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# Comparison of MIMO Modulation Technique under Alamouti Technique

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***Abstract- In wireless radio communication fading of channels is the serious cause of the received degraded signals. The effect of fading can be minimized by using different time and space domain techniques. However, space domain method is preferred over the others due to its advantages. In this paper, diversity technique, MIMO system under Alamouti's are studied. Basic idea in these sections is to transmit and receive more than one copy of the original signals. Using two transmitter antennas and one receiver antenna, the section provides the nearly same diversity order as the maximal -ratio receiver combining (MRRC) with one transmitter antenna, and two receiver antennas [4].***

***Keywords- MIMO System Model, Diversity Technique, Maximal Ratio Combining, Alamouti's Scheme and STBC.***

## I. INTRODUCTION

All radio communications systems, regardless of whether mobile radio networks such as 3GPP UMTS or wireless radio networks like WLAN, must continually provide higher data rates. In addition to conventional methods, like introducing higher modulation types or providing larger bandwidths, this is also being achieved by using multiple antenna systems. This application note gives an introduction to basic MIMO concepts and terminology and explains how MIMO is implemented in the different radio communications standards. The MIMO terminology refers to the channel, thus the transmitter is the channel input and the receiver the channel output [6].

The idea of using multiple transmits and receives antennas in wireless communication systems are one of the most important breakthroughs in communication theory during the last decade. Popularly referred to as MIMO technology, this concept can greatly improve data throughput and link performance in operate in, or anywhere between, one of the two possible modes. If the transmitter knows the channel, then one can use spatial beam forming techniques to steer RF energy in the direction of the receiver.

On the other hand, if the transmitter does not know the channel, one can use space-time coding which effectively distributes the transmitted power uniformly in all directions, and in addition augments the data with structure that can be used to combat from fading dips.

## II. MIMO SYSTEM MODEL

It is referred to as MIMO technology, this concept improve data throughput and link performance in wireless networks.When a transmitter and a receiver, with an appropriate channel coding/decoding scheme, are equipped with multiple antennas, the presence of multipath fading can improve by achievable transmission rates[4]. On the other hand, if the transmitter does not know the channel, one can use space-time coding which effectively distributes the transmitted power uniformly in all directions, and in addition augments the data with structure that can be used to combat from fading dips. Sometimes, space-time coding methods are grouped into two categories: those that focus on throughput improvement.

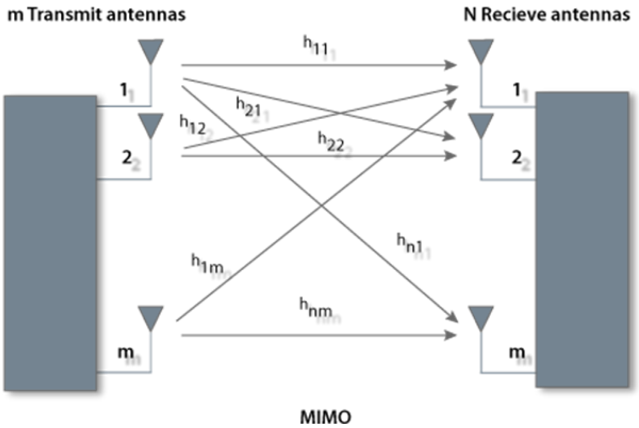


Fig 1: MIMO System Model

 

## III. DIVERSITY TECHNIQUE

**1. Frequency diversity**

This provides the multipath structure in different frequency bands is different. This fact can be used to mitigate the effect of fading. But, the positive effects of frequency diversity are limited due to bandwidth limitation [2].

**2. Time diversity**

In this, fading over different time intervals is different. By using channel coding the effect of bad fading intervals can be replaced by good fading intervals. However, due to delay constraints time diversity is difficult to exploit [2].

**3. Polarization diversity**

It makes the use of transmitted signals having uncorrelated fading statistics in VHF.The polarization diversity may obtain in dense scattering environments when there is line of sight (LOS) and non-line of sight (non-LOS) condition [2].

**4. Angle diversity**

Equal data traffic is used on the both uplink (reverse link) and downlink (forward link) in digital cellular communication but the system requires better reverse link performance because of the limitation of mobile terminal transmit power. There is uplink capacity deployed in CDMA system [2].

**5. Antenna diversity**

Antenna diversity, also known as space diversity or spatial diversity is any one of several wireless diversity schemes that uses two or more antennas to improve the quality and reliability of a wireless link [2].

## IV. RECEIVE DIVERSITY SCHEMES

Receiver diversity is a form of space diversity

1. Selection combining
2. equal gain combining and
3. Maximum ratio combining [1].

### *A. Maximum Ratio Combining*

It used the antenna array at the receiver to improve the demodulation performance, albeit with different levels of complexity.

