# Novel Approach Wavelet Transformation by Optimization in MIMO-OFDM with Rayleigh Channel

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***ABTRACT***-Due to enhancement in the wireless devices the requirement of the data places is also increased and demand of bandwidth is also enhanced. This is also necessary for the throughput and capacity of the communication system. MIMO-OFDM is the novel technique which meets with the needs of communication process. OFDM is used in multiple devices because it provides high spectral efficiency and resilience to multipath channel effects. OFDM make the process of channel equalization simple and it is sensitive to synchronization errors. The MIMO-OFDM approach is used to enhance the throughput of the channel without increasing the bandwidth or power. 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 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, GWO

## I. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) is an effective technique for alleviating ISI. OFDM is a Frequency Division Multiplexing (FDM) scheme used as a digital multi-carrier modulation method. In other words, OFDM is a frequency division multiplex of multiple carriers, which are orthogonal to each other, i.e they are exactly placed in the zeros in the modulation spectrum of each other. This makes OFDM all the more frightfully effective. In OFDM, information is isolated into a few parallel information streams or sub-channels, each sub-bearer being orthogonal to each other in spite of the fact that they are frightfully covering. Each sub-bearer utilizes a regular tweak conspire, (for example, QAM or PSK) at a low image rate, keeping up a similar general information rate as a customary single-transporter adjustment plot inside a similar data transfer capacity. In the present circumstance, MIMO is extremely helpful for the blend of OFDM frameworks. The utilization of the adaptability of the MIMO framework to get high information rates is an especially alluring exploration theme for the plan and use of future booking plans. Compared to conventional single-input single-output (SISO) systems, multiple-input multiple-output (MIMO) systems provide greater channel capacity [1].

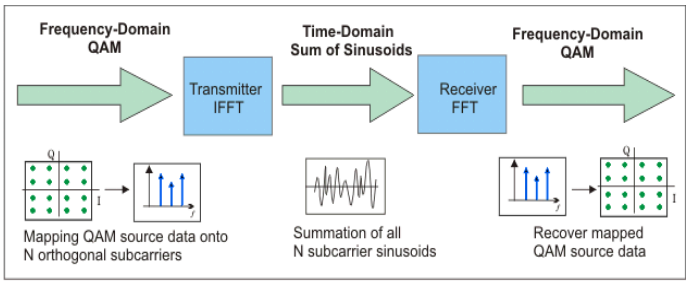


Fig1: OFDM Block Diagram

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 modulation schemes like QPSK and BPSK. In this QAM is performed with the help of space time block codes. This method controls the errors by using time and spatial dimensions. OFDM system combines with antenna array at transmitter and receiver which enhance the diversity gain known as MIMO-OFDM. It improves the system capacity on time-variant and frequency selective channels. This method improves t]he BER rate [1].Ashdowninvestigated the method of high rate data

transmission through metallic barriers using ultrasound. MIMO-OFDM is used to avoid the cross talk mitigation. In this a channel array is formed with the help of steel barriers. In these investigation effects of cross talk is discussed. It shows the effects of transducer misalignment on multi-channel capacity and data transmission rates [2].

Vamsidhar [3] worked on the multi-user MIMO-OFDM for BPSK modulation approach by using Discrete Wavelet method. The proposed concept is firstly fit in the area of Wi-Fi verbal schemes. The double multi-carrier scheme is performed on the simulator with Haar Wavelet. The performance of the proposed system is efficient than the existing system and reduce the bit error rate and using both antennas BPSK and QPSK for modulation on AEGN channel [3].Logesh, R. et al worked upon review the techniques and approaches of hybrid power generation system. In this author discussed about the structure of converters and their operations. The author also focused on the challenges related to PV integrated power generation techniques.. The execution of the proposed controller was checked from reenactments and associations. Beguilement happens displayed that the execution of the proposed ANFIS based Neuro-Fuzzy Controller could moist out the rehash deviation and achieve the steady express a driving force with less settling time[4].

