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Performance of 2:1 MISO System for M-QAM Underrayleigh and RICIAN Channels

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***Abstract* – Wireless access to data networks is expected to be an area of rapid growth for both fixed and mobile communications. Current and future wireless systems or standards like cellular mobile phones, wireless local area network (WLAN), Bluetooth, 4G all has to support multiple mode of operations like voice, image, text, and video data, that require high data rate with low error rate and wider coverage.**

Diversity combining is such a sophisticated spectral and power efficient fade mitigation technique, which is required to improve radio link performance. In this thesis, the major challenges provided by narrowband and broadband wireless channels and effective ways to mitigate those challenges through the use of techniques that take advantage of the spatial dimension are described. These techniques range from space-time processing, such as diversity combining, to spatial multiplexing and space-time coding, the discussion of which will be the main focus of the present thesis. In this thesis, the BER of 2:1 antenna systems using different modulation techniques in mobile environments such as Quadrature Phase Shift Keying (QPSK), Binary Phase Shift Keying (BPSK), 8-PSK and Quadrature amplitude modulation (M-QAM) are discussed. In addition to the above, it is proposed to compare the performances of various modulation techniques of 2:1 antenna systems under different fading environments such as Rayleigh and Rician fading. It is concluded that the BIT ERROR RATE (BER) and SYMBOL ERROR RATE (SER) is least in case of QAM modulation technique as compared to the other three modulation techniques i.e.: BPSK, QPSK, 8PSK for different fading environments i.e.: RAYLEIGH and RICIAN . In case of all the modulation techniques, for a particular value of error rate, RICIAN fading gives better result as compared to RAYLEIGH fading. So, the performance of RICIAN fading is better than RAYLEIGH fading.

***Keywords* — MIMO, Alamouti Scheme, M-QAM.**

I. INTRODUCTION

In wireless communication, mobile technology is advanced and in this system 4G is the latest at present. 4G mobile, aims to provide an effective solution for the next generation mobile services. Progressing from previous three generations, 4G mobile systems have been significantly improving in terms of interactive multimedia services. Current wireless systems require higher transmission rate with lower delay, higher link reliability and wider coverage. The traditional resources that have been used to add capacity to wireless systems are radio bandwidth and transmitter power.

Wireless systems operate over a complex and harsh time-varying radio channel which introduces severe multipath fading and shadowing, rendering the link budget expensive for a typical symbol error rate (SER)/ bit error rate (BER) requirement.

Diversity combining is such a sophisticated spectral and power efficient fade mitigation technique, which are used to improve radio link performance.

Diversity, where signal replicas are obtained through the use of either temporal, frequency, spatial, or polarization spacing, is an effective technique to mitigate the multipath to fading.

If one of the spatial subchannels experiences a deep fade, it may be possible to recover the information from the signal on the other spatial subchannel. For each additional diversity branch, the chance of the combined signal being severely attenuated decreases.

