IMPROVING PERFORMANCE OF MIMO-OFDM SYSTEM USING ANTENNA CONFIGURATIONS AND DATA COMPRESSION

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Abstract
The combination of multiple input multiple output and Orthogonal frequency division multiplexing improves high data rates, capacity of system. Orthogonal frequency division multiplexing is digital modulation technique for transmitting large data to receiver at high speed. The main aim of our project is to improve the communication speed of MIMO-OFDM system using antenna configurations and data compression. In this project we improve main lobe of transmitting antennas. By setting the angle of transmitting antenna we can send data in particular direction. These reduces bit error rate but increases delay in communication of system because of multiple error checking and antenna configuration layers. These delay can be reduce by applying data compression technique i.e. wavelet compression.
Keywords*:* Multiple input multiple output(MIMO), Orthogonal frequency division multiplexing(OFDM), Bit Error Rate(BER).

I. INTRODUCTION

The multiple input multiple output (MIMO) antenna technology which contains multiple antennas at the transmitter and the receiver. Multiple input multiple output is antenna technology for wireless communication which used multiple antennas at both source and destination. Orthogonal frequency division multiplexing (OFDM) is called as digital modulation technique. The data stream is split into N parallel streams and each can be transmitted on separate subcarriers.

OFDM works by splitting signals into sub-signals that are then transmitted simultaneously to receiver. Orthogonal Frequency Division Multiplexing (OFDM) is a digital multi-carrier modulation scheme that extends the concept of single subcarrier modulation by using multiple subcarriers within the same single channel. Rather than transmit a high-rate stream of data with a single subcarrier, OFDM makes use of a large number of closely spaced orthogonal subcarriers that are transmitted in parallel.

Data compression is known as source coding and bit rate reduction. By combining multiple input multiple output (MIMO) system with orthogonal frequency division multiplexing (OFDM) technique provides good coverage in nonline-of-sight environment, reliable transmission, high peak data rates and high spectral efficiency. Data compression is used to reduce data representation size, which is produced by a data compression algorithm. It is specifically used in communications because it enables devices to transmit or store the same amount of data in fewer or less number of bits. We used wavelet compression technique for data compression. Wavelet compression allows to get best compression ratio while maintaining the quality.

II. LITERATURE REVIEW

Arun Agrawal and Saurabh N. Mehata has proposed the combination of multiple input multiple output-orthogonal frequency division multiplexing (MIMO-OFDM) system to improve the performance of system. These increases high data rate, robustness and bandwidth efficiency of our system. The forward error correction (FEC) plays an important role with powerful interleaving algorithms. It improves the performance of the multiple input multiple output-orthogonal frequency division multiplexing (MIMO-OFDM) systems. In this paper, we have designed a simple multiple input multiple output-orthogonal frequency division multiplexing (MIMO-OFDM) system to reduce bit error rate and improve link reliability[1].

K. M. Ahmed and S. P. Majumder has proposed Forward error correction coding such as Convolutional coding (CC) to reduces bit error rate (BER) of system. In this paper, we discuss effect of fading and multipath dispersion analyzes bit error rate performance of the system. It includes multiple input and multiple output transceiver configurations to combat effect of fading. MIMO-OFDM system performs better with lower values of normalized Doppler frequency FDT5 with higher Rician k-factor, i.e. the system is substantially dominated by k-factor and FDT5. MIMO-OFDM system performance over fading channels can improve with convolutional coding[2].

M. M. Avval, C. Snow and L. Lampe has proposed the data rates are achieved by combining OFDM with multiple input multiple output (MIMO) transmission. In this paper, we discuss a novel analytical method for bit-error-rate (BER) and frame-error-rate (FER) estimation of bit-loaded coded OFDM and MIMO-OFDM systems using singular value decomposition (SVD), operating over frequency-selective quasi-static channels with non ideal interleaving. Then, introduced about three different algorithms. The first algorithm is based on selecting the best interleaver among a set of interleavers. In the second algorithm, a bit interleaver is designed based on the PEPs derived using our error-rate estimation technique. The third application is an adaptive coded modulation scheme using our BER-estimation technique. These reduce BER of MIMO-OFDM system[3].