Kumardesigned MIMO-OFDM by using 4: 8 antenna and OSTBS encoder which combines the different techniques and used to control the inter-symbol interference. Performance evaluation of the proposed system is done by using Bite error rate, signal to noise ratio, constellation plot and MSE [5].Zheng investigates the MIMO-OFDM with index modulation method which provides the flexible trade-off between spectral efficiency and error performance in 5G wireless communication. In this work author detects the interchannel interference which is a challenging task. It is done by using low complexity detectors which is based on Monte Carlo theory. These detectors work on the sub-blocks level and sub-carriers level to reduce the complexity [6].

BasarInvestigates the MIMO-OFDM with index modulation method which provides the flexible trade-off between spectral efficiency and error performance in 5G wireless communication. In this work minimum means square error detector and maximum likelihood detector are proposed for performance investigation [7].KhushbooPachori et.al introduced the active partial sequence for PAPR reduction in MIMP-OFDM. The proposed work is done in the Rayleigh fading environment. The proposed APS approach is combined with approximate gradient and partial transmit sequence. The proposed approach gives effective outcome by reducing the PAPR and does not affect the BER performance [8].

Tazvinga formulated optimal energy management model of solar hybrid battery. This model reduces the cost of fuels and battery and finds the optimal flow of power. The performance of the proposed approach is analyzed on 24 hours period of power supply. . In this way, the voltage-balancing out controllers were coordinated into the system with a specific end goal to keep the voltage size and recurrence consistent at the heap terminals, which requires steady voltage and recurrence [9]. Xudong Zhu et.al worked on the channel estimation process which is aware of sparsity and based on the SNR detection. This method is used to detect the sparsity level of the channel. If the priori is matched with the CS model subspace pursuit algorithm is used otherwise improved method for channel estimation is used. The result of the proposed approach represents its robustness and performs better than the existing approach[10].

## III. PROPOSED WORK

**Grey Wolf Optimizer (GWO)**

The latest bio-inspired algorithm is the grey wolf optimization algorithm. This algorithm's main concept is simulating the behavior of grey wolf living in a pack. They have a serious hierarchy of social dominance. Alpha is known as the level leaders and is responsible for decision making in the pack. The wolf pack persistence is based on the decision of alpha. Beta is known as the second level subordinate wolves. The beta operation is for help in making the decision for alpha or other activities.

Delta is known as the third level subordinate wolves. This category member consists of elders, scouts, hunters, caretakers, and sentinels. For region boundary observation and in any danger case, scouts are liable for the warning. The protection and pack's safety guarantee is given by sentinels. The expertise wolves are the elders, denoted as alpha or beta. Alphas and betas are helped by hunters while prey hunting and caring for the ill, weak, and wounded wolves by caretakers and providing food for a pack. Omega is the lowest level. All dominant wolves with omega wolves have to comply.

