

A Review Work ON Comparative Analysis OF DWT Based OFDM AND DFT Based OFDM Using Different Modulation Approaches TO Improve BER Performance

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Abstract---A review work on the BER based OFDM system is presented in this paper for the DWT OFDM approach. The OFDM communication model overcomes the drawbacks of conventional communicational model and offers the high data rate, and high spectral efficiency. Compared to conventional approaches the 4th generation Long term evolution application has better spectral efficiency in terms of accuracy and high data rate, the 4th generation Long term evolution approach is formed by the collaboration of OFDM and MIMO. Although OFDM has many advantages over FDM but it suffers from inter carrier interference and inter symbol interference when multiple carriers are used and due to this interferences loss of Orthogonality happens, in order to overcome these interferences usage of cyclic prefix has become mandatory. But usage of cyclic prefix shows huge negative impact on bandwidth efficiency as the cyclic prefix approach consumes nearly 20% of bandwidth and BER performance too affected. In this paper a novel wavelet based OFDM model is presented which is mainly intended to provide good Orthogonality and better spectral efficiency using various modulation techniques, the unique thing in the usage of wavelet based OFDM is it does not need any spectral efficiency and absence of the cyclic prefix increases bandwidth efficiency when bandwidth increases simultaneously spectral efficiency increases. Finally the usage of the wavelet based OFDM shows improved BER over conventional FDM communication model. The simulation results indicates the usage of wavelet based OFDM in place of DWT based OFDM in LTE and finally the comparison between wavelet based OFDM and DFT based OFDM.

Keywords: OFDM, MIMO, LTE, Cyclic Prefix, ICI & ISI, Spectral Efficiency

1. INTRODUCTION

In olden days people used to communicate with distant counterparts by make usage of traditional approaches like sending the information with birds, sending people as ambassador to convey the information. Most of the researchers termed 21st century as Communication arena due to the high end technological advancement in this area which makes communication fast and reliable. The intense research classified communication into two categories a) wire based communication b) wireless based communications. Wire based communications is considered as most useful tool in world wars to convey information from one end to another in 1940's and optical fiber plays a crucial role in wire based communication mechanism and after completion of war the dominance of United States of America (USA) and Union of Soviet Socialist Republics (USSR) over the world makes the research on communication so fast that in two decades communication research grows from daily life communication to satellite communication and this development mainly because of wireless communication.

2. RELATED CONTENT

2.1 OFDM and its Orthogonality

In orthogonal frequency division multiplexing communication model the sub carrier used are orthogonal to each other. The Orthogonality helps in employing the overlapping between the sub carriers in the respective frequency domain. The accuracy of communication model is based on how effective the bandwidth is used and this is technically termed as spectral efficiency or bandwidth efficiency, the acquired bandwidth efficiency is free of Inter carrier interference and the absence of Inter carrier interference (ICI) is mainly because of usage of

Orthogonality in orthogonal frequency division multiplexing.

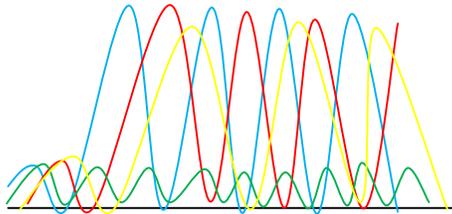


Figure 1: Orthogonality in orthogonal frequency division multiplexing (OFDM)

2.2 Basic OFDM System

The orthogonal frequency division multiplexing block diagram is illustrated as follows in figure 3. The input random signal data rate streams (high) are converted into data rate streams (low). The important aspect in the OFDM block diagram is the modulation technique which modulates the low data rate streams in parallel way and this parallel stream given input to the IFFT block which transforms the frequency data to time data before it reaches the channel. Adding the cyclic prefix acts as the guard interval and the reverse of transmission is accomplished at receiver end.

