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Simulation Study of Receive Diversity Techniques for MIMO Wireless Communication System Using MATLAB

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Abstract: - In modern day wireless communication MIMO technology is one of the promising technologies to provide high speed data, throughput and are operable at different frequency. Due to its features it is mostly find application in modern day emerging wireless communication such as Long Term Evolution(LTE), World Wide Interoperability of Microwave Access(WiMAX) and Third Generation Packet Project(3GPP).In this paper will simulate the receive diversity techniques using two parameters bit error rates and number of receive antenna.

Keywords: MIMO Technology, Time diversity, Frequency diversity, Space diversity, Polarization diversity, Cooperative diversity.

I. Introduction

Multiple inputs multiple outputs (MIMO) is a form of antenna array find application in high speed wireless communication. In MIMO a set of antenna array are used at transmitter (Source) and receiver (Destination). Main focus of using set of antenna or antenna array are to increase the data speed and reduce the bit error rates [6] [7]. In simple wireless communications, at each end single antenna are used for purpose of reception and transmission. Because in simple wireless communications there is a problems of fading due to multipath effects [1]. Here in this we are focusing about receive diversity techniques [9]. We are using a set of antenna or antenna array for interference cancellations and developed a techniques to measure the capacity of the system called multiple transmit/receive techniques. We are using receive diversity techniques for accurate reception of the signals transmitting by transmit antenna. In the case all array of antenna in receiver side receives the independent copy of the same signals [2].

II. MIMO Technology

Multiple input multiple output antennas is a form of smart antenna technology used in wireless communications. This is an emerging technology to increase the capacity and reliability of wireless communication media [4]. This technology has many forms such as:

A. SISO

In conventional wireless communications SISO (Single Input Single Output) antenna are used. In this types of wireless communications a single antenna are used for transmission and receptions.

B. SIMO

SIMO (Single Input Multiple Output) is forms of antenna technology in which single antenna is transmitting the signals at transmit end and set of antenna is receive the signals at receiving end. It is also called receive diversity.

C. MISO

In MISO (Multiple Input Single Outputs) a set of antenna is used for transmit the signals and single antenna is used for receive. This is called transmit diversity.

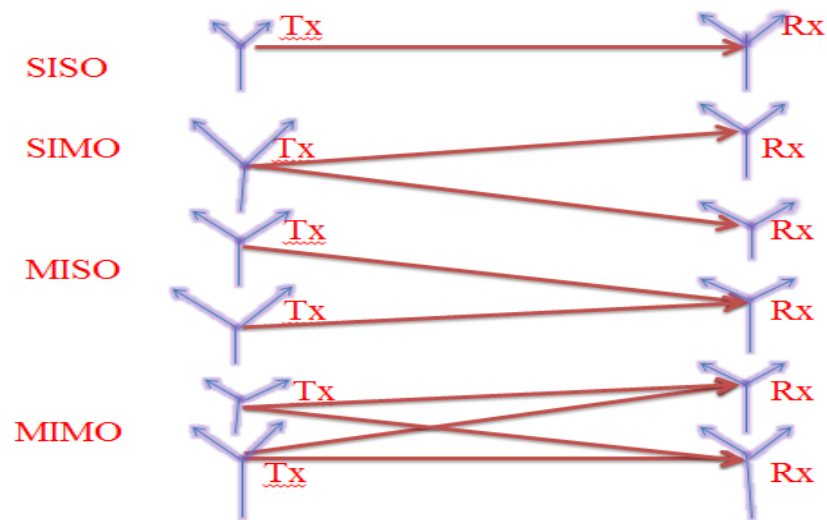


Figure 1: Forms of MIMO Technology

D. MIMO

In case of MIMO (Multiple Input Multiple Output) a set of antenna is used for transmit and receive the signals at each end. This is also called case of Trans/receives diversity.

III. Diversity Techniques

In telecommunication we are adopting a method to improving the reliability of the message signals. It is a technique to reduce the fading and bit error rate [3] [5]. There are various methods of diversity scheme:

