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Performance Analysis of MIMO System on Different Modulation Scheme over Rician Channel

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ABSTRACT

The wireless communications is one of the most active areas of technology development of our time. Recently, orthogonal frequency division multiplexing has been regarded as one of the core technologies for various wireless communication systems. The BER level is depend on the modulation type, SNR value and channel behavior. The Modulation schemes that we have used in this thesis are 4-QAM, 8-QAM, 16-QAM and 64-QAM which further improved using forward error correction codes (FEC). A comparison is made between the diversity gain of MIMO systems in terms of BER for high QAM modulation scheme. This work presents, by a simulation toll MATLAB R2013a used for model implemented using fading channel to the performance analysis of Bit Error rate (BER) V/S Signal to Noise ratio (SNR).

KEYWORDS: *MIMO-System, AWGN, BER, Rician Channel, OFDM*

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I. INTRODUCTION

The wireless communication history, every generation of computers get advanced with new frequency bands, high data rates and non backwards compatible transmission technology. Here as we know 4G is a successor of 3G, i.e. 4G provides internet broadband in computer devices and other mobile devices .Some of the other features you use now are days are parts of it like High definition Mobile TV, Video conferencing, video calling, accessing mobile internet, IP Telephony (Voice Over Internet Protocol [VIOP] it is the group of technologies which is used to deliver the voice communication through the internet protocol). 4G can be categorized in two types –LTE (Long Term Evolution [first used in Norway, Oslo in 2009]), Mobile WiMAX (firstly used in South Korea in 2006). WiMAX was establishes after 2008.

A. Comparison of 4G and 5G

The 5G (generation) of systems are driven by OFDM, MC-CDMA, LAS-CDMA, UWB, Network LMDS and IPV6. Following table compares 4-Generation versus 5-Generation technologies and mentions difference between 4G and 5G wireless technologies. It mentions basic comparison between 4G and 5G. Orthogonal Frequency Division Multiplexing (OFDM) converts a frequency-selective channel into a parallel collection of frequency flat sub-channels.

Table: 1: Difference Between 4G and 5G Wireless Technologies

Specifications	4G	5G
Full form	Fourth Generation	Fifth Generation
Data Bandwidth	2Mbps to 1Gbps	1Gbps and higher as per need
Frequency Band	2 to 8 GHz	3 to 300 GHz
Standards	Al access convergence including OFDMA,MC-CDMA, network-LMPS	CDMA and BDMA
Technologies	unified IP, seamless integration of broadband LAN/WAN/PAN and WLAN	Unified IP, seamless integration of broadband LAN/WAN/PAN/WLAN and advanced technologies based on OFDM modulation used in 5G
Service	Dynamic information access, wearable devices, HD streaming, global roaming	Dynamic information access, werable devices, HD streaming, any demand of users
Multiple Access	CDMA	CDMA,BDMA
Initiation from	year-2010	year-2015

II. Channel

A channel model is then applied to the transmitted signal. The model allows for the signal to noise ratio, multipath, and peak power clipping to be controlled. The signal to noise ratio is set by adding a known amount of white noise to the transmitted signal. Multipath delay spread then added by simulating the delay spread using an FIR filter. The length of the FIR filter represents the maximum delay spread, while the coefficient amplitude represents the reflected signal magnitude. The most important characteristics of wireless channel are:

- Path loss,
- Fading,
- Interference,
- Doppler shift.

A. Ricean fading model

The Ricean fading model is similar to the Rayleigh fading model, except that in Ricean fading, a strong dominant component is present. This dominant component is a stationary (non fading) signal and is commonly known as the LOS (Line of Sight Component).

III. MIMO System

A channel model is needed to properly assess a MIMO channel. In MIMO, the system configuration typically contains M antennas at the transmitter and N antennas at the receiver front end as illustrated in the following figure 1.

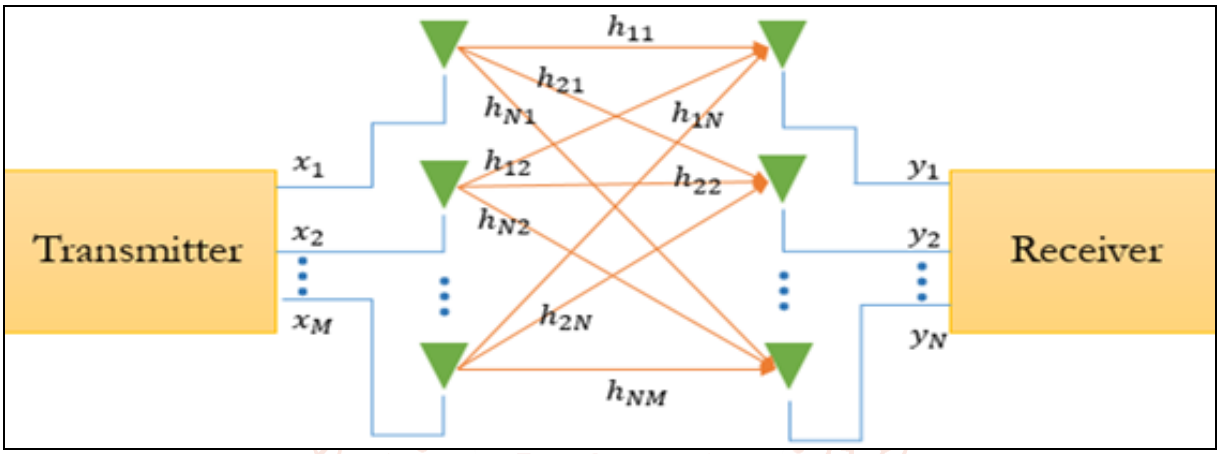

Fig. 1: MIMO System

IV. Simulation Results and discussion

We have developed the simulator in Matlab using modular approach. Each block of the transmitter, receiver and channel is written in separate ´.m´ extinction (Matlab file). The main procedure also contains initialization parameters, input binary data and delivers results in BER/SNR. The parameters that can be set at the time of initialization are the number of simulated OFDM symbols, CP length, modulation and coding rate, range of SNR values and channel model for simulation.

