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Alamouti Space-Time Coding for Channel Estimation in MIMO Systems

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Abstract— This article analyses various researches on MIMO STBC system to achieve better system performance. It is well known that wireless communication systems' performance can be improved by acquiring multiple transmit and receive antennas, commonly referred to as MIMO technology, and they have been combined. Space-time coding is a promising method for realising benefits in wireless communication systems using MIMO. Analyse more than two transmit antennas to increase the coding rate and the coding of orthogonal space-time blocks. Many researchers have studied many benefits and enough performance to achieve diversity. The development of transmission diversity technology has begun to expand the future of this fast fashion research field. Due to the potential increase in data diversity and the performance of wireless links provided by transmitting diversity and MIMO technology, this is expected to become the cornerstone of various wireless communication systems with multiple input multiple output technologies.

Keywords:- OFDM, MIMO, BIT ERROR RATE, Alamouti STBC, SNR etc.

1. INTRODUCTION

In the past ten years, the demand for wireless local area networks and cellular mobile systems has grown explosively. In particular, the demand for wireless Internet access and multimedia applications requires an order of magnitude increase in information throughput compared to the data rates provided by today's technology. A major technological breakthrough that makes it possible to increase the data rate is using multiple antennas on the transmitter and receiver in the system. Most wireless communication work has focused on having an antenna array at only one end of the wireless link usually at the receiver.

The seminal papers of Foschini and Gans [1], Foschini [2] and Telstar [3] showed that when antenna arrays are used at both ends of the link, there is sufficient capacity to expand the possibility of wireless communication. Highly dispersed environments can be Bring advantages. Many established communication systems are diversified at the base station. For example, the Global System for Mobile Communications (GSM) [4] base station usually receives two antennas. The technology obtained is used to improve the uplink quality from the mobile device to the base station without increasing any cost, size or power consumption of the mobile device [5]. Reference [6] usually discusses the use of diversity in cellular systems and its impact on system capacity. The diversity obtained has been studied extensively and has been used in Foschini's 1998 paper. This article introduces the modulator, channel and the three modules on the right side of the demodulator. The main problem that arises here is how to design the various parts of the modulator and demodulator to achieve efficient and reliable transmission through the mobile wireless channel. The wireless channel has several properties that make the design particularly challenging: it exhibits different echoes and phase shifts and amplitude (attenuation) change times. This article mainly studies the following parts of the modulator-demodulator series.

Space-time Codes

Space-time code is a commonly used method in wireless communication systems to improve data transmission reliability using multiple antennas [16, 17, 18]. STC relies on sending redundant copies of multiple data streams to the receiver, hoping that some of them will keep the physical path between sending and receiving in good condition to achieve reliable decoding. Space-time codes can be divided into three types. First, the space-time trellis code (STTC) [16] distributes multiple antennas and a trellis code on multiple time slots. STTC is always used to provide coding gain and variable gain. The space-time trellis code proposed by Tarokh [19] is a scheme in which the symbols are encoded according to the antenna. The symbols are transmitted and decoded simultaneously using maximum likelihood detection through the antenna. Trellis coding is a very effective scheme that can provide considerable performance advantages because it combines forward error correction coding and variable transmission. However, this solution requires a good trade-off between constellation diagram size, data rate, diversity gain and grid complexity. The second type of STC is space-time turbo code, a combination of space-time coding and turbo coding [20]. They were originally introduced as double-error error codes composed of the parallel combination of two recursive system convolutional codes. These convolutional codes use suboptimal but very powerful iterative decoding algorithms (called turbo decoding algorithms). Today, Turbo theory has been successfully applied to many detections and decoding problems, such as serial concatenation, equalisation, code modulation, multi-user detection, joint interference suppression and decoding. The third type of STC is space-time block codes. They operate on data blocks. STBC provides the benefits of diversity, but not the benefits of coding. Compared with STTC and STTuC, this reduces the complexity of STBC implementation.

