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Modelling of MIMO using MATLAB

K.N.S Ganesh
ECE Department
Sreenidhi institute of science and technology
knagasivaganesh@sreenidhi.edu.in

P.Sravani
ECE Department
Sreenidhi institute of science and technology
pagadalasravani1999@gmail.com

D.Manisha
ECE Department
Sreenidhi institute of science and technology
dumbalamanisha@gmail.com

A.Nikhitha
ECE Department
Sreenidhi institute of science and technology
nikhitha.alladi123@gmail.com

Abstract*—Multiple input and multiple output system in wireless network using STBC are presented.** ***MIMO plays important role in achieving high data rates for technologies like Wifi,WiMAX,and 4G LTE.Bit error rate is one of important parameter to overcome fading effect in multipath channels for data communication. This paper describes the efficiency of 2X2 MIMO frame work in Diversity. Diversity was achieved through the use of the transmitter's space-time block coding technique (STBC), a recent breakthrough motivated by the need for higher wireless channel throughput. Matlab is used to simulate 2X2 MIMO and STBC systems to encode the modulated QPSK signal before being transmitted via a flat-fading Rayleigh channel.

Keywords—*MIMO,WiMAX,LTE,STBC,QPSK,Rayleigh channel, fading.*

I. INTRODUCTION

System with more than one input and more than one output then system known as Multi-Input-Multi- Output system. By using two transmitting antennas and two receiving antennas, we add a degree of freedom. MIMO technology uses multiple antennas using the reflected signals to provide channel robustness and gain throughput. It is essentially a form of radio antenna technology because it uses several TX and RX antennas to allow the data to be carried across the variety of signal paths. Spatial diversity and spatial multiplexing characterize the MIMO system.

MIMO technology focuses on its ability, by using multiple antennas, to increase channel speed, thus enhancing the increase in spatial diversity [1]. Consequently, the number of users on wireless systems equipped with MIMO technology is rising significantly. In this work 2x2 MIMO Systems performance was analyzed with transmission and diversity.

II. FORMATS OF MIMO

There are two main formats for MIMO:

1. Spatial diversity: This spatial diversity is often used for the transmission and reception of diversity in the narrow sense [2]. Two such methodologies are used to improve the signal-to - noise ratio and are characterized by increasing device efficiency with respect to various fading methods.

Spatial multiplexing: By using different routes to carry additional traffic, that is by increasing data throughput capacity, this MIMO approach offers extra data capacity. The spatial multiplexing principle differs from the coding process for a space-time block.

In order to increase the linear bandwidth of the aerials this multiplexing technique uses many antennas on both the TX and RX. This method breaks down a high-speed bit stream into four different 1/3 bit lines, which are then passed on by several antennas. The channel uses the same frequency spectrum, which blends the two signals.

III. REVIEW OF LITERATURE

All types of wireless systems face the difficulty of multipath, signal fading, increasing interference and limited spectrum [5]. To reduce all these difficulties we can use variety of diversity techniques, in which the fading levels can be reduced.

Most used diversity techniques which have been applied in practice include time diversity like channel coding, spatial diversity like MIMO system, and combination of multi-path and frequency diversity like Orthogonal Frequency Division Multiplexing (OFDM) systems.

By using Multiple Output Multiple Input (MIMO) systems its Diversity gain reduces the fading and increases coverage, improves quality of system.