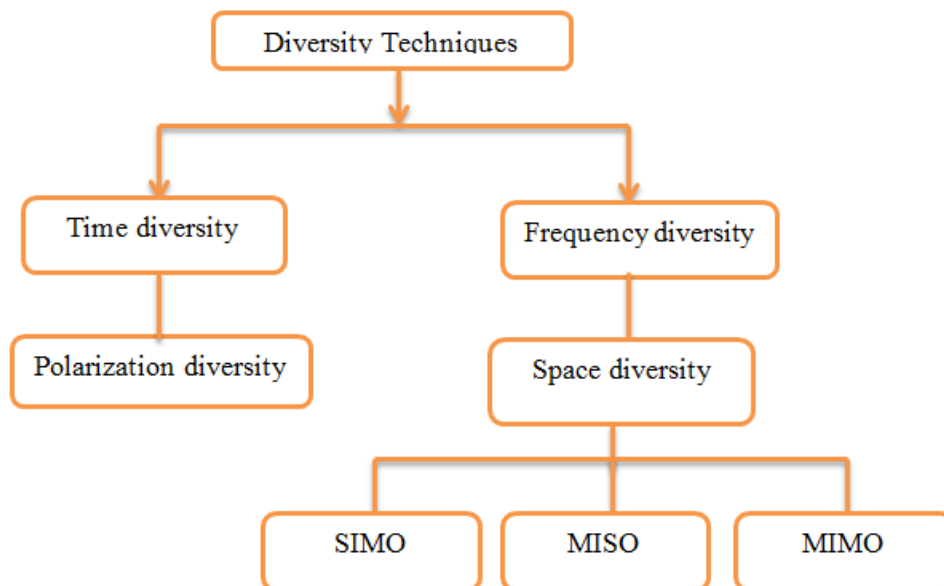


Figure-2 Diversity techniques in MIMO wireless communication

A. Time diversity

Numerous copy of same signal is conveyed at different time's instants. We use a redundant bit and FEC (forward error correction) code while message is spread in time.

B. Frequency diversity

In these schemes signals are using many frequency channels while it is being transmitted. And signals are speeded over wide range of frequency and distracted by frequency selective fading.

C. Space diversity

The signals are propagates through different paths, but in case of wired transmission it can be possible by a multiple wires. In wireless communication we are using antenna which transmit signals in free space so this can be achieved by antenna diversity by using multiple antenna at transmitting and receiving side. Whatever multiple antenna used at transmitter is called transmit diversity and multiple antenna used at receiver is called receive antenna.

D. Polarization diversity

In polarization diversity multiple antennas is used to transmitter and receiver for transmission and reception of signals at different polarization. We use a combining technique in receiver side called diversity combining techniques.

E. Multiuser diversity

Multiuser diversity is obtained by opportunistic user scheduling at either the transmitter or the receiver. Opportunistic user scheduling is as follows: at any given time, the transmitter selects the best user among candidate receivers according to the qualities of each channel between the transmitter and each receiver. A receiver must feedback the channel quality information to the transmitter using limited levels of resolution, in order for the transmitter to implement Multiuser diversity.

F. Cooperative diversity

Achieves antenna diversity gain by using the co-operation of distributed antennas belonging to each node. In this diversity techniques, many nodes which having only one antenna terminals make a coalition to co-operatively works as a large receive or transmit antenna. When antenna co-operate as a transmit antenna, they first exchange message and then co-operatively transmit those message as a multi-antenna broadcast transmitter; similarly for receive antenna.

IV. Simulation and Results

We are using MATLAB to simulate the receive diversity techniques. We are considering that channel is Rayleigh fading and modulation which we have considered is BPSK modulation. We are plotting the graph between number of receive antenna and SNRs. We have observed that whatever increasing the number of receive antenna we see that SNR increases that means for more value of SNR BER will be less.

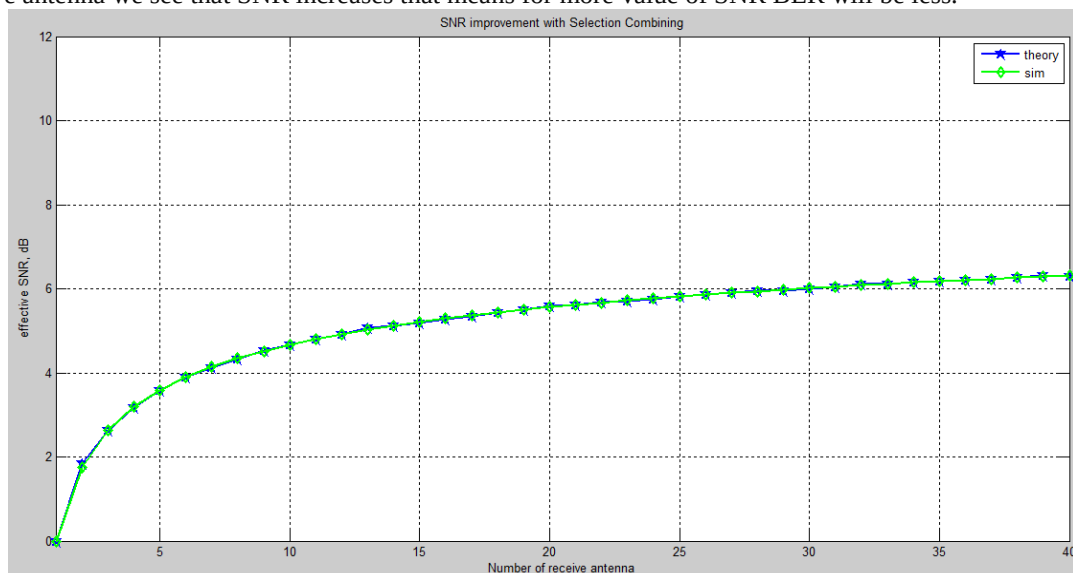


Figure 3: SNR improvement in Rayleigh fading channel in selection diversity

V. Conclusions

This paper presents the modern scenario of diversity techniques used in MIMO wireless communication system. In this this paper we have simulate the receive diversity which is the part of space diversity techniques. We have taken two parameters first one is SNR (signal-to-noise ratio) and second one is number or receive antenna. We have seen that when number of receive antenna is increases SNR increases slightly means bit error rate will low. Our main motto is to reduce bit error rate and increase the signal-to-noise ratios.

VI. References

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