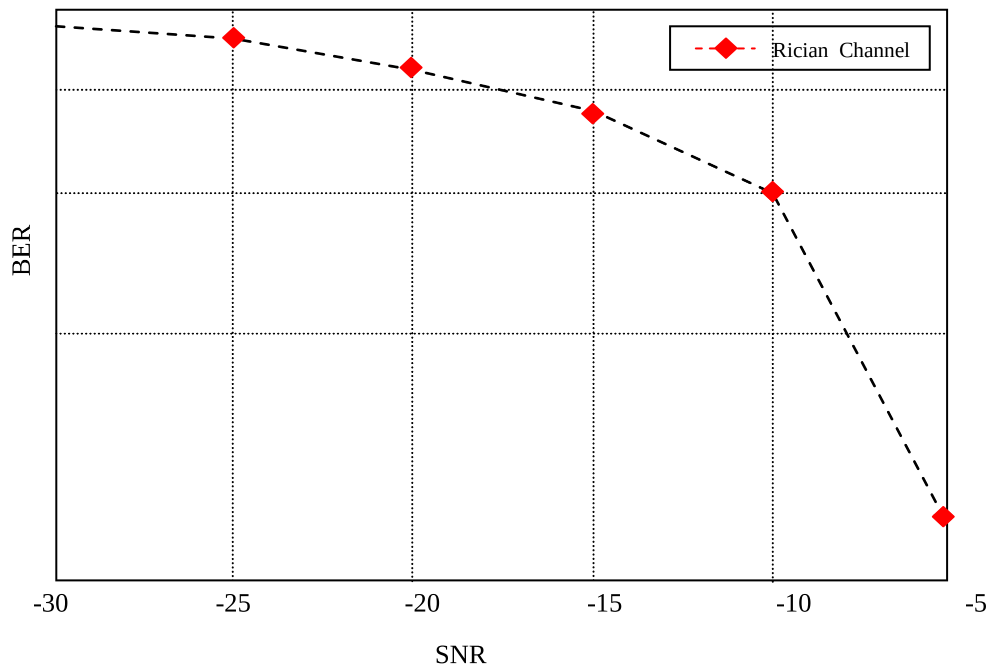

FIGURE 1: BER VS SNR OF THE LDPC BASED OFDM SYSTEM IN RICIAN CHANNEL USING QAM

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