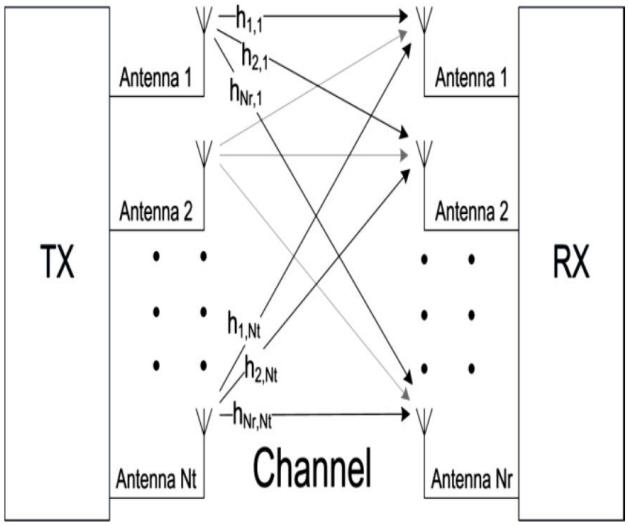
IV. METHODOLOGY

Basically the methodology of MIMO is that it uses several antennas on the both TX and RX to allow a range of signal routes such that they carry data by choosing the paths for each antenna to create certain signal path. MIMO is very useful for radio antenna technologies.

The output of receiver can be expressed by following mathematical equation:

$$Y=HX+C$$

When Y is the output of receiver and H is the channel coefficient, X is the input and C is the noise.



One of the main ideas for underpinning the processing of space-time signals for wireless systems using MIMO is in which the spatial aspect inherent in the use of several antennas located on various sites is complemented by time. Therefore, wireless systems with MIMO can be seen as a logical expand of intelligent antennas that are used for several years for developing wireless networks.

It can be detected by the TX and the RX, i.e. the signal follows the other directions. Additionally which moves the antennas by small distance, the paths used will change. There are different types of paths available which is due to the number of objects appearing on the side of the TX and RX.

Previously, this paths which were only used to cause an interference [4]. These additional paths can be used to gain the benefit by using MIMO. It provides the additional robustness to the radio link by improving the SNR ratio or by increasing the data link capacity.

When C is the “channel capacity in bits per second”, BW is the “bandwidth in Hertz”, and SNR is “Signal to Noise Ratio”.

$$C = BW \log2 (1 + SNR)$$

MIMO is a combination of multiple antennas and signal paths to gain the knowledge of the communication channel. MIMO systems can achieve higher data rates than conventional single-input, single-output (SISO) network systems, using this spatial diversity aspect of a transmission flux..

V. SPACE TIME BLOCK CODE

Before comprehension of the STBC (Space Time Block Coding), let us understand what is alamouti coding. This coding technique was one of the first to have been adopted [3]. One of the key benefits of this coding technique is that it needs only channel state information (CSI) at the end of Rx while other coding techniques include CSI at both Rx and TX. But it had some drawbacks, as it operated only in situations where only two TX antennas were involved.

There was, therefore, the implementation of Space Time Block coding. Find a space-time encoded communication system. In the block diagram below, the 'k' information bits are subject to error coding and redundancy, resulting in n symbols (n>k). These modulated code words are mapped to different antennas using the space time encoder. Here, Nt corresponds to the space dimension, and p corresponds to the time dimension symbol span.

VI. APPLICATIONS

- Communication network applications like broadcast Networks, cellular network, satellite communication.
- It is used in RFID.
- It is used in digital home.

VII. ADVANTAGES

- Take advantage of multipath propagation.
- Increased Capacity.
- Increased Quality.
- Spectral Efficiency.
- Fast data acquisition.

VIII. DISADVANTAGES

- Further barriers to the design of topology arrays.
- More complex Focusing retrieval system.
- The analysis of the channels is complex.

IX. CONCLUSION

Nowadays, the demand for 5G technology has created a totally new variety of telecommunications, of which MIMO technology will certainly be a core component. MIMO technology includes antennas, which facilitates better signal transmission, achieves better coverage, and increases network capacity, as well as being ideal for bandwidth reallocation [6]. MIMO networks are in general multi-factorial systems; indeed, almost every modern technological solution related to 5G technology is a multi-factorial proposal.

Future research activity on MIMO networks should focus on novel ways of using new technologies and infrastructures. New ideas for optimizing factors like power consumption, costs for back-hauling, and bandwidth, among others, should be investigated and weighed before their use. Moreover, other types of variable costs (e.g. daily operation and maintenance costs) also play a critical role in the cost formation. New cost models should be developed for all the key 5Genabled technologies, combining costs with the corresponding technology requirements. Furthermore, the research could focus on optimizing the number of MIMO

transceivers and receivers on each side and weight and improve various contradictory parameters.

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