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Designing and Performance Evaluation of Wireless Communication System Based On Advance STBC

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Abstract: Orthogonal frequency division multiplexing (OFDM) is an emerging technique for high data rate wireless communication systems over frequency selective channels and can be considered as one of the most promising techniques for the future wireless system. However, it is well known that OFDM-based systems are sensitive to the inter-carrier interference (ICI) generated by a carrier frequency offset (CFO), which degrades the error probability performance for both single-antenna OFDM systems. Moreover, in a multipath fading environment, performances of OFDM system in a wireless channel are severely degraded by random variations in the amplitude of the received signals as well as by the presence of inter-symbol interference (ISI) and inter-carrier-interference (ICI) which also limit the OFDM system performance. Recently, Alamouti STBC has gained much attention as an effective transmit diversity scheme to provide a reliable transmission with high peak data rates to increase the capacity of wireless communication system. In this research work, an advanced method for STBC-OFDM is proposed. The advancements which are done to the existing method is remapping of complex data after STBC encoding and serial to parallel conversion of complex data. This modification actually doubles the length of the data. At the receiver end again demapping of data is done which halfs the data length. This procedure helps in reduction of chances of error in the signal. The main objective of proposed method is to reduce the BER and SER in the STBC-OFDM system. For each simulation, blocks of 1024 symbols are simulated. The proposed system is simulated with two transmitter antennas, two receiver antennas. We have used channel conditions, which have two independent paths with path delays in seconds and average path gains = [0 - 20] dB. The performance of the proposed method is compared with that of existing STBC-OFDM system using BER and SER. MATLAB R2013 has been used as an implementation platform to simulate the proposed method. Wireless communication toolbox and generalized MATLAB toolbox is used for the same.

Keywords: Space-Time Block Code (STBC), Orthogonal Frequency Division Multiplexing (Ofdm), Alamouti Code etc.

INTRODUCTION

Space-time block codes (STBC) are a general version of Alamouti scheme [2] but have the same main features. These codes are orthogonal and can attain full transmit diversity specified by the number of transmit antennas. Space-Time Block Coding (STBC) with Multiple-Input Multiple-Output (MIMO) set-up was proved to be a proficient method for better BER performance [5]. These codes are orthogonal and can accomplish full transmit diversity specified by the number of transmit antennas [1]. The space-time block coding (STBC) technique, one of representative multiple antenna techniques, is most attractive for these purposes since it easily provides the diversity at the receiver by transmitting a space-time coded signal through multiple antennas [4].

Orthogonal Frequency Division Multiplexing (OFDM) has the property of high-speed transmission and robustness to multipath interference [6]. It has become the popular modulation technique in high-speed wireless communications [5]. It is more advantageous comparatively to the other technologies [2]. In spite of its advantages, it has some obstacles also. The high peak-to-average ratio (PAPR) is the main obstacle which causes non-linearity at the receiving end [5].

A promising modulation technique that is increasingly being adopted in the telecommunication field is Orthogonal Frequency Division Multiplexing (OFDM [3]. Orthogonal Frequency Division Multiplexing (OFDM) is a Multi-Carrier Modulation technique in which a single high rate data-stream is divided into multiple low rate data streams and is modulated using sub- carriers which are orthogonal each other. OFDM is a ―Multi-Carrier Transmission Scheme‖ ODFM is a good solution for high-speed digital communications. In this the data to be transmitted is separated over a large number of orthogonal carriers, each being modulated at a low rate. The carriers can be made orthogonal by appropriately choosing the frequency spacing among them. But with these benefits there are some issues in using OFDM:

(i) OFDM signal has very high Peak to Average Power Ratio (PAPR)
(ii) Intercarrier Interference between the subcarriers can cause a big problem in the system.
For any system Bit Error Rate with Signal to Noise Ratio must me improved so that the overall system performance will be enhanced by adopting our Method it can be assured that the system will perform with optimum value [7].