The Rician channel is used to simulate the system to achieve the performance limit. The BER and SNR curve for Rician channel are shown in figure 2 and comparatively perform of Rician cannel with different modulation scheme result shown in figure 3.

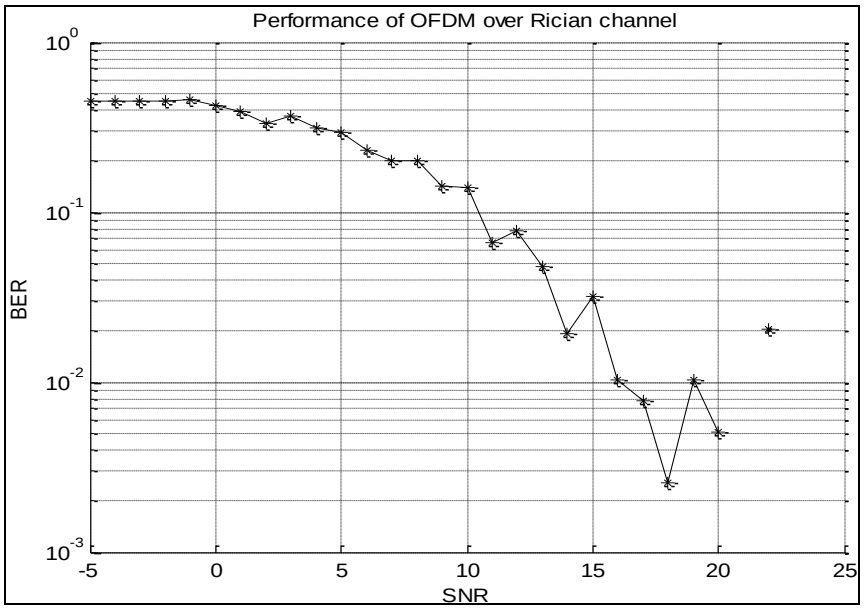

Fig. 2: Performance of OFDM over Rician communication channel

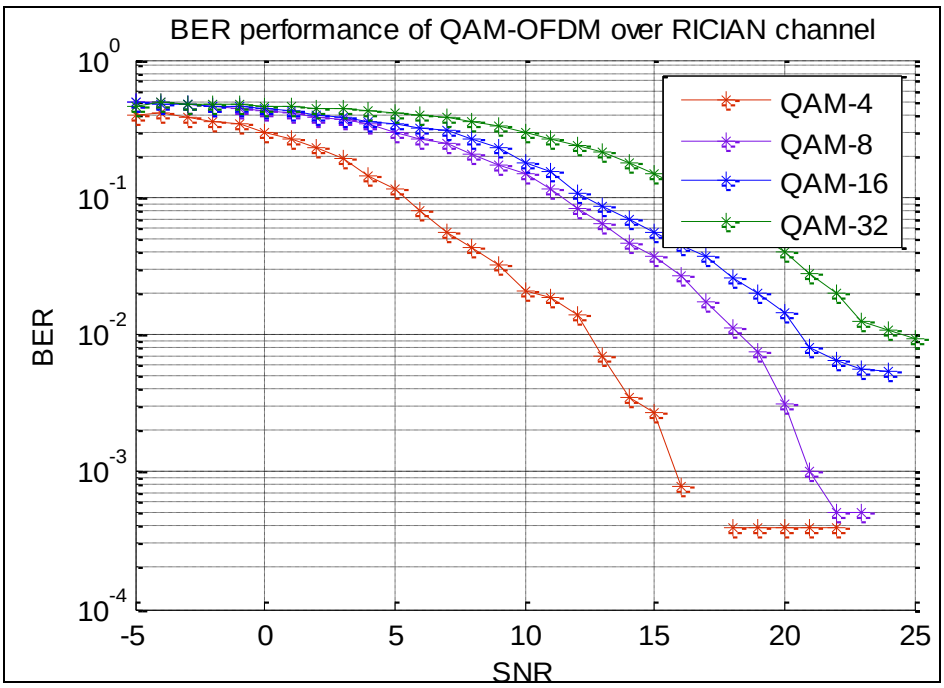

Fig. 3: BER performance of different QAM-OFDM over RICIAN

Conclusion and Result Analysis:

In conclusion, wireless communications globally is something that people can expect as technology advances. Wireless communications has a lot of benefits and can make the world a lot more efficient. In this performance, we have used the Alamouti scheme with communication Rician channel and different modulation techniques. The performance is displayed in figure 3 in terms of the BER verses SNR logarithmic plot. In the figure 3 in this plot we analysis the 32-QAM, SNR is increased 4.1 dB on BER at 10^{-2} as compared to 16-QAM and Modulation Techniques at a constant signal power.

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