IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 10 ISSUE : 05 Print / Issue Publication Date: 13-Nov-2025

ISSN : 2455-2143

DOI : 10.33564/IJEAST.2025.v10i05.010

Indexed In

Google Scholar | Open Access | doi | Crossref

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International Journal of Engineering Applied Sciences and Technology, 2025
Vol. 10, Issue 05, ISSN No. 2455-2143, Pages 94-98
Published Online September 2025 in IJEAST (http://www.ijeast.com)

PERFORMANCE COMPARISON OF PROPOSED SCHEME CODED DWT-OFDM SYSTEM WITH THAT OF PROPOSED SCHEME CODED CONVENTIONAL OFDM

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Abstract: **In this paper, we have investigated the Proposed scheme coded DWT-OFDM system in comparison to Proposed scheme coded FFT-OFDM system over AWGN channel. 16, 32, 64 – QAM and PSK modulation schemes have been considered to evaluate the system performance. Simulations are performed using MATLAB software. It is found that proposed scheme based DWT-OFDM system performs better than Proposed scheme based FFT- OFDM system under all the considered modulation schemes.**

Keywords: **OFDM, DWT, FFT, QAM, PSK**

I. INTRODUCTION

A communication network should be able to transfer data from one end to another with acceptable accuracy. During transmission, data/message gets corrupted in channel. The channel can be microwave links, fibre optic or co axial cables which is subject to the various kind of noise, distortions and interference. Occurrence of error is random in nature, which are either due to interference in environment or due to physical defects. Such interference leads to change in the shape of the signal (original data).

Orthogonal Frequency Division multiplexing (OFDM) is a multi-carrier modulation (MCM) technique which has been found to be very effective for communication systems. OFDM scheme divide the available channel bandwidth into low bandwidth sub-channels. In the OFDM technique, a high-bit-rate data stream is split into N parallel low-bit rate data channel [1]. The parallel data streams are transmitted simultaneously on different carrier frequencies. This enables the channel to be robust against multi-path propagation [2]. OFDM suffers from many disadvantages. Sensitivity to carrier frequency offset, High peak to average power ratio, receiver complexity are the main disadvantages of OFDM systems [3]. In order to improve the orthogonality between the sub carriers, wavelet based OFDM [4] came in to picture. In Wavelet based OFDM, signal is localized in both time and frequency domain. Since, wavelets maintain their orthogonality even in difficult channel conditions [5], so wavelet based OFDM system provide more robustness against the inter symbol interference (ISI) and inter carrier interference (ICI). Further, DWT-OFDM has much higher spectrum efficiency than conventional OFDM.

During transmission of data from sender to receiver through communication channel, the data gets corrupted due to varying channel conditions. In order to provide more robustness against the errors introduced, the data is send into coded form from the sender end. The technique used for coding the data at the sender side is called Error Detection and Correction Codes (EDAC) [6]. EDAC are mainly of two types- Automatic Repeat Request (ARQ) and Forward Error Correction (FEC) codes. In ARQ, the receiver sends positive or negative acknowledgement to the sender[7]. If negative acknowledgement is received at the sending end, the sender resends the data to the receiver. This process will be repeated until positive acknowledgement is received from the receiver [8]. But, this scheme is not suitable in case of noisy channel conditions. As for a noisy channel conditions, the chances of receiving corrupted bits are very large at the receiver side. So, data has to be sent at large number of times [9]. This will not be cost effective. Moreover, it will lead to increase in the time of communication. FEC's found to provide more reliable data transmission than ARQ. In FEC, extra bits are send along with the information bits from the sending end [10]. These extra bits help to correct the corrupted bits at the receiver side. As the correction of the corrupted bits is done at the receiver side, so there is no need of resending of the data. So, FEC is a cost effective to some extent but it must be kept in mind that this increased error correction capability is achieved at the cost of loss of band width [11]. Various error correction codes have been developed till date namely Block codes, LDPC Codes, Turbo codes, Convolution codes etc. Among all, the convolution codes have gained much attention due to their simple construction and exceptional error correction capability [12].