J. Zhang and Q. Zhao has proposed the simulation and analysis of MIMO-OFDM based on simulink. Estimation of LMMSE gives better performance than LS estimation when SNR is 0-6 dB and performance is same when the SNR is 6-8 dB. When SNR is greater than 8dB, the bit error rate under LS estimation has always been lower than LMMSE[4].

Z. Iqbal and S. Nooshabadi has proposed four different channel coding and interleaving schemes to reduce bit error rate. Four different schemes are Cross-antenna convolutional coding with per-antenna interleaving, Per-antenna convolutional coding with per-antenna interleaving, Cross-antenna convolutional coding with cross-antenna interleaving and Per-antenna convolutional coding with per-antenna interleaving. Compare all these schemes based on bit error rate. Cross-antenna coding and per-antenna interleaving system give best performance under all SNR condition for all modulation schemes[5].

M. Li, Z. W. Zheng, X. H. Ma, P. F. Sun and Y. Yao has proposed space-time trellis coding (STTC) improve the performance of system. Multiple input multiple output-orthogonal frequency division multiplexing (MIMO-OFDM) system based on STTC. In this paper, describe basic principle of STTC-MIMO-OFDM system. Simulation is performed under case of different time delay, subcarriers and analyzed and compare the performance. STTC-MIMO-OFDM system achieve lower bit error rate[6].

Z. Iqbal, S. Nooshabadi and Heung-No Lee has proposed the wireless communication for metropolitan area network (MAN). Comparison is done on the basic of four different channel coding and interleaving schemes. It is shown that Cross-antenna coding and per antenna interleaving gives the best performance under all SNR conditions and all modulation schemes. Analyze and compare of bit error rate (BER) performance of four schemes. Cross-antenna coding and per antenna interleaving give best performance based on BER[7].

A. Ogale, S. Chaoudhary and A. J. Patilhas has proposed the combination of MIMO system and Orthogonal Frequency division multiplexing (OFDM) system. It used MIMO channels for reducing bit error rate and increasing capacity. MIMO-OFDM system performance is measured based on BER. Throughput results of system analyzed with 64 QAM used image as an input. Matlab® Simulink is used to reduce bit error rate, improve the capacity as well as link reliability (BER) of system[8].

III. IMPLEMENTATION

There are four modules in our project. These modules are OFDM transmitter, Data compression, OFDM receiver with data decompression and Antenna configuration.

3.1.OFDM Transmitter:

The input data is forward to OFDM transmitter block. OFDM is digital modulation technique that breaks a large bandwidth into small subcarriers and splits the signals into sub-signals using IFFT. The data on each subcarriers being modulated using Phase-shift keying (PSK) technique. Phase-shift keying allows digital data and converted to complex value. The OFDM transmitter performs modulation using QPSK. The amount of data transmitted on each subcarrier.

3.2.Data Compression:

In second module wavelet compression technique is used for data compression. We use four types of wavelet compression are Haar, db2, db4 and db8. Check these four types on the basis of compression ratio. Haar gives best compression ratio with DWT function. We use Haar wavelet compression for data compression.

3.3.OFDM Receiver with data Decompression:

Data compression block forward data to OFDM receiver with data decompression block. It decompresses data using Haar with IDWT function. After decompression it perform parallel to serial conversion of sub-channel using FFT and demodulate signals. Data is converted to digital form.

3.4.Antenna Configuration:

Antenna reconfiguration module use Direction of Arrival (DOA) to perform one to one relationship between sender to receiver. We use 2 transmitting antennas and 2 receiving antennas. We set the angle of transmitting antennas to send the data in particular direction. These reduces bit error rate of our system.

