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SPACE TIME BLOCK USING DIFFERENT MODULATION TECHNIQUES

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ABSTRACT

Space-time block codes are used for MIMO systems to enable the transmission of multiple copies of a data stream across a number of antennas and to exploit the various received versions of the data to improve the reliability of data-transfer. Space-time coding combines all the copies of the received signal in an optimal way to extract as much information from each of them as possible. However, wireless devices are range and data rate limited. The MIMO Alamouti scheme is an ingenious transmit diversity scheme for two transmit antennas that does not require transmit channel knowledge. Maximum likelihood decoding is achieved in a simple way through decoupling of the signals transmitted from different antennas rather than joint detection. In this paper, we have evaluated the performance of space time block codes with increased order of pseudo random number generator using different modulation techniques, for which the results have been verified through Matlab simulations.

KEYWORDS: Rayleigh Fading Channel, Higher Order STBC Codes, MIMO

INTRODUCTION

Space–Time Block Coding is a technique used in wireless communications to transmit multiple copies of a data stream across a number of antennas and to exploit the various received versions of the data to improve the reliability of data-transfer. Space time block coding uses both spatial and temporal diversity and in this way enables significant gains to be made. Space-time coding involves the transmission of multiple copies of the data. This helps to compensate for the channel problems such as fading and thermal noise. Although there is redundancy in the data some copies may arrive less corrupted at the receiver. When using space-time block coding, the data stream is encoded in blocks prior to transmission. These data blocks are then distributed among the multiple antennas (which are spaced apart to decorrelate the transmission paths) and the data is also spaced across time. A space time block code is usually represented by a matrix. Each row represents a time slot and each column represents one antenna's transmissions over time.

$$H = \begin{pmatrix} h_{1,1} & h_{1,2} & \cdots\cdots & h_{1,N_t} \\ h_{2,1} & h_{2,2} & \cdots\cdots & h_{2,N_t} \\ \cdots\cdots & \cdots\cdots & \cdots\cdots & \cdots\cdots \\ h_{Nr,1} & h_{Nr,2} & \cdots\cdots & h_{Nr,Nt} \end{pmatrix}$$

Within this matrix, Sij is the modulated symbol to be transmitted in time slot i from antenna j. There are to be T time slots and nT transmit antennas as well as nR receive antennas. This block is usually considered to be of 'length' T.

RESULTS

In fact, space–time coding combines *all* the copies of the received signal in an optimal way to extract as much information from each of them as possible. Table 1 describes the performance parameters taken to study the STBC codes with second order of pseudorandom number generator using different modulation techniques.

Table 1: Performance Parameters

Parameters	
No. of transmitting antennas	2
No. of receiving antennas	1
Diversity order	2
Modulation technique used	4QAM,8QAM, 16QAM
Code used	STBC
Order used	SECOND

Table 2 shows the BER analysis for different value of SNR. Performance analysis is done for second order with different modulation techniques.

Table 2: Performance Analysis

Modulation	BER for SNR-8 db	BER for SNR-10db
4 QAM	0.01	0.004
8 QAM	0.05	0.04
16QAM	0.08	0.06

For the performance analysis of space time block codes with second order of pseudorandom number using different modulation techniques, Graph for BER with particular values of SNR is plotted. From this graph, we observe that with second order of the generator performance is better for 4QAM as compared to 8QAM and 16 QAM in terms of BER.