Researchers are continuously working to enhance the performance of the convolution code based systems. Simmi Garg et al. have proposed an error correction code that can lead to improvement in the performance of the communication system [13]. Authors have investigated the relative performance of the Proposed scheme coded DWT-OFDM with Convolution scheme coded DWT- OFDM system and results depicted that proposed scheme based DWT-OFDM system outperform the Convolution scheme coded DWT-OFDM system[14]. In this present paper, authors have studied the performance comparison of proposed scheme coded DWT-OFDM with that of Proposed scheme coded conventional OFDM systems. System model has been explained in section 2. Section 3 explains the results and discussions while section 4 concludes the paper.

II. SIMULATION MODEL

The main objective of our work is to simulate the proposed scheme coded DWT-OFDM using wavelet family and compare its performance with proposed scheme coded FFT-OFDM. The block diagram of the proposed system is shown in the figure 1.

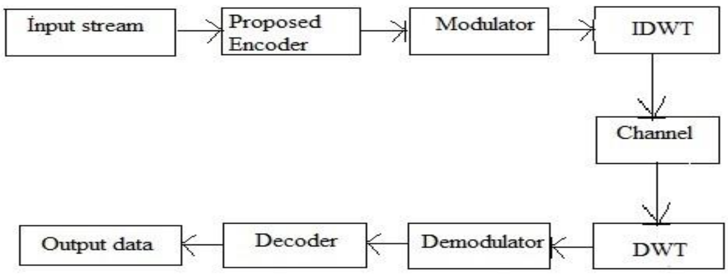

Figure 1 Block diagram of simulation model

For simulating the desired communication system, we have considered randomly generated input data bits. The number of input data bits is 64000. MATLAB software is used to write algorithm for the proposed scheme coded DWT-OFDM system. Various parameters are changed to study the performance of proposed system.

III. RESULTS AND DISCUSSION

In our study, we have done simulations to study the performance of proposed scheme coded DWT-OFDM system in comparison to proposed scheme coded FFT-OFDM system. The BER plots of the proposed system have been compared with that of proposed scheme coded FFT-OFDM system over AWGN channel. Figure 2 represents the performance of proposed scheme coded DWT-OFDM and proposed scheme coded FFT-OFDM using Haar wavelet and 16-QAM modulation. It is clear from the graph that proposed scheme coded DWT-OFDM outperforms proposed scheme coded FFT-OFDM system.

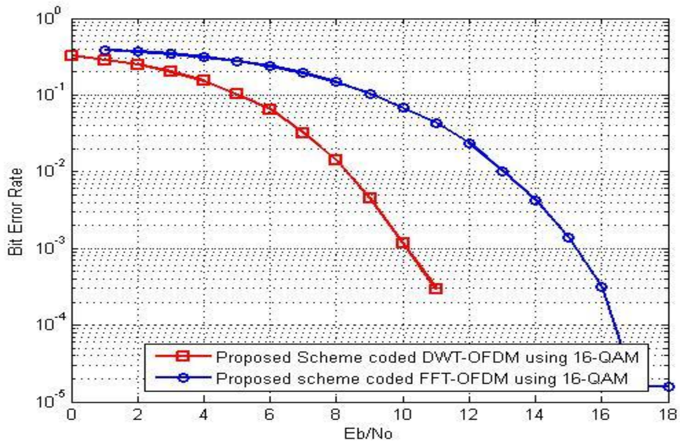

Figure 2 Performance of proposed scheme coded DWT-OFDM system as compare to Proposed scheme coded FFT-OFDM using 16-QAM modulation

Figure 3 and 4 depicts the relative performance of proposed scheme coded DWT-OFDM system and Proposed scheme coded FFT-OFDM using 32-QAM and 64 QAM modulation respectively. AWGN channel has been considered for simulations. This is clear from the results obtained that performance of the proposed scheme coded DWT-OFDM system is better than Proposed scheme coded FFT-OFDM for both types of modulation schemes.