PROPOSED METHODOLOGY

MATLAB R2013 has been used as an implementation platform to simulate the proposed method. Wireless communication toolbox and generalized toolbox is used for the same. In this research work, an advanced method for STBC-OFDM is proposed. The advancements which are done to the existing method is remapping of complex data after STBC encoding and serial to parallel conversion of complex data. This modification actually doubles the length of the data. At the receiver end again demapping of data is done which halfs the data length. This procedure helps in reduction of chances of error in the signal. The main objective of proposed method is to reduced the BER and SER in the STBC-OFDM system. For each simulation, blocks of 1024 symbols are simulated. The proposed system is simulated with two transmitter antennas, two receiver antennas. We have used channel conditions, which have two independent paths with path delays in seconds and average path gains = [0 - 20] dB.
The steps of the implementation are given below:

1. Declaration of some input parameters
   - Number of transmit antenna
   - Number of Receive antenna number receiver
   - Number of parallel channels to transmit
   - FFT length
   - Number of carriers
   - Number of number frames
   - Number of loops
   - Number of information OFDM symbol for per number frames
   - Number of time slot
   - Modulation type: QPSK/BPSK
   - Symbol rate
   - Bit rate per carrier
   - Length of guard interval
2. Declaration of an outer loop according to number of loops
3. Declaration of an inner loop according to number of frames
4. Declaration of an inner loop according to different values of input SNR
5. Declaration of some counters
   - Number of error bit
   - Ratio of error bit
   - Total number of error signal
6. Designing of transmitter
   - Generation of Data according to Number of parallel channels, Number of time slot and Modulation type i.e. QPSK
   - QPSK modulation of generated data
   - Conversion of data into signal to be sent through Number of parallel channel in both time slot
   - Conversion (Encoding) of signal into STBC
   - Serial to parallel conversion of STBC signal
   - Remapping of data to double the length of it
   - Application of IFFT on STBC signal
   - Insertion of Guard interval into signal
   - Parallel to serial conversion of updated signal
   - Application and Calculation of Attenuation by computing Signal power and attenuation constant
   - Preparation of channel
7. Designing of Receiver
   - Breaking of received signal into two parts
   - Mounting of signal on to the channel and addition of
   - Noise to the signal
   - Serial to Parallel conversion of data
   - Removal of Guard interval from signal
   - Application of FFT on signal
   - Decoding of STBC signal
   - QPSK demodulation of decoded signal
   - Computation of Symbol Error Rate (SER)
   - Computation of Bit Error Rate (BER)
   - Display of SER and BER

EXPERIMENTAL RESULTS

This section gives the details about the performance evaluation of proposed approach. Simulations are done in MATLAB R2013a using the Rayleigh multipath fading channel model. In this research work, an advanced method for STBC-OFDM is proposed. The advancements which are done to the existing method is remapping of complex data after STBC encoding and serial to parallel conversion of complex data. This modification actually doubles the length of the data. At the receiver end again demapping of data is done which halfs the data length. This procedure helps in reduction of chances of error in the signal. The main objective of proposed method is to reduce the BER and SER in the STBC-OFDM system. For each simulation, blocks of 1024 symbols are simulated. The proposed system is simulated with two transmitter antennas, two receiver antennas. We have used channel conditions, which have two independent paths with path delays in seconds and average path gains = [0 - 20] dB. The order of the modulation stipulates the number of the diverse symbols that can be transmitted in a digital communication system. There are various modulation schemes like PSK, FSK, and AM. In this work, the proposed approach was tested over various PSK modulations like BPSK, QPSK, 16-PSK, and 32-PSK over Rayleigh fading channel. The performance of the proposed method is compared with that of existing STBC-OFDM system using BER and SER. To keep the comparison level same, we have kept all the input parameters almost same. The list of the used parameters is given below in table no. 1

Table 1 List of input parameters

S. No.	Parameter Name	Value
1.	Number of transmitters	2
2.	Number of receivers	2
3.	Number of channels	512
4.	Length of FFT	1024
5.	Number of carriers	512
6.	Number of Frames	10
7.	Number of Loops	10
8.	Number of Symbols	4
9.	Number of slots	2
10.	Symbol rate	250000
11.	Guard Interval Length	128
12.	Noise	AWGN
13.	System Model	MIMO