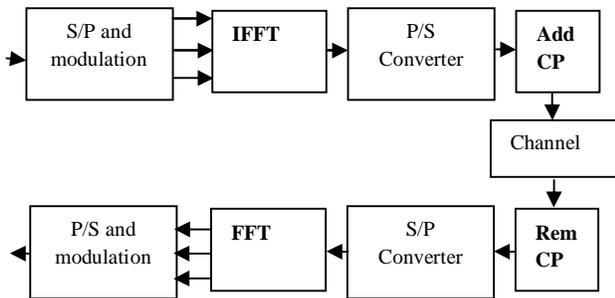


Figure 2: Block diagram of Basic OFDM system

2.3 MIMO OFDM system

The below block diagram represents the MIMO-OFDM system which comprises of transmitters and receivers in multiple way. The input data (digital) is generated by binary source generator as shown in below figure and the binary data is modulated with modulation approach such as BPSK, QPSK and QAM with several different constellations. The serial to parallel performs the task to convert the serial data to the parallel mode in N various sub streams. Then these various sub streams are modulated through the IFFT modulation block.

The IFFT block in the block diagram in design to transform the frequency to time domain for

obtaining the delay related issues at the channel and then guard interval named CP is inserted to tackle the issues like ICI/ISI. The OFDM symbols are initialized in the time domain which has specified length before giving it to the channel then the operation is performed in the inverse direction to remove all the operations which are performed and gets the output as OFDM signal in MIMO format.

3. LITERATURE SURVEY

(1) A novel 4G cellular system based research oriented review paper is proposed by IAN F. AKYILDIZ *, DAVID M. GUTIERREZ-ESTEVEZ, ELIAS CHAVARRIA REYES in the year 2010. The analysis of the LTE (Advanced) and detailed review on the technologies related to the LTE (advanced) are discussed in the paper. Initially the optimized evolution from the 3G to 4G is discussed in detailed way based on the properties and characteristics. The novel thing presents in this paper is development of the advance integration approach which integrates the current and future generation radio access technologies based on the 3GPP network architecture. In the latter step the drawbacks frequently happen are highlighted and necessary approaches are presented to resolve the issues in equipped way [3].

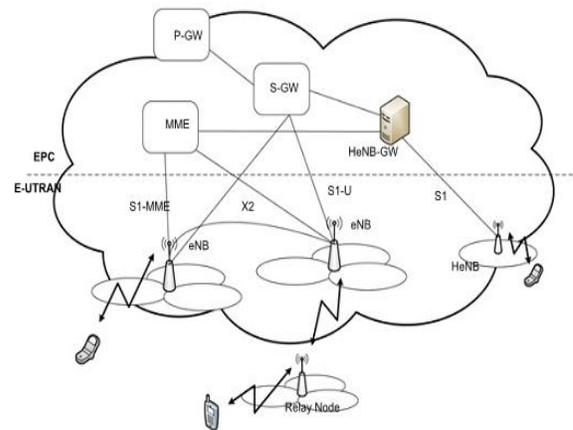


Figure 3.1: Architecture of the LTE-Advanced E-UTRAN

This literature review focuses on technologies like enhanced MIMO, carrier aggregation, reception, transmission in terms of multipoint approach and relays. All technologies are analyzed in detailed way to know the benefits in order to tackle the problems

and although tremendous amount of research done in past years still lot of problems yet to be solved which needs attention in future works.

(2) An optimized multicarrier modulation has proposed by JOHN A. C. BINGHAM in the year 1990. The proposed method in this review work divided the transmission data into several small bit streams based on the principle of transmitting data. These divided small bit streams are used to modify the several carriers according to the properties of the data carriers and the presence of these bit streams are observed in the COLLINS KINEPLEX system [4].