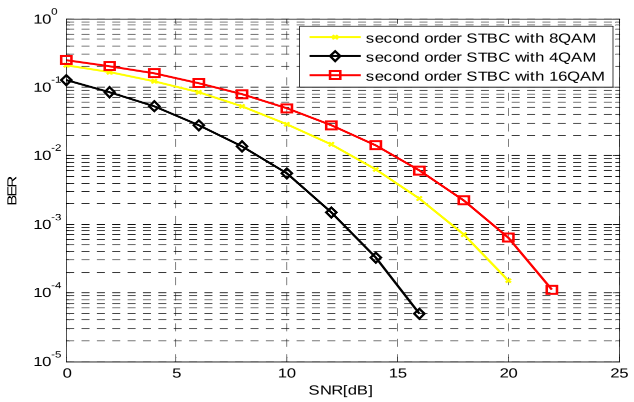

Figure 1: Improved BER Using STBC Code by Second Order of Random Number Generator Using Different Modulation Techniques

Table 3 describes the performance parameters taken to study the STBC codes with THIRD order of pseudorandom number generator using different modulation techniques.

Table 3: Performance Parameters

Parameters	
No. of transmitting antennas	2
No. of receiving antennas	1
Diversity order	2
Modulation technique used	4QAM,8QAM,16QAM
Code used	STBC
Order used	THIRD

Table 4 shows the BER analysis for different value of SNR. Performance analysis is done for THIRD order with different modulation techniques.

Table 4: Performance Analysis

Modulation	BER for SNR-8 db	BER for SNR-10db
4 QAM	0.006	0.002
8 QAM	0.03	0.01
16QAM	0.04	0.02

For the performance analysis of space time block codes with THIRD order of pseudorandom number using different modulation techniques, Graph for BER with particular values of SNR is plotted. From this graph, we observe that with third order of the generator performance is better for 4QAM as compared to 8QAM and 16 QAM in terms of BER.

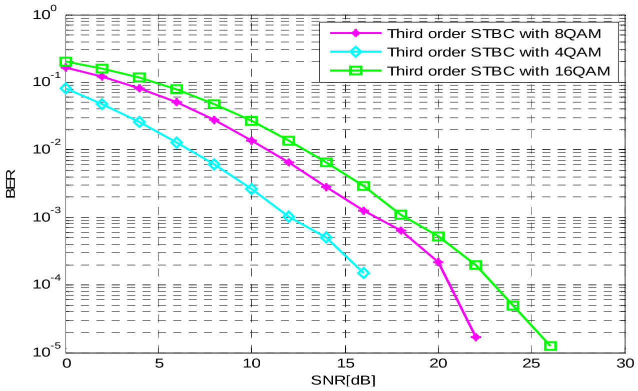

Figure 2: Improved BER Using STBC Code by Third Order of Random Number Generator Using Different Modulation Techniques

Table 5 describes the performance parameters taken to study the STBC codes with forth order of pseudorandom number generator using different modulation techniques.

Table 5: Performance Parameters

Parameters	
No. of transmitting antennas	2
No. of receiving antennas	1
Diversity order	2
Modulation technique used	4QAM,8QAM,16QAM
Code used	STBC
Order used	FOURTH

Table 6 shows the BER analysis for different value of SNR. Performance analysis is done for fourth order with different modulation techniques.

Table 6: Performance Analysis

Modulation	BER for SNR-8 db	BER for SNR-10db
4 QAM	0.0008	0.00009
8 QAM	0.01	0.0005
16QAM	0.03	0.01

For the performance analysis of space time block codes with fourth order of pseudorandom number using different modulation techniques, Graph for BER with particular values of SNR is plotted. From this graph, we observe that with forth order of the generator performance is better for 4QAM as compared to 8QAM and 16 QAM in terms of BER

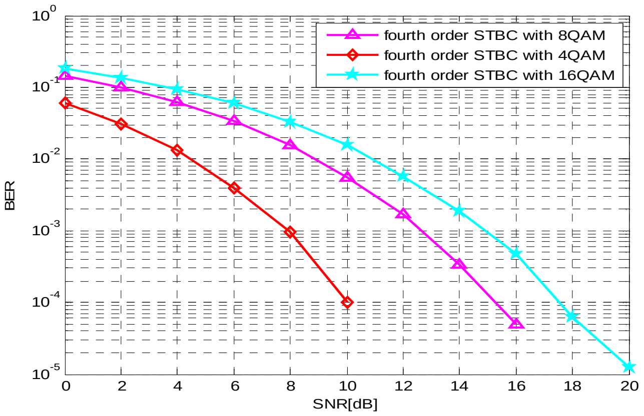

Figure 3: Improved BER Using STBC Code by Fourth Order of Random Number Generator Using Different Modulation Techniques