II. PRINCIPLE OF MIMO SYSTEM

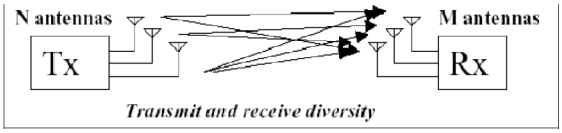

Fig.2.1. Complete DAB transmitter block diagram

i) MISO systems: Analysis of System Model

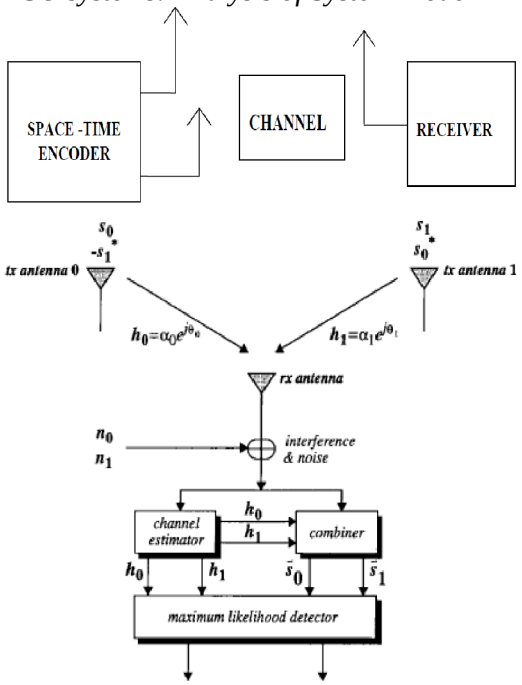

Fig.2.2. The new two-branch transmit diversity scheme with one receiver.

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III. M-QAM (8-QAM)

Quadrature amplitude modulation (QAM) is a modulation scheme in which two sinusoidal carriers, one exactly 90 degrees out of phase with respect to the other, are used to transmit data over a given physical channel. Because the orthogonal carriers occupy the same frequency band and differ by a 90 degree phase shift, each can be modulated independently, transmitted over the same frequency band, and separated by demodulation at the receiver. For a given available bandwidth, QAM enables data transmission at twice the rate of standard pulse amplitude modulation (PAM) without any degradation in the bit error rate (BER). QAM and its derivatives are used in both mobile radio and satellite communication systems**.**

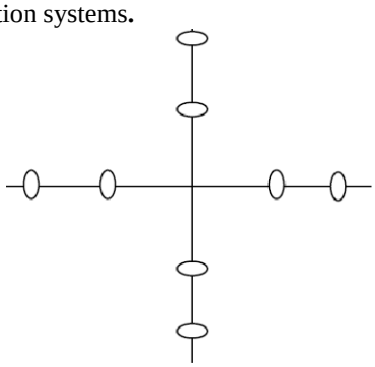

Fig.3.1. 8-QAM Constellation diagram

3.1 Monte Carlo (MC) Simulation Basics for various modulations

Monte Carlo simulation is a common computational tool to imitate the behavior of complex real-life systems. MC simulation was named after the city Monte Carlo, famous with its casinos containing games of chance.

Components of a generic MC Simulation: 33

Probability density function:

The physical/mathematical model under consideration must be described statistically.

A random number generator: Most mathematical software packages/programming languages have uniform random generators.

Sampling rule: Generation of samples with desired pdf.

Scoring (tallying): Counting the number of occurrences of events of interest

Error estimation: Estimation of error as a function of the number of trials in order to set the number of trials respectively.

IV. PERFORMANCE RESULT

4.1 Parameters Used

Modulation Technique: 8-PSK

Fading: RAYLEIGH

Total symbols transmitted = 10000

Transmitted energy from two Transmitter antennas per symbol duration, Es = 1; Number of bits per symbol, bits = 3;

Energy per bit, Eb = Es/bits

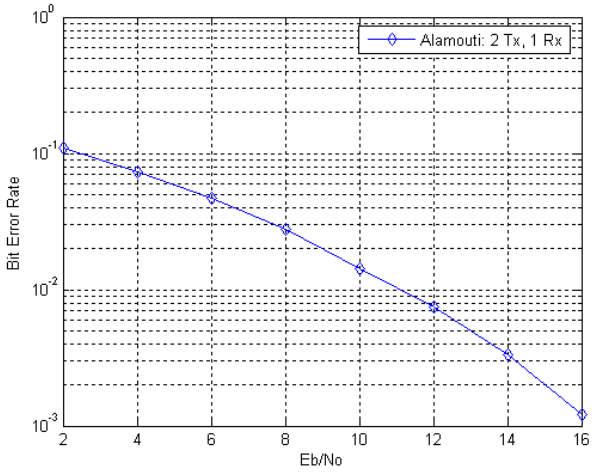

Fig.4.1. BER performance of 8-PSK for RAYLEIGH fading

4.2 Parameters Used

Modulation Technique: 8- QAM

Fading: RICIAN

Total symbols transmitted = 10000

Transmitted energy from two Transmitter antennas per symbol duration, Es = 1; Number of bits per symbol, bits = 3;