2. LITERATURE SURVEY

By taking advantage of the available diversity gain and spatial multiplexing advantages, communication systems using multiple antennas in a transmitter or receiver have recently gained the ability to provide substantial capacity improvements while achieving low error rates and high data rate. The reasons have increased. (Zhang et al., 2011). Recently, transmission diversity as an effective technology has received widespread attention, effectively coping with fading and simplifying mobile terminals' implementation (Zhu et al., 2011). STBC provides the benefits of diversity, but not the benefits of coding. Compared with STTC and STTuC, this reduces the complexity of STBC implementation. Several methods of transmitting diversity have been proposed (Zhu et al., 2011; Almouti 1998; Wang and Wang 2004; Derryberry et al., 2002). Alamouti Space-Time Block Coding (STBC) (Alamouti 1998) is very simple and attractive because it has the advantage of not requiring channel state information and easy-to-implement feedback. So far, the research on Alamouti space-time transmit diversity (STTD) has mainly focused on binary phase shift hold (BPSK) or quadrature phase shift hold (QPSK) modulation (Alamouti 1998; Wang and Wang 2004; Derryberry et al. 2002). received. Gujarat and Leung, 2003). Although analysis and research on the BPSK-STTD system with incomplete pilot symbol channel estimation has been proposed (Gujrat and Leung 2003). Since limited spectrum resources challenge wireless communication, multi-user spatial multiplexing has recently attracted considerable attention. If the number of multi-threaded antennas is far greater than the number of receiving antennas, a multi-user MIMO system can significantly improve system throughput through transceiver signal processing (Choi et al., 2004). Alamouti STTD has been analysed and analysed by multi-level secondary amplitude modulation (M-QAM), which is very attractive for wireless communication due to its high spectral efficiency (Zhu et al., 2011). In Rayleigh fading with incomplete pilot symbols to assist channel estimation, STTD without BER is 16/64-QAM. However, the analytical formula's integral calculation requires a heavy calculation burden, so it is impractical to extend the STTD system. (Xia and Wang 2005) proposed an effective method for evaluating QAM performance using analysis functions.

3. PROBLEM STATEMENT

After all literacy studies, it is concluded that when the wireless communication system using MISO with 8-PSK modulation and all-around STBC cannot transmit data reliably, it is transmitted from multiple inputs. A single output may be distorted. Therefore, we are applying new technology to overcome this defect. The main purpose is to develop simulation programs for systems using MIMO to avoid this shortcoming. Therefore, the system can work more efficiently to distribute information from source to destination reliably.

4. PROPOSED ALGORITHM

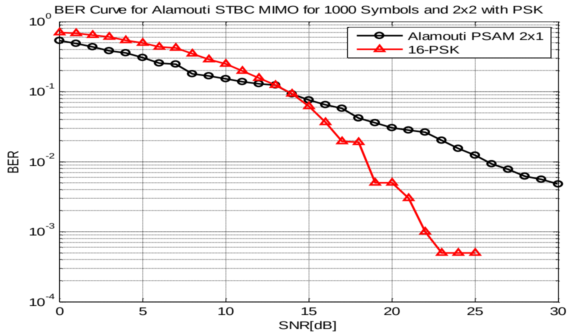
The block diagram of the proposed model is shown in Figure 2. The mentioned wireless communication system has been considered to stimulate and improve the performance of existing systems. Use MISO and Alamouti STBC with 8-PSK modulation to improve the existing wireless communication system. However, the system proposed in this paper adopts a multiple-input multiple-output (MIMO) system better to realise reliable information distribution from source to destination. It uses 16-PSK modulation to enhance security and data rate technology and obtain better errors. Bit rate. Alamouti STBC is integrated with the above system. The proposed system's main module is to apply 16-PSK modulation to the input data, followed by the Alamouti STBC encoding that needs to initialise the channel. Data is first sent with 16-PSK modulation in the proposed method, where a given data or signal is modulated. Then apply AlMouti STBC on the modified signal. Start the channel to estimate the value of BER. After that, add some noise and broadcast the signal through the channel. Then delete STBC and demodulate the given signal. Then, the output performance after demodulation will be better. Then apply AlMouti STBC on the modified signal. Start the channel to estimate the value of BER. After that, add some noise and broadcast the signal through the channel. Then delete STBC and demodulate the given signal. Then, the output performance after demodulation will be better.

5. RESULT & ANALYSIS

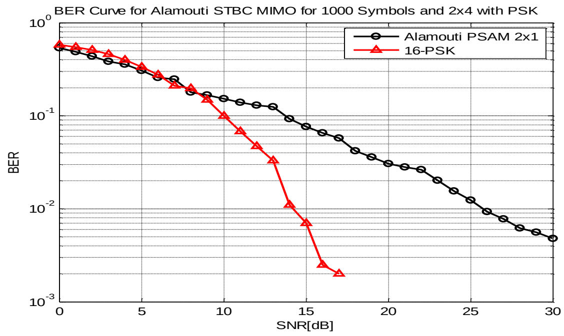
Implement a wireless communication system and explain the results of the proposed system in this section. The result is based on a bit error rate (BER). BER is an indicator used to analyse end-to-end performance, calculated for a fixed range of signal-to-noise ratio (SNR). The proposed system is evaluated under various MIMO configurations, as shown in the figure and table below.

MIMO 2x2 Configuration:

Analysing this configuration with 2 transmitters and 2 receivers, the BER obtained is the minimum range $10^{-3.5}$, which is smaller than the current function (i.e., $10^{-2.4}$), as shown in Figure 2.