**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.

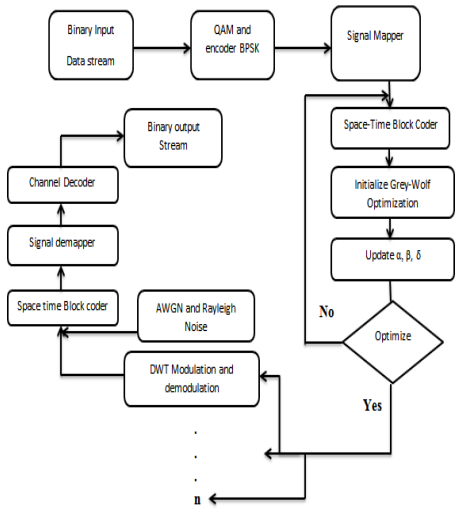


Fig.2: Flow Chart of the Proposed Methodology

## 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

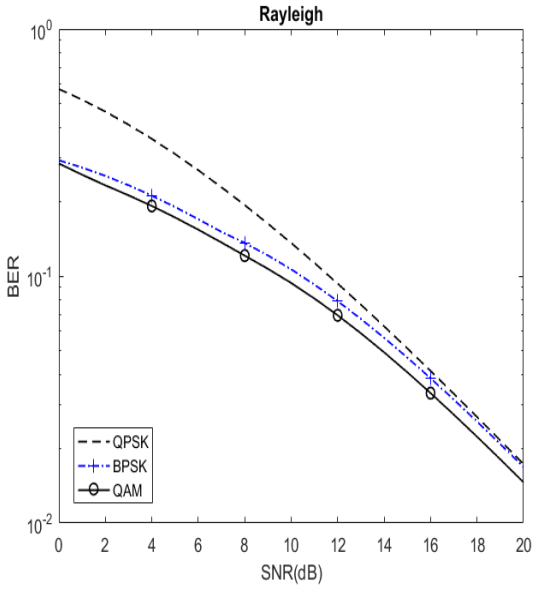


Fig.3: Rayleigh on QPSK, BPSK and QAM

In Figure 3 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).

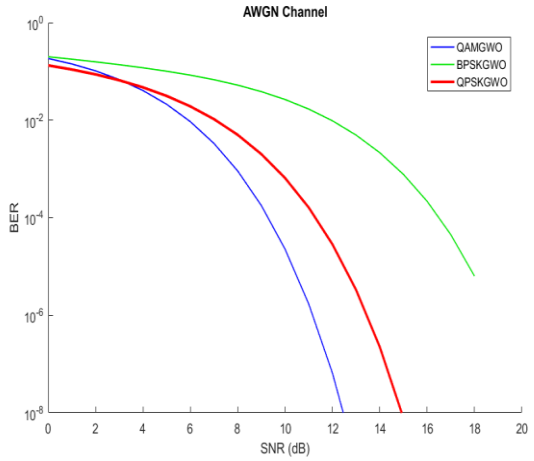


Fig.4: AWGN on QPSK, BPSK and QAM with GWO (Grey Wolf Optimizer)

In Figure 4 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.

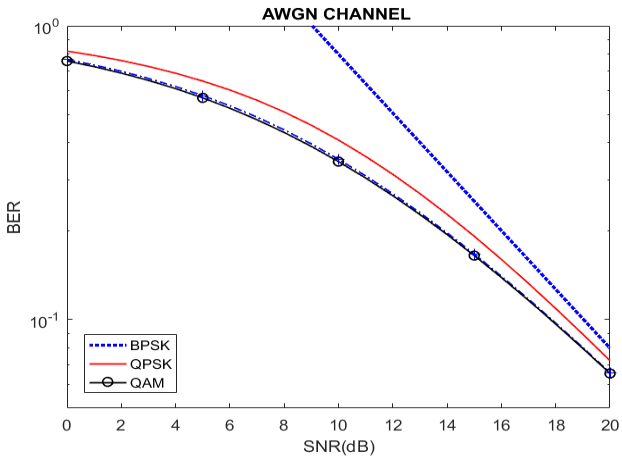


Fig.5: AWGN on QPSK, BPSK and QAM with GWO (Grey Wolf Optimizer)

In Figure 5 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). The blue line in figure presents BPSK, red line presents the QPSK and solid black line presents the values of QAM.

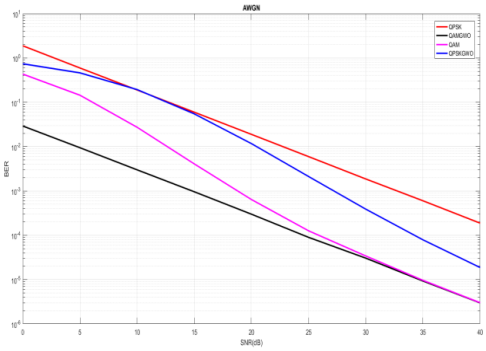


Fig.6: Comparisons of QPSK and QAM with GWO and Without GWO

In figure 6 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

In this technique data is transmitted over multiplke channels that are orthogonal to each other. In this high rate data is converted intosmall data streams and transmitted to subcarriers and it converts the selective channels into a set of flat fading channels. The nex communication technique Multiple-input multiple-output enhance the performance level of the system. It employs multiple antennas at the sender and receiver end which transmits the data at same frequency bands.This method is also known as spatial multiplexing which enhance the spectral efficiency and reliability without using any additional transmit power. 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

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