Energy per bit, Eb = Es/bits

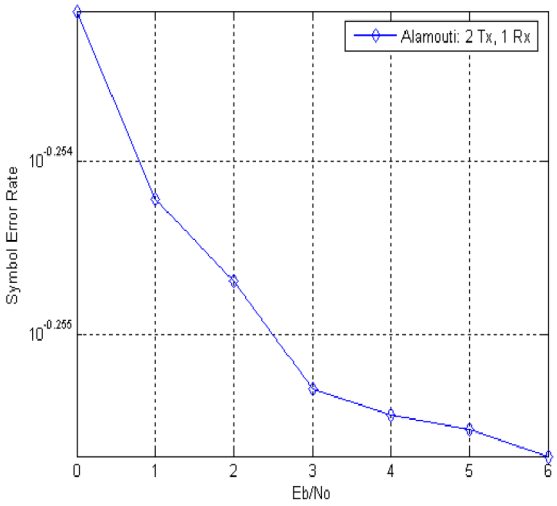

Fig.4.2. BER performance of QPSK for RAYLEIGH fading

Performance of Rate 1 Code under RICIAN Fading Using Different Modulation Techniques

Parameters Used

Total symbols transmitted = 10000

Transmitted energy from two Transmitter antennas per symbol duration, Es = 1; Number of bits per symbol, bits = 1/2/3;

Energy per bit, Eb = Es/bits

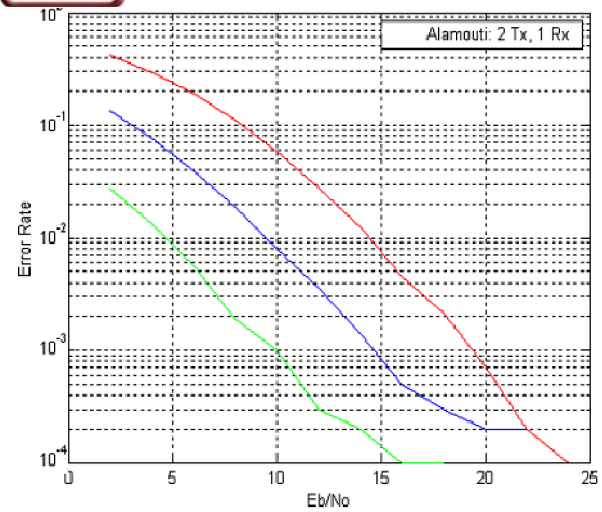

Fig.3.17. BER performance of rate 1 code in RAYLEIGH fading using different modulation techniques.

V. CONCLUSIONS

In this paper a comparative study of different modulation techniques with 2:1 MISO system under different fading environments is done. The study of ALAMOUTI SCHEME is also carried out. In case of RAYLEIGH fading channel the bit error rate (BER) is least i.e.: 0.001 for 8-QAM modulation technique as compared to the other three modulation techniques i.e.: BPSK, QPSK, 8PSK. Hence the performance of the Quadrature Amplitude Modulation is best when RAYLEIGH fading in present in 2:1 MISO system. It is also found that in case of RAYLEIGH fading the symbol error rate (SER) is least i.e.:0.001 for QAM modulation technique as compared to the other three modulation techniques i.e.: BPSK, QPSK, 8PSK,the performance of 8-QAM modulation technique is better in comparison to BPSK, QPSK and 8-PSK in terms of SER also.

In case of RICIAN fading the bit error rate (BER) and symbol error rate(SER) is again least for QAM modulation technique as compared to the other three modulation techniques i.e.: BPSK, QPSK, 8PSK . Hence the performance of the Quadrature Amplitude Modulation is best when RICIAN fading in present in 2:1 MISO systems.

The performance of BPSK and QPSK modulation schemes in RAYLEIGH and RICIAN fading environments.

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