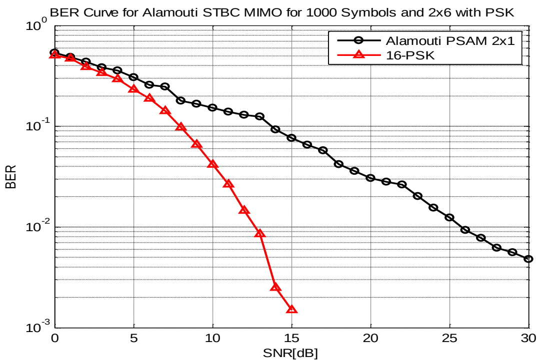
BER vs Curve for 2x2 MIMO with 16-PSK and Alamouti STBC



BER vs Curve for 2x4 MIMO with 16-PSK and Alamouti STBC

MIMO 2x6 Configuration:

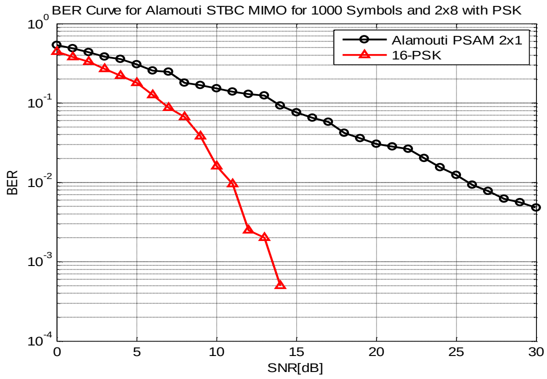
This configuration is analysed with 2 transmitters, and 6 receivers and the BER are achieved minimum in the range of 10^{-3} which is lower than existing work (i.e., $10^{-2.4}$) as shown in Fig.



BER vs Curve for 2x6 MIMO with 16-PSK and Alamouti STBC

MIMO 2x8 Configuration

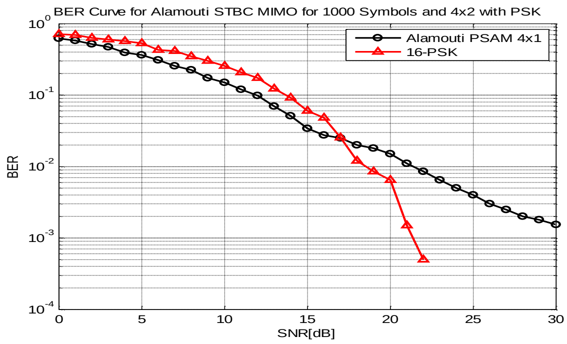
This configuration is analysed with 2 transmitters, and 8 receivers and the BER is achieved minimum is of the range of $10^{-3.3}$ which is lower than existing work (i.e., $10^{-2.4}$) as shown in Fig.



BER vs Curve for 2x8 MIMO with 16-PSK and Alamouti STBC

MIMO 4x2 Configuration:

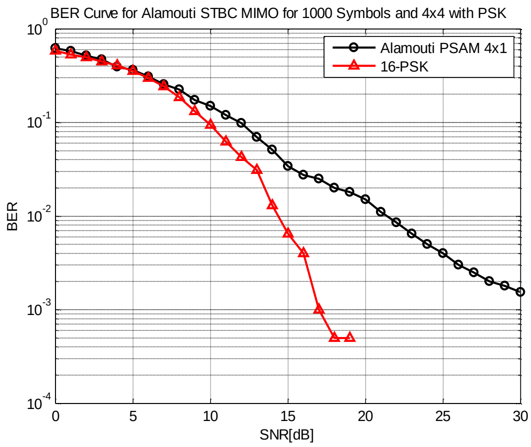
This configuration is analysed with 4 transmitters, and 2 receivers and the BER is achieved minimum is of the range of $10^{-3.5}$ which is lower than existing work(i.e., $10^{-2.9}$) as shown in Fig.



BER vs Curve for 4x2 MIMO with 16-PSK and Alamouti STBC

MIMO 4x4 Configuration:

This configuration is analysed with 4 transmitters, and 2 receivers and the BER is achieved minimum is of the range of $10^{-3.5}$ which is lesser than existing work (i.e., $10^{-2.9}$) as shown in Fig.



BER vs Curve for 4x4 MIMO with 16-PSK and Alamouti STBC

CONCLUSION

The previous section has proved the proposed model's simulation results, and the analysis of the system using BER tells us that the proposed method uses a better

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MIMO architecture in the technology and has a lower error probability. The 2xM and 4xM configurations provide better BER for a higher signal power range, thereby keeping the number of receivers (M) equal to or less than the number of transmitters. However, at all signal powers, when the number of receivers increases compared to the transmitter BER, the current work is better than the pilot-assisted STBC MISO system. MIMO architecture shows that its performance can be better than 16-PSK modulation and MISO used by Alamouti STBC. It is certain that using more efficient modulation techniques (such as QAM instead of PSK), the proposed system will have better performance.

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