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Reducing Bit Rate Error in OFDM Using DPSS Technique

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Abstract: The latest technology that provides higher bit rate and transmits data from source to the destination in greater speed is the OFDM technique. The multiplexing of various signals and transferring them orthogonally is done through various signals within the OFDM. For the purpose of transmitting data various OFDM techniques are being utilized amongst which the MIMO is the most efficient technique. The signal is split into various signals in the MIMO technique. For the purpose of receiving and demodulating the signals at the destination end, various receiving antennas are present. Higher bit rate errors caused are the major drawback of this technique. For the purpose of reducing bit rate error in MIMO, various new techniques have been evolving over the past few decades. A novel technique is proposed in this study which reduces the bit rate error within the OFDM MIMO technology. This technique involves the filtering mechanism in which the DPSS filter is utilized for reducing the bit rate error within the system.

Key words: OFDM, MIMO, DPSS, bit rate error, filtering, system

INTRODUCTION

There is an increase in demand of the wireless and high speed wireless communication systems with the advancement in technology. There is a need of swifter data processing, incremented data rate as well as improved performance (Theodore, 2010). These requirements are provided with the help of combination of two powerful technologies, known as Multiple-Input Multiple-Output (MIMO) antennas and orthogonal frequency (Armstrong, 1999). The transmission across wireless links that are created over multiple antennas that are equipped on transmitters and receivers is known as MIMO wireless communication. There is an increase in performance of systems as this communication provides increment in reliability factor (Zhao and Haggman, 2001). Also, higher data rate is provided with the help of spatial multiplexing within the system. For multipath signals travelling through different paths have their independent effect imposed by the channel. The discrete implementation of multicarrier modulation that partitions the transmitted bitstream into various substreams is known as the OFDM technique (He *et al*., 2008). These substreams are forwarded to various sub-channels that are orthogonal. The selection of various sub-channels along with which it is ensured that each sub-channel comprises of bandwidth which isles than the coherence bandwidth of the channel. There is very less Inter-Symbol Interference (ISI) present within each sub-channel. Within various high data rate wireless systems the OFDM is utilized due to its advantages. For the removal of ISI from the signal various equalizers are utilized. There are various enhancements made over channel. For this the knowledge of CIR (Channel Impulse Response) is required which helps in recovering the signal that is transmitted (Kang *et al*., 2011; Lajos, 2010). The physical medium of the system that connects the transmitter and receiver is done with the help of the SISO/MIMO channel model within the communication mode. There are both wireless and wired modes of connection provided by them. There are various factors that might lead to the corruption of the received waveforms. Some of such factors are non-linear distortion, interference from various transmissions, atmospheric noise, fading and so on. There are numerous antennas present at the receiving end of the digital communication system (Agrawal and Raut, 2011). A weighted and filtered sum of various transmitted waveforms is received from every different antenna. Towards the transmitter and/or receiver, less number of RF chains is included for solving this issue. This also includes the antenna selection technique along with it which also reduces the complexity of the system along with the maintenance of benefits of MIMO systems. For the MIMO channels are not related to each other, this antenna selection scheme also provides better results. The fading correlation which also provides lack of spacing within the antennas is depicted by the most practically provided cellular channels. As the signals at

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various antenna elements depict the correlation within such channels, the hybrid selection methods do not perform better as compared to the full-complexity methods. This further decreases the profit of the antenna selection (Sarma and Mitra, 2010).

