ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 10, October 2015

Performance of OFDM-IDMA System for single user

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ABSTRACT: Current wireless communication in real-life applications as well as reliable transmission of high data rate wireless communication model called OFDM requires communication systems for all kinds of orthogonal frequency division multiplexing is the base model (OFDM) multicarrier modulation technology that every single low rate data stream containing divides the spectrum available in subcarriers with subcarrier is nothing but further OFDM. Recently the Interleave-division multiple-access (IDMA) is presented scheme for multiple access. This approach employs the random interleaves as this is only way for user separation. But as compared to the CDMA, IDMA scheme based on number of distinguished features of CDMA by overcoming the limitations of CDMA. Later this allows multi user detection (MUD) algorithm to use with multiple inputs and multiple outputs (MIMO) where numbers of users are more high-rate multiple access communication. The main aim of this paper is to present the review of OFDM model as well as an single user OFDM-IDMA model. OFDM-IDMA system is result of combination of advantages of both IDMA and OFDM.

KEYWORDS: OFDM; IDMA; CDMA; Multiuser Detection; Interleave; transmitter; receiver.

I. INTRODUCTION

The limitation of using wireless communication systems is the limited bandwidth. This is becomes more limited as the use of such communication system increases rapidly [1]. Thus due to the limited bandwidth availability, the big organizations are suffering from huge loss [2]. Therefore currently the advances in central processing unit as well as digital signal processor resulted into the more improvements in the algorithms and smart antenna system's experimental validations build the environment where the use of cost effective smart antennas is feasible in different kinds of wireless markets [3].

Recently another multiple access schemes based on the Orthogonal Frequency Division Multiple Accesses commonly used for high –data rate multiple user transmission system. OFDMA technique is robust against Inter symbol Interference and Multiple Access Interference. Whatever in order for efficiently utilizes the bandwidth of the system, it has to be shared by all users which is limiting the data rate.

To solve this issue, in literature many authors proposed an OFDM-IDMA system where the authors presented the receiver performance assuming that the channel is known. The transmitted signal interacts with the channel environment in a very complex way. As a radio signal travels between the transmitter and receiver, the signal experiences a path loss in power.

In recent years a new multiple access technique, where the users are separated through their unique interleaving patterns, has generated a large interest in the research community. The technique, referred to as IDMA [1], and has been shown to mitigate multiple access interference while simultaneously achieving a high spectral efficiency. IDMA shares many properties with code division multiple access (CDMA), where user separation is obtained through user-specific spreading codes, and has shown similar performance but with a reduced receiver complexity [1]–[4]. When the system bandwidth grows in single carrier systems, the equalization process becomes increasingly challenging due to the increase in the number of resolvable paths. Introducing orthogonal frequency division multiplexing (OFDM) simplifies this task by transforming the wideband channel into a set of orthogonal narrow band sub channels. A simple scalar equalization can then be performed separately for every sub channel. By combining IDMA and OFDM, an efficient multiuser system is formed which efficiently combats ISI and also reaches a high spectral efficiency [5], [6].

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In this paper we are presenting the review of OFDM systems with their mathematical models and equations used as well as OFDM- IDMA. We are also presenting the advantages of using OFDM- IDMA.

II. Related work

Orthogonal frequency division multiplexing (OFDM) is a multicarrier modulation technique that available spectrum subcarriers, each subcarrier with a low rate data stream containing the proper spacing and Subcarriers. Pass band filter shape shown in Figure 1 as orthogonality to santush OFDM wireless communication. Is a proven, scalable, adaptive technology by providing cognitive radio (CR) concept will play an important role in realizing. Gap symbol interference (ISI) completely every OFDM symbol in a guard-band OFDM using guard bands. Using cyclically in the tax gap-carrier interference (ICI) to avoid extended the advantage of robustness OFDM system in wireless communication is the environment in which channel the vanishing. Frequency selective fading is reduced by increasing the number of subcarriers. By choosing the coherence bandwidth is greater than the subcarrier spacing of channel, every subcarrier is going too affected by a flat channel and thus no or simple channel equalizer is needed.

OFDM is used in many wireless applications today. Already it is used in different WLAN standards (e.g. HIPERLAN-2, IEEE 802.11a), Wireless Metropolitan Area Networks (WMAN), Digital Video Broadcasting (DVB), 3GPP-LTE, Asymmetric Digital Subscriber Line (ADSL) and power line communications.

Despite of OFDM advantages, it has a major potential drawback in the form of high Peak-to-Average Power Ratio (PAPR). The high PAPR has nonlinear nature in the transmitter and it degrades the power efficiency of the system.