The performance of proposed approach is given in snapshot below. BER and SER wrt input SNR are calculated and shown below. Figure 1 is the snapshot of SER vs. input SNR of proposed work. Figure 2 is the snapshot of BER vs. input SNR of proposed work. Figure 3 is the snapshot of comparison of BER vs. input SNR of proposed work and existing work. We have also given the values of BER at different input SNR in Table 2.

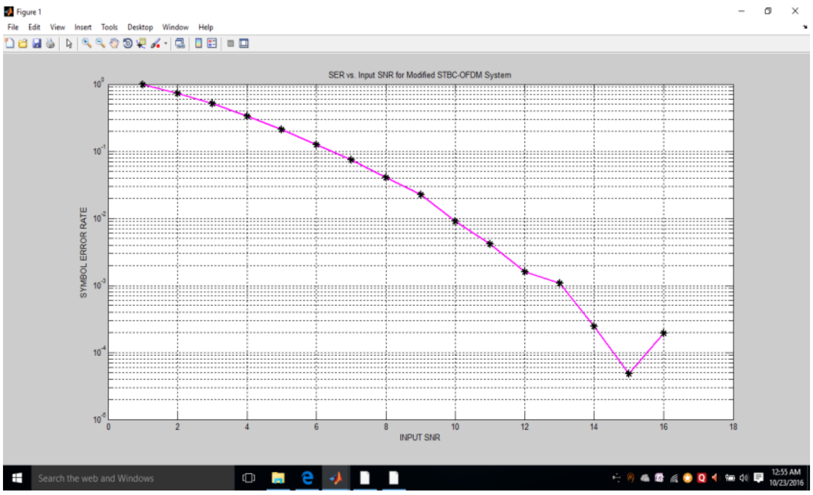

Figure 1 snapshot of SER vs. input SNR of proposed work

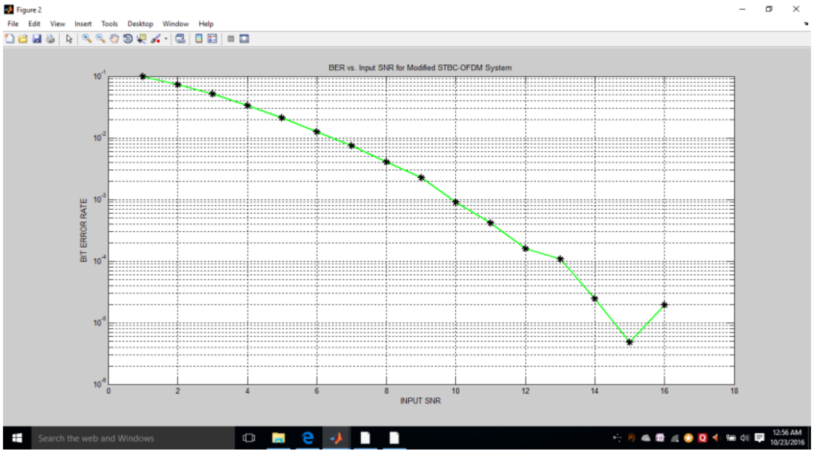

Figure 2 snapshot of BER vs. input SNR of proposed work

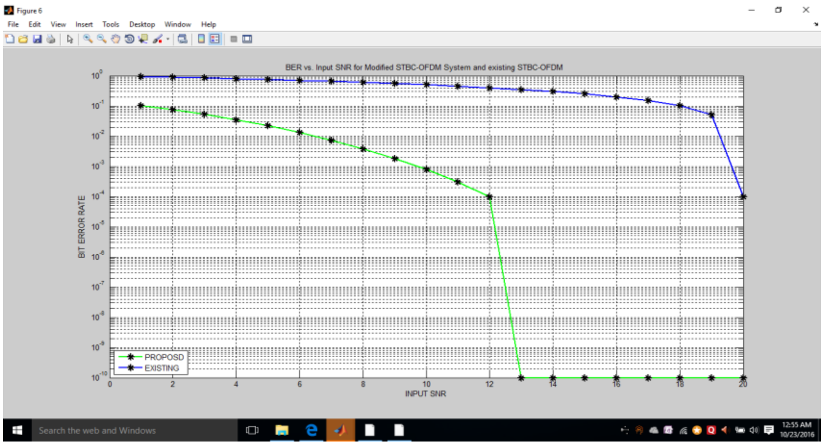

Figure 3 snapshot of comparison of BER vs. input SNR of proposed work and existing work

Table 2 Comparison between existing and proposed STBC-OFDM system using BER

Input SNR in dB	BER for existing STBC-OFDM	BER for proposed STBC-OFDM
1	0.9501	0.1018
2	0.9001	0.0754
3	0.8501	0.0523
4	0.8001	0.0348
5	0.7501	0.0222
6	0.7001	0.0132
7	0.6501	0.0073
8	0.6001	0.0037
9	0.5501	0.0018
10	0.5001	0.0008
11	0.4501	0.0003
12	0.4001	0.0001
13	0.3501	0.0000000001
14	0.3001	0.0000000001
15	0.2501	0.0000000001
16	0.2001	0.0000000001
17	0.1501	0.0000000001
18	0.1001	0.0000000001
19	0.0501	0.0000000001
20	0.0001	0.0000000001

CONCLUSION

An advanced MIMO-STBC-OFDM system has been presented in this research work. Simulation results indicate that the performance of the advanced STBC-OFDM system is better than or comparable to that of the existing STBC-OFDM according to BER. The proposed advanced STBC-OFDM has the advantages of a lower computational complexity and a higher data rate. The proof of above statements is given in the last chapter. It is very clear from there that proposed method is very efficient in terms of BER as compared to that of the existing system. The advanced STBC-OFDM aims to