In MaximumRatio combining each signal branch is multiplied by aweight factor i.e.proportional to the signal amplitude.Branches with strong signal are further amplified, while weak signals are attenuated.Maximal-ratio combining is the optimum combinerfor independent AWGN channels. Maximum ratio combining is a linear combining method, where various signal inputs are individually weighted and addedtogether to get an output signal [4].

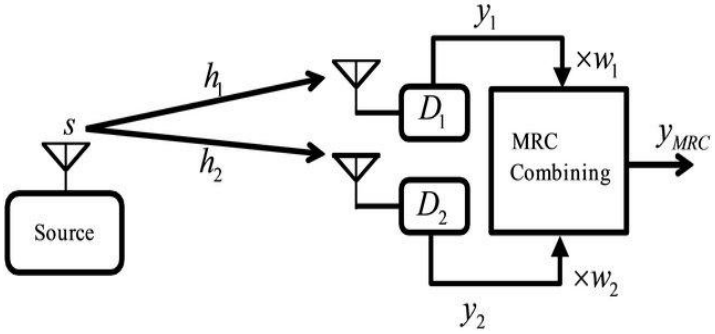


Fig 2: Maximum Ratio Combining

## V. TRANSMIT DIVERSITY SCHEME

The information is spread across multiple antennas at the transmitter. Let as discuss a popular transmit diversity scheme called Alamouti Space Time Block coding (STBC). We will assume that the channel is a flat fading Rayleigh multipath channel and the modulation is BPSK [1].

**ALAMOUTI STBC**

A simple Space Time Code, A Simple Transmit Diversity Technique for Wireless Communication, offers a simple method for achieving spatial diversity with two transmits antennas. The scheme is as follows: [1]

1. Consider that we have a transmission sequence, example $\{x_1, x_2, x_3, \cdots, x_n\}$.
2. In normal transmission, we will be sending $x_1$ in the first time slot, $x_2$ in the second time slot, $x_3$ and so on [1].
3. Alamouti suggested that we group the symbols into groups of two. In the first time slot, send $x_1$ and $x_2$ from the first and second antenna. In second time slot, send $-x_2^*$ and $x_1^*$ from first and second antenna. Inthird time slot send $x_3$ and $x_4$ from the first and second antenna. In fourth timeslot, send $-x_4^*$ and $x_3^*$ from the first and second antenna and so on [1].
4. Notice that though we are grouping two symbols, we still need two time slots to send two symbols. Hence, there is no change in the data rate [1].

 

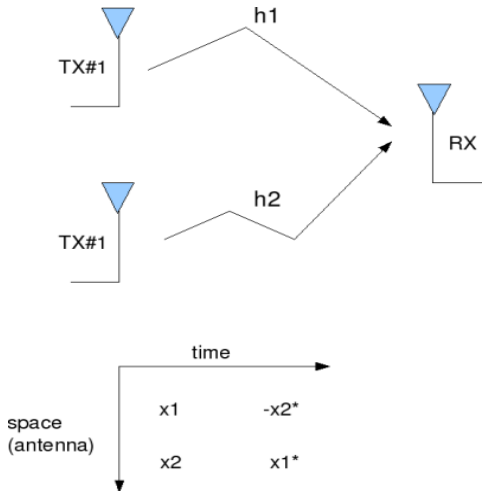


Fig 3: Transmit, 1-Receive Alamouti STBC coding

## VI. FUTURE SCOPE

Even in the next-generation of networks, known as 4G, which will be based on orthogonal frequency division multiple access (OFDMA) technology; MIMO's entrance could be delayed. MIMO will be written into the LTE and ultra-mobile broadband standards [5].

MIMO would have to be written into existing 3G standards in order to be integrated into chipsets and mobile devices. The WIMAX standard, however, could bring MIMO to the forefront quicker, as MIMO should improve capacity of OFDMA networks by a factor of three on the low side, five on the high side [5].

MIMO already is part of the latest version of Wi-Fi, known as 802.11n, which is designed to extend the speed and range of Wi-Fi to allow Ethernet-like wireless services that span several office floors, with less infrastructure and maintenance costs [5].

## VII. CONCLUSION

In this paper, a comparison of diversity technique for Estimating the channel performance of mobile Communication signals affected by Rayleigh multipath Fading phenomena is discussed. The performance of Alamouti STBC and Maximum ratio combining techniques are evaluated under the assumption of BPSK Signals.

Earliertechnology was basic formats like MISO, SISO, SIMOthen MIMO comes, but after this fading was reduced and many industrial fields were using MIMO concept. In this post we have discussed about MIMO system models that how data are transmitted from one end and received by another end.

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