Novel Approach Wavelet Transformation by Convex Optimization in MIMO-OFDM with Multi User Enviorment

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Abtract- The main issue in the wireless communication is multipath fading. This issue occurred due to the arrival of transmitting signal from different paths. These signals arrived on the receiver through different angles with different time delay and frequencies. The fluctuation in the signal power results into multipath fading and limited bandwidth which makes designer's task challenging and data rate and reliability is also low. The proposed work describes the detail on MIMO-OFDM and work on the issues like this. The proposed work is based on the GWO algorithm for effective and optimized results. The result of the experiment shows the significance improvement of BER and reduction in SNR with different modulation and noisy channel.

Keyword- MIMO-OFDM, OPTIMIZATION, Convex

I. INTRODUCTION

Multiple Input Multiple Output Orthogonal Frequency Division Multiplexing (MIMO-OFDM) is the primary air interface for 4G and 5G broadband wireless communications. It consolidates various info numerous yield (MIMO) innovation to expand the limit by transmitting distinctive flags over different reception apparatuses, and Orthogonal Frequency Division Multiplexing (OFDM) innovation, which separates the radio channel into countless dispersed sub-channels. To give higher speed and dependable interchanges. Research conducted in the mid-1990s showed that while MIMO can be used with other popular air interfaces such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA), the combination of MIMO and OFDM is higher Data rate.

MIMO-OFDM is the premise of the most progressive remote LAN (Wireless Local Area Network) and portable broadband system models since it accomplishes the most elevated ghostly effectiveness and subsequently gives the most astounding limit and information throughput. Greg Raleigh concocted MIMO in 1996. He demonstrated that by utilizing spatially transmitted signals to reflect objects, (for example, the ground) and utilizing numerous ways to achieve a similar recurrence, diverse information stream collectors can be transmitted at the same time on a similar recurrence.

Information, distinctive information streams can be sent through various ways. Raleigh proposed and later demonstrated that with OFDM, the preparing required for MIMO at higher rates will be the most straightforward to oversee.

Modulation, because OFDM converts high-speed data channels into multiple parallel low-speed channels [1]. Fig. Figure 1 shows the basic structure of a MIMO OFDM system.

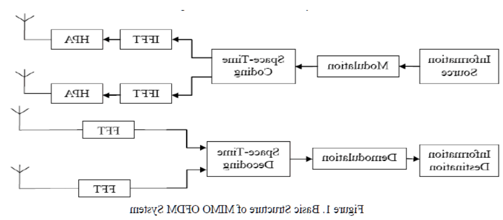

Fig.1: Structure of MIMO-OFDM

Orthogonal Frequency Division Multiplexing (OFDM) is one of the most promising physical layer technologies in high data rate wireless communication due to its robustness to frequency selective fading, high spectral efficiency, and low computational complexity. OFDM can be utilized as a part of conjunction with a different info numerous yield (MIMO) handset to expand decent variety pick up or potentially framework limit by misusing the spatial space. Since OFDM frameworks successfully give numerous parallel restricted band channels, MIMO-OFDM is viewed as a key innovation in developing high information rate frameworks such as 4G, IEEE 802.16 and IEEE 802.11n[2].

II. RELATED STUDY

Deshmukh, et al analyzed the different digital **Bhasker Gupta** [18] proposed the equalization algorithm for the improvement in BER in OFDM systems. This work is done to solve the issue of inter symbol interference in the wireless communications. The equalization algorithm used in this work is zero forcing and minimum mean square equalizer. The BER is improved in this work by using these algorithms.