offer wireless multimedia service for a digital home where the high data rate is essential. We concluded that the proposed method is suitable for real-time multimedia service in the general wireless digital home environment and can be applied to the extremely adverse channel environment.

REFERENCES

[1] Apeksha Deshmukh, Prof. Dr. M. D. Kokate “Comparison of BER for Different Scheme in STBC-OFDM Receiver” International Journal of Modern Trends in Engineering and Research, Volume 2, Issue 7, [July-2015] pp. 1518-1524.

[2] Madhu Gandhi V Sisodiyas, K N Pawar “A Review on Channel Estimation Methods in MIMO-OFDM” Global Journal of Advanced Engineering Technologies Volume 4, Issue 4- 2015. Pp. 431-435.

[3] Manik, Gunjan, Alka Kalra, and Sanjeev Kalra. "Performance Analysis of STBC-OFDM System under Multipath Fading Channel." International Journal of Soft Computing and Engineering 1.6 (2012): 87-90.

[4] Jung, Ho-Chul, et al. "A Comparative Performance Analysis of STBC-OFDM Systems under Rayleigh Fading Environments." Daeduck science town, Republik of Korea: Hankuk Aviation University (2000).

[5] Maurya, Gaurav, and Pramod Patel. "An Extensive Review on STBC for MIMO-OFDM System." International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 8, August 2014. Pp. 352-357.

[6] V. Sudha Rani and B.L Malleswari “ A Review: OFDM with Diversity Techniques in Wireless Communications” MPGI National Multi-Conference 2012 (MPGINMC-2012) “Advancement in Electronics & Telecommunication Engineering” 7-8 April 2012 Proceedings published by International Journal of Computer Applications. Pp. 36-38.

[7] Mahesh Shankar Pandey and Brahma Swaroop Tripathi “Review on STBC coded MISO and MIMO in Frequency Selective Wireless Fading Channel” International Journal of Computer Applications (0975 – 8887) Volume 100– No.13, August 2014 pp. 4-9.