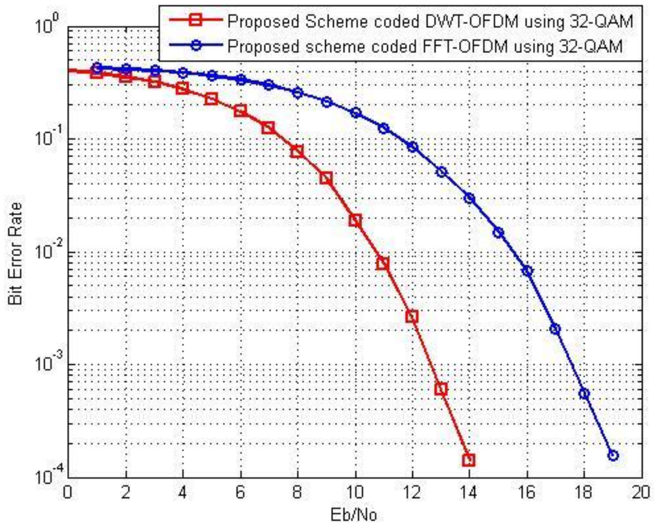

Figure 3 Performance of proposed scheme coded DWT-OFDM system as compare to Proposed scheme coded FFT-OFDM using 32-QAM modulation

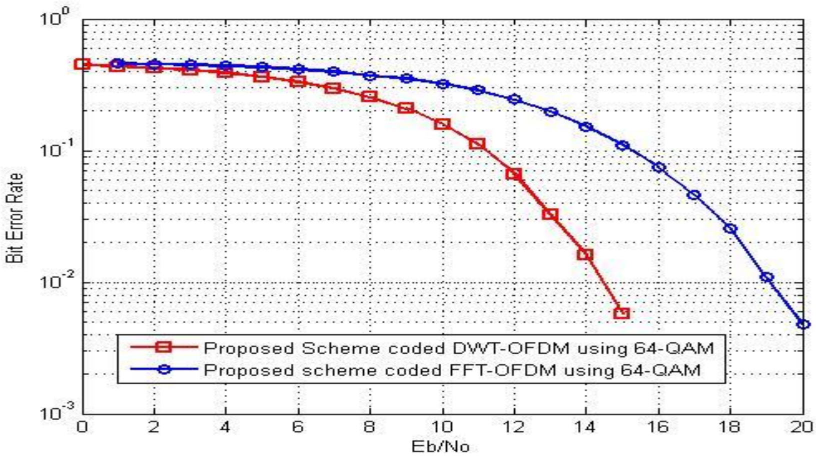

Figure 4 Performance of proposed scheme coded DWT-OFDM system as compare to Proposed scheme coded FFT-OFDM using 64-QAM modulation

Moreover, the Proposed system has been studied using different PSK modulations over AWGN channel. Figure 5 shows that performance of Proposed scheme coded DWT-OFDM with Proposed scheme coded FFT-OFDM system using 16-PSK modulation over AWGN channel. Haar wavelet has been considered for simulations. Proposed system outperforms the Proposed scheme coded FFT-OFDM over entire range of Eb/No considered. For example, in order to achieve BER of 10^{-3}, Proposed system requires 13dB of Eb/No value while conventional FFT-OFDM system needs 18 dB of Eb/No value.