IV. RESULT AND DISCUSSION

We perform simulation using MATLAB. PSK modulation technique is used for OFDM transmitter scheme. The channel noise is considered as additive white Gaussian. Here we used 2 transmitting antennas and 2 receiving antenna**s.** Figure Shows compressed data, BER performance graph of SISO-OFDM using QPSK before setting angle of transmitting antenna, angle of transmitted antenna and BER performance of MIMO-OFDM using QPSK modulation technique after setting angle of transmitting antenna.

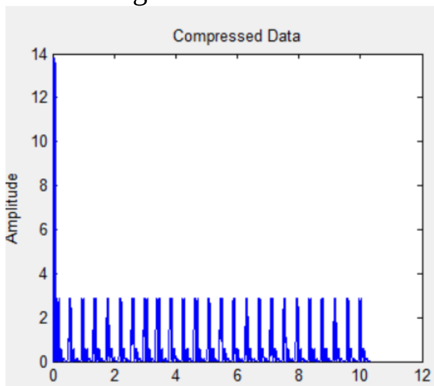

Figure 1- shows compressed data.

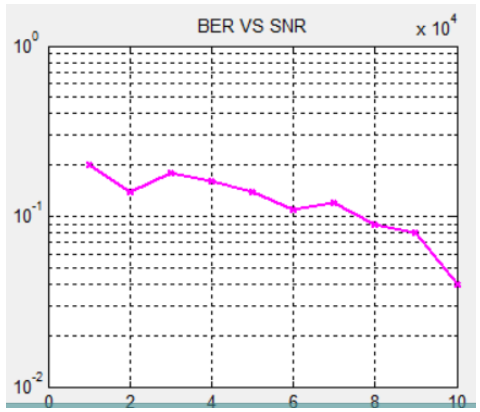

Figure 2 - shows the BER performance graph of SISO-OFDM system using QPSK.

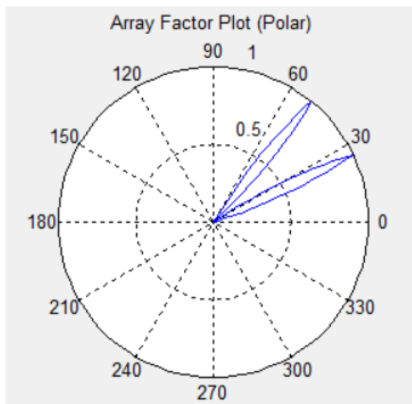

Figure 3- shows angle of transmitted antenna.

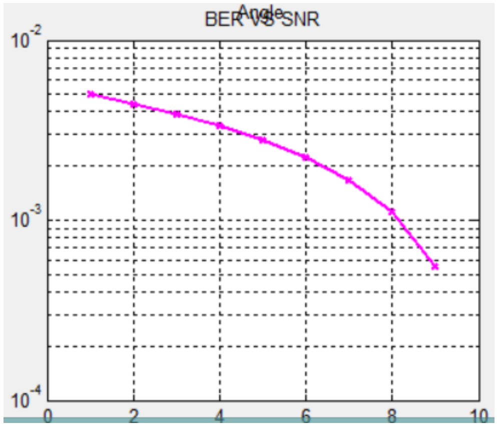

Figure 4- BER performance graph of MIMO-OFDM using QPSK modulation technique after setting angle of transmitting antenna.

V. CONCLUSION AND FUTURE WORK

In this project we have set the angle of transmitted antennas to send the data in particular direction. After setting angle of transmitting antenna data are send in particular direction. It performs one to one relationship between sender to receiver. These reduces Bit error rate of our system. Above process reduces BER but increases delay in communication. This delay can be reduced by using data compression technique on transmitted data. Antenna configurations and data compression are used to improve the performance of system. As a further extension, we can improve security of the system using encryption algorithms like AES, RSA, ECC, etc and improve the speed using FPGA implementation.

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