CONCLUSIONS

This paper evaluates the ***space time block codes with increased order of pseudo random number generator*** in MIMO system using different modulation techniques. We have presented the BER performance of higher order STBC. The simulation results show that by increasing the order of random number generator in space time block codes, BER of the system is improved. Table 7 describes the compiled results of STBC code with increased order using different modulation techniques. We also SIMULATE THE RESULTS for the SNR and Bit Error Rate with different modulation techniques. which shows that the higher order STBC scheme provide full diversity. The simulation results conclude that with fourth order of pseudorandom generator using 4 QAM provides effective BER for particular values of SNR gain.

Table 7: Performance Analysis Using Different Modulation Techniques

Modulation	Order of Random No. Gen.	BER for SNR-8 db	BER for SNR-10db
4 QAM	Second	0.01	0.004
8 QAM	Second	0.05	0.04
16QAM	Second	0.08	0.06
4 QAM	Third	0.006	0.002
8 QAM	Third	0.03	0.01
16QAM	Third	0.04	0.02
4 QAM	Fourth	0.0008	0.00009
8 QAM	Fourth	0.01	0.0005
16QAM	Fourth	0.03	0.01

REFERENCES

1. A. J. Paulraj, R. U. Nabar, and D. A. Gore, *Introduction to Space-Time Wireless Communications*, Cambridge, UK: Cambridge Univ. Press, 2003.
2. S. Alamouti, “A simple transmitter diversity, technique for wireless communications,” *IEEE J. of Select. Areas of Comm.*, vol. 16, no. 8, pp. 1451-1458, Oct. 1998.
3. V. Tarokh, H. Jafarkhani, and A. R. Calderbank, “Space time block codes from orthogonal designs,” *IEEE Trans. on Infor. Theory* vol. 45, no. 5, pp. 744-765, Jul. 1999.

4. A. F. Molisch and M. Z. Win, “MIMO systems with antenna selection,” *IEEE Microw. Mag.*, vol. 5, pp. 46-56, Mar. 2004.
5. S. Sanayei, A. Nosratinia, “Antenna selection in MIMO systems,” *IEEE Commu. Mag.*, vol. 42, no. 10, pp. 68-73, Oct. 2004.
6. D. Gore, R. W. Heath Jr., and A. Paulraj, “Transmit selection in spatial multiplexing systems,” *IEEE Commun. Lett.*, vol. 6, no. 11, pp. 491-493, Nov. 2002.
7. A. Ghrayeb and T. M. Duman, “Performance analysis of MIMO systems with antenna selection over quasi-static fading channels,” *IEEE Trans. Veh. Technol.*, vol. 52, pp. 281-288, Mar. 2003.
8. D. A. Gore and A. Paulraj, “MIMO antenna subset selection with space-time coding,” *IEEE Trans. Sig. Proc.*, vol. 50, pp. 2580-2588, Oct. 2002.
9. G. Foschini and M. Gans, “On limits of wireless communications in a fading environment when using multiple antennas,” Wireless personal communications, vol. 6, no. 3, pp. 311–335, 1998.
10. G. Tsoulos, MIMO system technology for wireless communications. CRC Press, 2006.
11. Yuling Zhang, Wenwei He, Yunbo Cheng, “Combining of antenna selection with adaptive modulation and coding in STBC system.” The Ist international conference on information science and engineering.
12. Vahid Tarokh, Hamid Jafarkhani and A. Robert Calder bank, “Space time block coding for wireless communication: Performance results”. IEEE JOURNAL IN COMMUNICATIONS, VOL. 17, NO. 3, pp 451-460, MARCH 1999.