Literature review: Armstrong (1999) presented in study, that there are certain effects caused by the errors resulting in OFDM technique. In terms of complex weighting coefficients, description of ICI is provided. This is due to the fact that there is carrier frequency offset within ICI. There has been a proper analysis made with respect to complex weighting factors on the self ICI cancellation and windowing schemes. It is seen, that the component of ICI is canceled because of the linear variation of the weighting coefficients when a group of three coefficients is put through. The novel self ICI cancellation schemes that have been proposed involve the cancellation of higher order components (Armstrong, 1999). Zhao and Haggman (2001) proposed a study on the ICI self cancellation scheme which helps in providing ICI effect on the OFDM systems. With the help of simulations the theoretical studies have been proposed for the enhancement in CIR. Within a multipath radio channel which includes the Doppler frequency spread, the method gives better performances. The performance of standard OFDM systems is much better than the OFDM system that includes the ICI self-cancellation method when similar bandwidth efficiencies and larger frequency offsets are involved. Without enhancing the system complexity, there is no need for reducing the ICI which also involves reduction in the system complexity (Zhao and Haggman, 2001). He *et al*. (2008) proposed a new method which involves the fading channels within it along with the analysis of ICI and ISI. Within this study, the combined analysis is done on the two types of interfaces along with the implementation of the Kalman filter. The noise is reduced with the help of equalizer which also includes the estimation of channel for uncertain interferences found across the channel (He *et al*., 2008). Kang *et al*. (2011) utilized a CQI table adaption method for the channel prediction which also involves the effective modulation as well as the coding method within the OFDM method. On the basis of specific statistical parameters and various other filters the analysis of the channel. This further helps in noise analysis. The quality of channel and the adaptive utilization table is created for getting the verification regarding the channel limits related to various parameters. Some of these parameters involved are the error reduction specified to the wiener filter (Kang *et al*., 2011). Agrawal and Raut (2011) proposed the technique which involves the fading of channel as well as the Gaussian noise technique which also involves the study of BER performance related to MIMO OFDM system. This system includes the AWGN (Additive White Gaussian Noise) channel and rayleigh Fading channel which follows the simulation channel with the help of various modulation techniques. Two different ways are utilized in which the first is proposed for the analysis of BER. The second involves the reduction of ICI for which the second Kalman filter is implemented for analyzing BER (Agrawal and Raut, 2011). Sarma and Mitra (2010) proposed in this research, a new technique which includes the MIMO channel modeling along with Temporal Artificial Neural Network architectures. The statistical nature of the network is adapted by the network along with the combination of the neural. This helps in providing efficient channel estimation along with symbol recovery. The multi-layered perception architecture is kept as a base for providing such enhancements. The indoor network is involved here in which the slow fading conditions are performed for modeling the channel.

LDPC codes and DPSS filtering: A class of linear block codes is known as the Low-Density Parity-Check (LDPC) code. The ideology of this technique is developed from its property of parity-check matrix involved. This method contains only few 1' as comapared to the number 0's. The performance very similar to the numerous channels and the linear time comples algorithms for decoding is involved here. This is very beneficial for the performance of this code. The techniques that involve parallelism also are now utilizing this code within their system applications for enhancing the performances. A regular LDPC code involves that each code digit is provided in the same number of equations. Also, similar numbers of code symbols are present within each equation (Tan *et al*., 2011).

Filtering is a very important factor within the radio communication systems. The removal of noise form the electromagnetic ssignal while protecting the useful information is done with the help of good filtering for avoiding the corruption of noises within the radio communication signals (Mackay, 1999). The deformities present within the linear systems are removed with the help of DPSS method which includes various mathematical equations which provide an efficient computational means for estimating the state of a process. This helps in reducing the mean of the squared error of the application. The statistically optimal results are to be produced recursively by applying this filter on the stream of noisy data. It supports estimations of pat, present as well as future states and also performs better when the precise nature of the modeled system is not known.

MATERIALS AND METHODS

One of the emerging communication methods which provide efficient communication using the multi-carrier

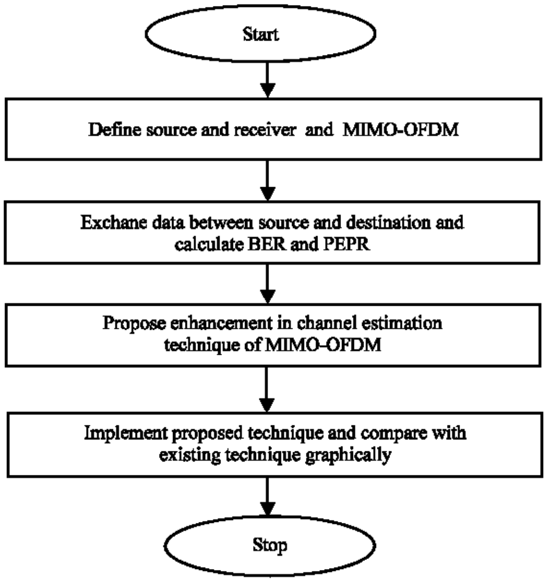

Fig. 1: Flowchart of methodology

modulation is the MIMO OFDM technique. This technique has been utilized by various wireless networks. The channel frequencies identified across the network are basically an inspiration for the OFDM communication within the network. The inter carrier interference is the orthogonal distortion which occurs across the channel within the network. The issue is resolved by utilized the two phase Kalman filter which analyzes the signal interference as well. The analysis of signal for PAPR is done within the first phase with the help of DPSS. This reduces the PAPR noise which further reduces the overall noise present within the application. In this research, the DPSS (Discrete Prolate Spherpoidal Sequences) channel estimation tecgnique will be applied with forward propagration to reduce bit error rate in MIMO-OFDM. There are various finite as well as infinite values on which the double orthogonal property of the DPSS technique is imposed. The bit error rate of the MIMO-OFDM technique is reduced. Further, the windowing techniques are utilized for channel estimation. With the help of back propagation method, the DPSS method is utilized at the receiver side. The DPSS technique is run in an iterative manner with the help of back propagation technique and further the error is reduced at each iteration (Fig. 1).