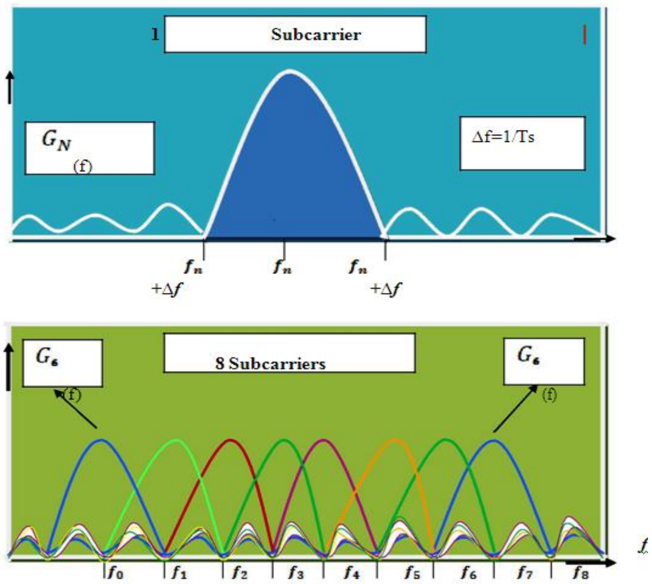

Figure 1: OFDM subcarriers in a frequency domain

III. Proposed SYSTEM

OFDM is a special case of multicarrier transmission, where a datastream is transmitted over a number of lower rate subcarrier. By using, OFDM is to increase the robustness against frequency selective fading or narrowband interference.

Proposed OFDM-IDMA architecture shown in figure 2. The transmitter side contains channel encoder, spreader, interleaver, symbol mapper, IFFT, cyclic prefix (CP) is added then data goes through AWGN channel. Then removal the CP is done, signal goes to FFT .Elementary signal estimator evaluates BER and other performance measures for the user-k .The receiver side deinterleaving, dispreading is done and last decoding operation is done with SOVA decoder.

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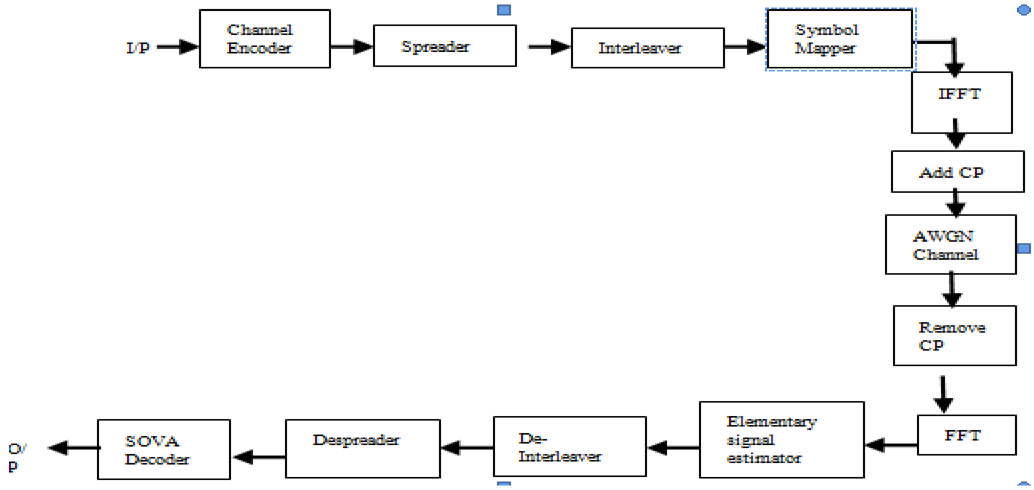

Figure 2: Proposed OFDM-IDMA system.

A Basic OFDM-IDMA system is described in Figure 2. Here an input data symbols are supplied into a channel encoder that data are mapped onto BPSK/QPSK/QAM constellation.
The data symbols are converted from serial to parallel and using Inverse Fast Fourier Transform (IFFT) to achieve the time domain OFDM symbols. Time domain symbols can be represented as:

$$x_n = IFFT\{X_k\}$$
$$= \frac{1}{N}\sum_{k=0}^{N-1} X_k e^{\frac{j2\pi kn}{N}} \quad 0 \le n \le N-1$$

Where, X_k is the transmitted symbol on the k^{th} subcarriers N is the number of subcarriers. Time domain signal is cyclically extended to prevent Inter Symbol Interference (ISI) from the former OFDM symbol using cyclic prefix (CP).

Simulation Settings and Environment

- We used the MATLAB simulation tool for the performance evaluation of proposed scheme against the existing scheme.
- Following are the software details for simulation study:

Software: MATLAB 2009 or Onwards

- We are considering the following OFDM system design parameters with modulation technique such as BPSK etc.
- IFFT/FFT size = 64
- no of data subcarriers = 52
- BPSK = 2
- OFDM symbol=10^1
- SNR = 20dB

Turbo encoder is combination of 2 convolution encoder and random interleaver. Spreader is used to spread the bit in 3 part. OFDM specification is specified.