Lee, You-Seok et al. (2009) worked upon the noise estimation in the OFDM on time domain threshold. This noise can be reduced by using the proper selection of a threshold value. The proposed approach is a standard deviation of noise which is obtained by wavelet decomposition. The result of the proposed approach by reducing the BER rate shows its effectiveness. [19]

Zhao, Ming et al. (2008) proposed an approach for turbo channel estimation for OFDM system in which pilot and soft decoded data is used in the iterative manner. The performance of the system is improved by time and frequency in selective fading channel. The throughput of the system is maintained by it. The numerical and result analysis show the effectiveness of the proposed method. [20]

Ingmar, Hammerstrom (2007) proposed the power allocation approaches to amplify and forward relay links in OFDM. In this work optimization is performed on nodes that transmit on power constraints. The joint optimization process of source and the relay P.A is also performed in this work. The proposed approach provides an optimal P.A at source with a node transmit power constraints. [21]

MasoomehTorabzadeh and Yusheng Ji (2006) proposed the multi-output fair queuing scheduler for MIMO system. This approach is used to enhance the data rate in the antennas array in MIMO-OFDM. The effectiveness and efficiency in results show the adaptability of the scheduler. [22]

Nihar Jindal et al. (2005) Contrasting the dirty paper coding (DPC) and time division multiple access (TDMA) abilities of a different receiving wire (Multiple Input Multiple Output (MIMO)) Gaussian communicates channel. They found that the aggregate rate limit of multi-radio wire BC (achievable utilizing DPC) is at most a base () times the greatest single-client limit (ie, TDMA entirety rate) in the framework, where is the quantity of transmit reception apparatuses and is the quantity of beneficiaries. This outcome is free of the quantity of getting radio wires and the channel to pick up framework and is substantial at all flag to-clamor proportions (SNRs). [23]

KyeongJin, Kim et al.(2005) This article considers the blend of orthogonal recurrence division multiplexing (OFDM) and (MIMO-OFDM) V-BLAST writes to enhance ghostly proficiency and multi-client downlink throughput. A joint MIMO-OFDM information, location and channel estimation calculation in view of QRD-M calculation and Kalman channel is proposed. The Kalman channel is utilized to track each channel between the radio wire components, and the QRD-M calculation utilizes a restricted tree pursuit to surmise the most extreme probability locator. The shut shape image mistake rate is given in the instance of M = 1 with QPSK adjustment, restrictive on the execution of a static channel. A versatile intricacy QRD-M calculation (AC-QRD-M) is likewise considered, which doles out various estimations of M to each subcarrier in light of its assessed got control. The governing for choosing utilizing subcarrier control M is gotten utilizing a piece thickness gauge joined with the Lloyd-Max calculation.[24]

Hongwei, Yang (2005) In this paper, it gives a short specialized review of the MIMO-OFDM framework plan. It centers around different research themes for MIMO-OFDM based air interfaces, including spatial channel demonstrating, MIMO OFDM handset plan, MIMO-OFDM channel estimation, MIMO-OFDM space-time innovation, and blunder adjustment codes. Comparing join level reenactment comes about are empowering and show that MIMO-OFDM is a promising way for future broadband remote access. [25]

Tobias Dahl (2004) Another technique is proposed for coordinate visually impaired acknowledgment of the principle free particular mode without evaluating the channel network itself. The privilege and left particular vectors with the biggest relating solitary esteem are resolved utilizing the payload information and are persistently refreshed while being utilized for correspondence in the meantime. The practicality of this technique is exhibited by reenacting the execution of commotion blurring on time-fluctuating channels. [28]

III. PROPOSED WORK

Proposed Methodology steps

Step1 Input binary data stream.

Step2 Encode by using QAM and BPSK Encoder.

Step3 Map signals by using signal Mapper.

Step4 Send the mapped signal to space time block coder.

Step5 Input the values into grey wolf optimization algorithm for optimization process.

Step6 If optimized the go to step 7 otherwise repeat step 4.

Step7 Compute the modulation and demodulation process and send the output to space and block coder by adding AWGN and Rayleigh Noise.

Step8 Demap the signals and then send signal to the channel decoder

Step9 Binary output stream.