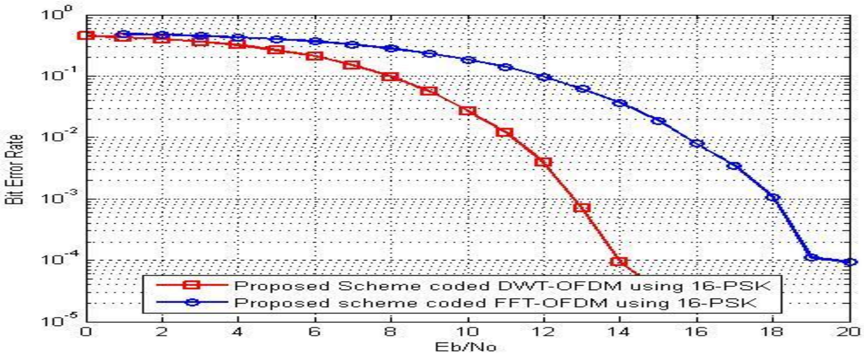

Figure 5. Performance of proposed scheme coded DWT-OFDM system as compare to Proposed scheme coded FFT-OFDM using 16-PSK modulation

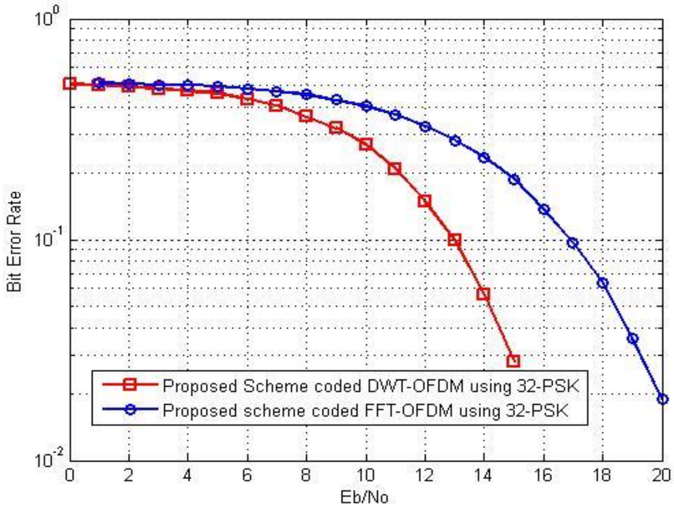

Figure 6. Performance of proposed scheme coded DWT-OFDM system as compare to Proposed scheme coded FFT-OFDM using 32-PSK modulation

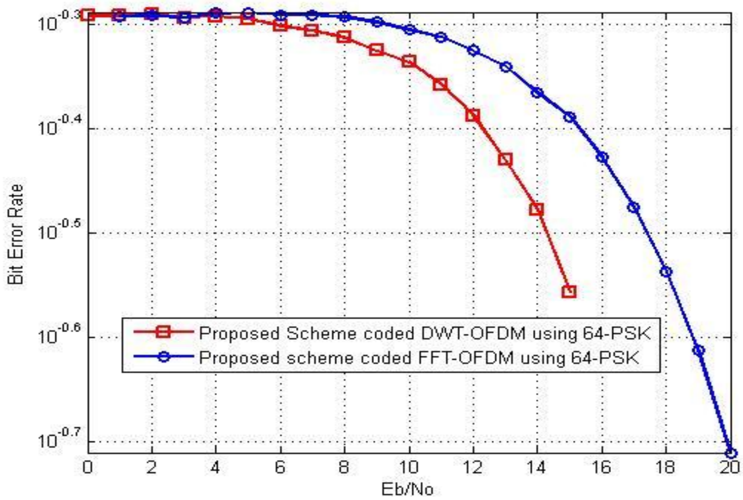

Figure 7. Performance comparison of Proposed DWT-OFDM with FFT-OFDM using 64PSK modulation

Figure 6 and 7 shows the performance comparison of proposed system with that of Proposed scheme coded FFT-OFDM system using 32 and 64 PSK modulation scheme over AWGN channel. Here again, Proposed scheme coded DWT-OFDM system found to outperform the conventional system.

IV. CONCLUSIONS

In this paper, earlier proposed error correction scheme based DWT-OFDM is compared with proposed error correction scheme based FFT-OFDM. Performance of the system has been evaluated using 16, 32, 64 QAM and PSK modulation schemes. Results depict that Proposed scheme coded DWT-OFDM system outperforms the Proposed scheme coded FFT-OFDM with all types of modulation schemes considered.

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