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IV. SIMULATION RESULTS

The simulation study involves 1 user data with 8 iteration in Fig. 3 10^1 message input bit is send and get 28dB SNR. The main objective of this project is to send maximum data with minimum error. In Fig. 4 10^2 message input bit is send and get 29dB SNR. In Fig. 5 10^5 message input bit is send and get 8dB SNR .In Fig. 6 graph for coded and uncoded is shown, in coding data is encoded through encoder. In uncoded data is not encoded through the encoder.

To show the result and testing purpose various bits send through the input.

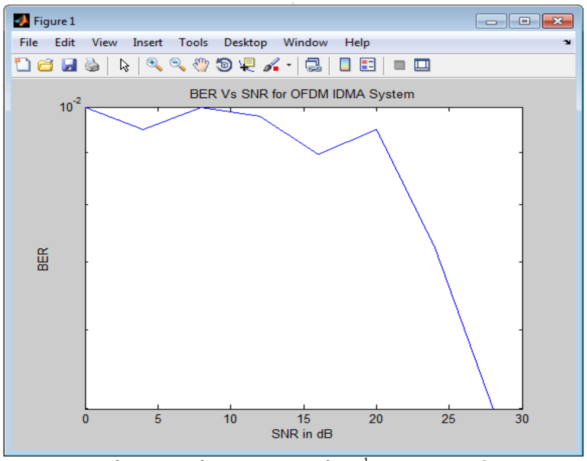

Fig.3. BER Performance of OFDM-IDMA for10^1 message input bit

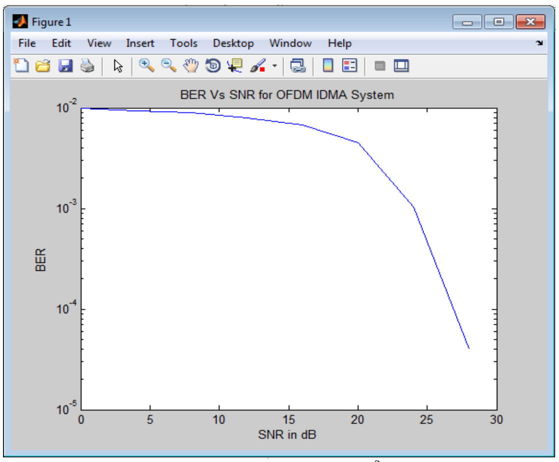

Fig. 4. BER performance of OFDM-IDMA for 10^2 message input bit

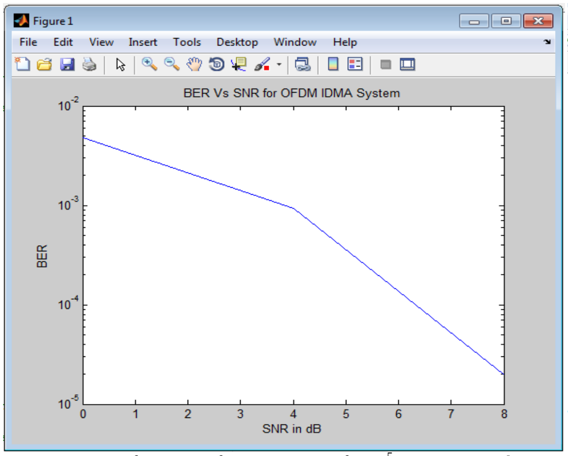

Fig.5. BER performance of OFDM-IDMA for 10^5 message input bit

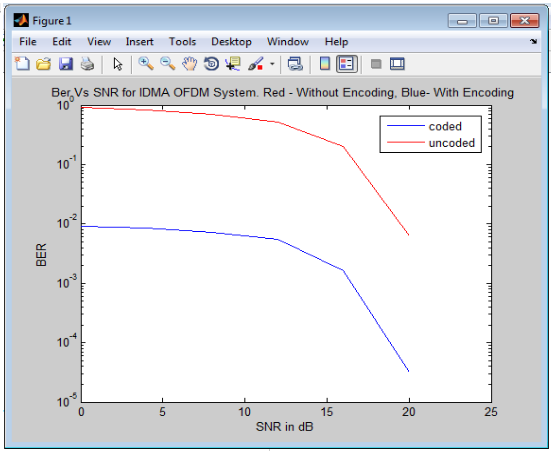

Fig 6. BER performance for coded and uncoded OFDM-IDMA system

V. CONCLUSION AND FUTURE WORK

In this paper we have discussed the OFDM-IDMA systems at first. After this point, we are presenting the efficient method of wireless communication system called OFDM-IDMA. As per our survey, OFDM-IDMA is proposed to overcome the limitations of existing communication techniques such as OFDM, OFDM-CDMA etc. OFDM-IDMA combines the advantages of OFDM and IDMA in order to overcome problems like MAI and ISI. For the future work, we suggest to work on efficient channel estimation technique for OFDM-CDMA.

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