Proposed Algorithm

Algorithm: GWO

Step 1:Input binary data stream.
Step 2:Encode by using QAM and BPSK Encoder.
Step 3:Map signals by using signal Mapper.
Step 4:Send the mapped signal to space time block coder.
Initialize GWO $\boldsymbol{A_i}$(i=1, 2, …n)
Initialize x, X, and Y
Step 5 : Calculate fitness function for every search agent
$\boldsymbol{A_\alpha}$←best search agent
$\boldsymbol{A_\beta}$← second beat search agent
$\boldsymbol{A_\delta}$← Third best search agent

IV. RESULT AND DISCUSSION

In this section result of the proposed approach is presented in the graphical form on the different parameters by using three modulation approaches that are QPSK, BPSK QAM. The experiment is performed on AWGN (Additive White Gaussian Noise) and Rayleigh. The parameters used for the performance evaluation are:

- BER: Bit Error Rate
- SNR: Signal to Noise Ratio

Figure 1.2 Rayleigh on QPSK, BPSK and QAM

In Figure 1.2 show the Rayleigh graph on QPSK, BPSK and QAM. In this graph X-axis represents the value of SNR (Signal to Noise Ratio) and Y-axis represents the value of BER (Bit Error Rate). The Black dotted line show the highest value of Rayleigh of QPSK on graph, Blue dotted line show the values less than QPSK and the solid Black line represents the value of QAM whose value is less than the other two methods (QPSK and BPSK).

Table 5.1 System Simulation Parameters

Parameters	**Assumptions**
Modulation	QPSK, BPSK QAM
Carrier Frequency	16GHZ
Bandwidth	512Kbyte
FFT size	1024 bits
Cyclic Prefix	5 block
Subcarrier mapping	Interleaved FDMA
Relative Velocity	120Km/hr
IFFT size	1024 bits

Table 5.2 QPSK, BPSK and QAM on Rayleigh noise channel

SNR	QPSK	BPSK	QAM
4	0.06	0.07	0.072
8	0.08	0.010	0.011
12	0.010	0.014	0.016
16	0.016	0.018	0.019

In Figure 5.2 QPSK, BPSK and QAM are performed with GWO (Grey Wolf Optimizer). In this graph X-axis represents the value of SNR (Signal to Noise Ratio) and Y-axis represents the value of BER (Bit Error Rate). In this figure Blue line shows the value of QAM with GWO, Red Line shows QPSK with GWO and Green line shows the value of BPSK with GWO. The figure shows the value of QAM with GWO is low and the green line BPSK with GWO has highest value on AWGN channel. The red line QPSK with GWO is low in starting but as the SNR is increased its values is also enhanced.In Figure 5.4 QPSK, BPSK and QAM are performed with GWO (Grey Wolf Opmizer). In this graph X-axis represents the value of SNR (Signal to Noise Ratio) and Y-axis represents the value of BER (Bit Error Rate). The blue line in figure presents BPSK, red line presents the QPSK and solid black line presents the values of QAM.

Table 5.4 QPSK, BPSK and QAM on AWGN noise channel with GWO (Grey Wolf Optimizer)

SNR	BPSK	QPSK	QAM
4	0.000	0.003	0.004
8	0.000	0.008	0.011
12	0.006	0.010	0.016
16	0.008	0.018	0.019

In figure 5.4 the comparison of the QPSK and QAM with GWO and Without GWO is performed to analyze the performance on AWGN channel. In this graph X-axis represents the value of SNR (Signal to Noise Ratio) and Y-axis represents the value of BER (Bit Error Rate). The red line shows the values of QPSK, blue shows QPSK with GWO, pink line shows QAM and black line shows the values of QAM with GWO.

V. CONCLUSION

This technique come at the extent cost and increase the computational complexity as compare to the traditional antenna system. To identify the strengths and weakness of the new approaches many experiments are performed and requires testing. In this work it is concluded that the proposed approach performs better due to the optimized results of the Grey Wolf Optimization algorithm and performes effectively on BER and SNR parameters. The proposed work open a lot of research areas in this field.

VI. REFERENCES

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