RESULTS AND DISCUSSION

The MIMO-OFDM is the technology which sends the data from source to destination using orthogonal frequency multiplexing technique. The DPSS technique is applied with the MIMO-OFDM to reduce bit error rate in the network. The simulation of the proposed and existing model is done in MATLAB and performance of both models is compared in terms of bit error rate.

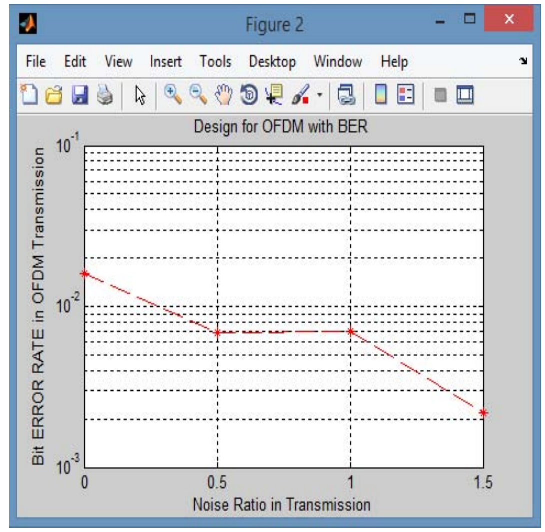

Fig. 2: MIMO-OFDM due to noise

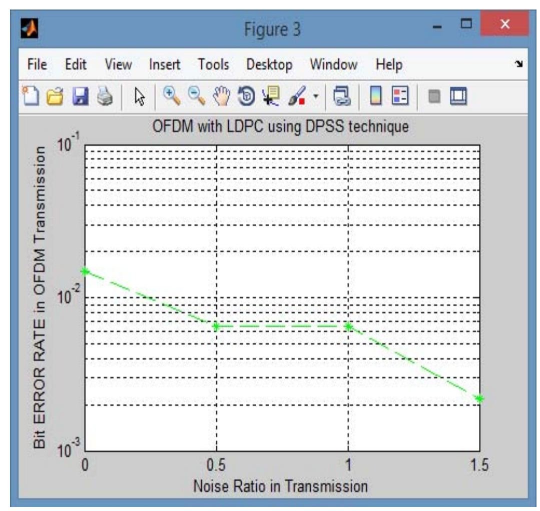

Fig. 3: MIMO-OFDM with DPSS

As illustrate in Fig. 2 red line shows the noise ratio in MIMO-OFDM transmission. As illustrate in Fig. 3 green line shows noise ration using DPSS filter in MIMO-OFDM transmission.

As illustrate Fig. 4 red line shows noise ratio in MIMO-OFDM and green line shows noise ratio in MIMO-OFDM with DPSS filter. It shows that, noise ratio and bit error is less with DPSS as compare to simple MIMO-OFDM.

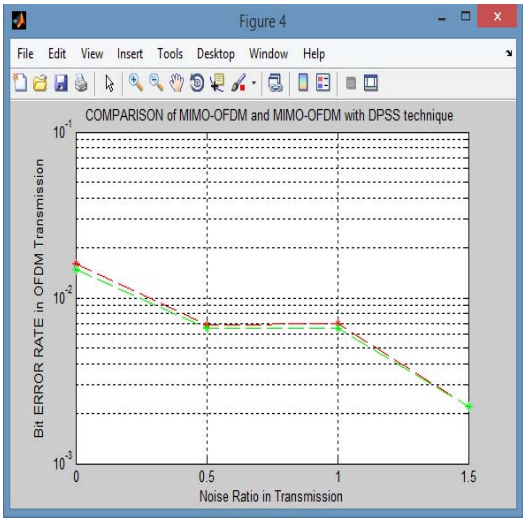

Fig. 4: Comparision of both techniques

CONCLUSION

Through various results, it is seen that the OFDM MIMO is an efficient technology which provides the transferring of data at higher bit rate. The efficiency of the network is reduced due to the higher bit rate provided by the MIMO technique. The DPSS technique is utilized for reducing the bit rate error which is a filtering technique and includes mathematical computations. It is seen from the simulation results that the proposed technique is more efficient as compared to the previous technique.

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