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Adaptive Mimo System with OSTBC using Spatial Diversity and Spatial Multiplexing

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Abstract:-- **The advances in wireless technology leads to the simultaneous growth in the field of communication by increasing the data speed with high accuracy .It is a very complex task to increase the requirements of a data rate. So in order to meet these requirements Multiple-Input-Multiple -Output (MIMO) system has been developed. The adaptive system is having the variable number of transmit and receive antennas. Adaptive MIMO system uses an adaption algorithm. The number of transmit and receive antennas will change depending on this algorithm and it uses an Orthogonal Space Time Block Codes (OSTBC). These codes help in improving accuracy and providing high data rates. This can be done by using the two techniques spatial diversity and spatial multiplexing.**

The frames present in the adaptive system will operate with either one, two or three or four transmit and receive antennas. The OSTBC encoder block will encode the information symbols from the QPSK modulator by using the Almouti code. The QPSK demodulator will demodulate the output of the OSTBC combiner. The frame error rate for three transmit and two receive antennas is 0.1999 at 10db and the frame error rate for four transmit and two receive antennas is 0.5107. From the above results it is observed that the three transmit and two receive antennasisbetter.

Index Terms **— MIMO,OSTBC, Spatial multiplexing, Spatial diversity, FER,SNR.**

I. INTRODUCTION

In the field of Wireless communication the multiple antennas are became more popular .In the earlier days the SISO technology has been used. This technique is having the single input and single output..But the SISO system is not possible for providing the high speed applications that requires the user. so, for avoiding these problems the multiple input and multiple output system (MIMO) has been introduced The MIMO system can be defined as that the system which is having the various number of transmitting antennas and the receiving antennas .The system is also having the multipath propagation .The MIMO system is mainly divided in to two types .one is spatial diversity and another one is spatial multiplexing .The MIMO system can also overcome the fading. MIMO can increase the data linearly by using spatial multiplexing process .This can be achieved by using Nt antennas and Nr receive antennas. This system can also increase the signal to noise ratio also .In future for achieving the high speed data some important techniques has been developed like SIMO and MISO.

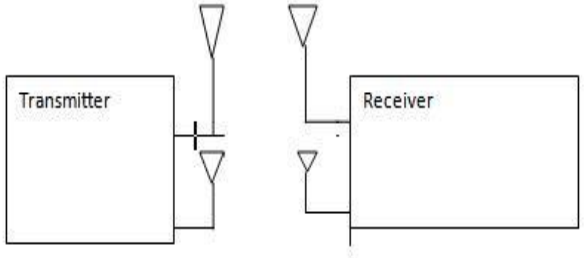

Figure: MIMO(MULTIPLE INPUT MULTIPLE OUTPUT)

II. SINGLE INPUT AND MULTIPLE OUTPUT(SIMO):

SIMO is the another important format in the wireless communication .SIMO is having the single input and multiple output .The SIMO is necessary, if the transmitter is having the single antenna and the receiver is having the multiple antennas. The method is also called as the receive diversity .The receive diversity is mainly applicable for enabling the receiver system .For avoiding the fading problem it receives the signals from the different number of sources which are not depending on the another source ,to

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avoid the fading problems ,like ionospheric fading and interference .The main advantage of SIMO is that it will be very useful for the different number of applications .The SIMO is also having one disadvantage also, that is it uses the processing in the receiver side .The receivers will be placed in the mobile device. The SISO having the limited processing levels.

III. MULTIPLE INPUT AND SINGLE OUTPUT:

MISO is an another important process in the MIMO technology .This system is having the single input and multiple output .MISO can be used where the system requires multiple antennas at the transmitter side and single antennas at the receiver side .MISO can also be considered as transmit diversity .MISO system uses the processing for getting the coding redundancy. It shows the positive impact on the size ,cost and battery life.

A SPATIAL DIVERSITY

Spatial diversity is the one of the important technique in the wireless communication .In this method different number of antennas are used. These are used for increasing the reliability and also increases the quality of a wireless link. In this all the information will be transmitted through each antenna .This process also used in the space time block codes. Especially, this process is very useful in the densely populated areas. This is why because there is no clear line of sight (LOS) in between the transmitter and the receiver. .due to this reason multipath fading will appears on the transmission path .so ,in order to avoid this problem spatial diversity system has been developed . In some areas the signal will be loss and it takes much time for recovering the signal ,so ,here this process is more helpful .It increases the system performance also. This is why because, the spatial diversity is having several transmit and receive antennas .that is, if one antenna experience a fade ,another one will have a clear signal. In this method signals will be transmitted and this will be received by the number of channels. Due to this reason they will face independent fading.

B. SPATIAL MULTIPLEXING:

1. The multiple antenna systems which handling the streams of data in parallel is called as the spatial multiplexing .This method is mainly used for increasing the transmission rate of the data. It is an important technique in the wireless communication. This method requiring the antenna technology. The main function of this method is that ,in this ,bit streams will be divided in to several data segments .and these are transmitted through different antennas .so ,the bit rate will increases without using of an additional bandwidth. In this method the signal which is having high rate will be split into small streams .These streams are very useful for same transmitting process to different receivers. In this method gain will be decreased by the spatial correlation.

For suppose if the transmitter contains nt antennas and in the same way receiver having nr antennas .Then the maximum rate will be calculated as:

ns=min(n t ,nr)

advantages:

The main advantage in the spatial multiplexing is that:

It is very simple to design

It does not require more bandwidth

C. ORTHOGONAL SPACE TIME BLOCK CODES

Space time block coding is an important method in the wireless communication. Today the space time block codes are extended ,so this can be called as orthogonal space time block codes These codes are able to transfer different streams of data .The codes will increase the transmission rate of the data.th is e block codes are having the full diversity. The codes can also provide the maximum likelihood decoding process .The orthogonal space time codes can be considered as an attractive technique to the wireless communication .It does not require a gain coding. At the receiver side the OSTBC combiner has been placed .This combiner and it produces the soft information symbols .These symbols are useful for demodulating or decoding.

IV. SIMULATION AND PERFORMANCE

ANALYSIS:

The simulation results include the performance of the adaptive MIMO by using spatial diversity and spatial multiplexing techniques which has been evaluated for two ,three or four transmitting antennas and one ,two receiving antennas There ,the signal to noise ratio can be varied from 0to 10db.the frame error rate will be calculated depending on signal to noise ratio .In this way the frame error rate for MIMO system is calculated by varying the signal to noise ratio in (db).

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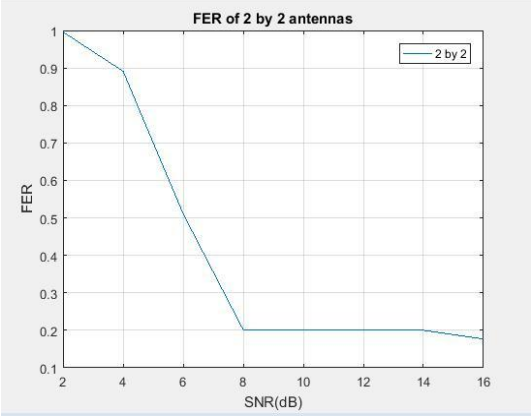
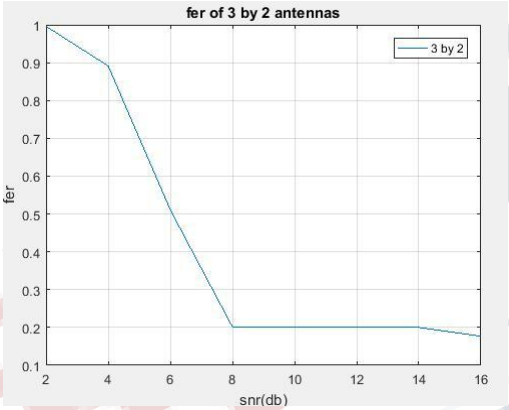


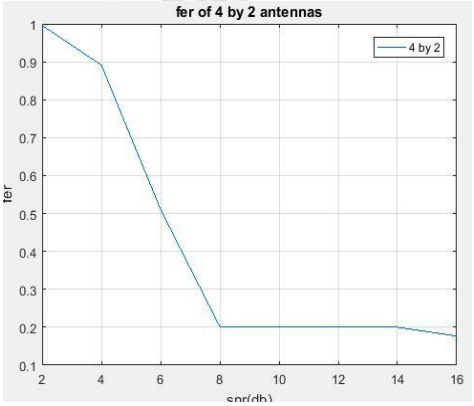
Fig(1):Two transmit Two receive antennas

The above three figures Fig(1),Fig(2),Fig(3)represents the frame error rate calculation for multiple antennas by varying the signal to noise ratio from 0 to 16 db.



Fig(2): Three transmit two receive antenna

The above figure represents the frame error calculation for three transmit and two receive antennas.



Fig(3): Four transmit Two receive antennas

V. CONCLUSION:

The Frame error rate for the two trransmit two receive and three transmitt two receive and four transmit two receive antennas are calculated.From the above results it is observed that the two transmit and two receive and three transmit and two receive antennas are having the minimum frame error rate of 0.1999 at 10db and the four transmit and two receive antennas are also having the same minimum frame error rate of 0.1999 at 10db.So,finally on comparingall these multiple antennas,it is concluded that the three transmit and two receive antennas will gives the better performance with minimum frame error rate of 0.1999 at 10db.

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