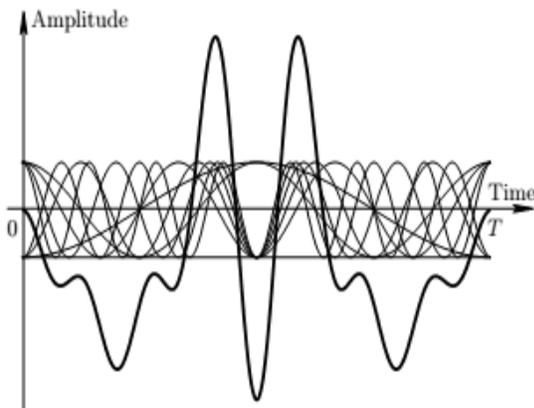


Figure 3.2: Representation of the multi carrier modulated signal

The HDSL application has great role various wireless standards and moreover high speed data is considered as the initial parameter for the HDSL. Multi carrier modulation approach is also spelled in different names as following but commonly it is called as multicarrier modulation (MCM). (a) Quadrature amplitude modulation (QAM) which is orthogonal in nature (b) Frequency division multiplexing (FDM) which is orthogonal in nature (c) Dynamically assigned multiple QAM. The digital multicarrier modulation approach changed drastically over the years and moreover the advanced modulation approach does not any enhancement at the receiver end.

(3) A bit error performance evaluation approach is proposed by L. JUN, T. TJENG THIANG, F. ADACHI, H. CHENG LI in the year 2000. The OFDM modulation scheme offers high data rate but frequently suffers from the inter carrier interference and fading which results in degradation of the bit

error rate. A novel closed form formula is designed in this work for the OFDM bit error rate performance assessment in two different frequency selective channels with huge diversity reception. Here three different profiles types are used for obtaining the bit error rate curves in terms of root means square delay spread approach. The different profiles are (i) One sided exponential profile (ii) Uniform profile and finally (iii) double spike profiles [5].

This review paper presents a work for the bit error performance evaluation in frequency selective channels in terms of Rayleigh and Rician channel. The parameters like probability and L paired gaussian variables is helps to form the closed form expression which is used to evaluate the performance of in terms of OFDM-MDPSK system in terms of bit error rate.

To meet the high speed wireless communication standards the work in this review paper use the newly derived formula and this bit error rate evaluation performance is based on the two selective channels in terms of frequency and time. Both frequency and time selective channels belong to the systems mobile radio frequency channel and finally this review work improves the bit error rate performance in an efficient way based on the LOS component.

(4) This review paper focuses on the work which evaluates the OFDM based multi wavelets performance by K. ABBAS HASAN, M. WALEED A., N. SAAD in the year 2010. Although OFDM has attracted attention from the worldwide researchers due to its ability to provide high data rate and mobility and at the same time OFDM suffers from drawbacks like Inter carrier interference, Inter symbol interference and delay. The reasons behind the frequent occurring of the inter carrier interference in the OFDM are its limitation in ability to use Orthogonality at the receiver end in the wireless communication reception and presence of inter carrier interference results in the abnormal accuracy in the channel tracking.

Generally the cyclic prefix usage is the common approach in the OFDM modulation scheme but the presence of the cyclic prefix shows its impact on the spectral efficiency. The cyclic prefix acts as the guard interval before the ach block in the OFDM system. The role of the transform technique has great

impact in assessing the OFDM performance in terms of bit error rate. Dft based OFDM offers low spectral efficiency compare to the DWT based OFDM and in this work the DWT based OFDM modulation scheme is replaced by the multi wavelets which helps in reducing the interference levels in both carrier and symbols and gradually shows good results in terms of increasing the spectral efficiency [12].

(5) A multicarrier modulation is consider as promising technique for wireless communication and a new work is proposed by K. WERNER, P. GOTZ, U. JORN, Z GEORG in the 2000. The paper focus on the ISI/ICI occurrence in the typical time changing channels and also compares the various trans-multiplexer structures. Here three types are discussed namely Wilson type, Gabor type and wavelet type and al these three represents the trans-multiplexer structures. The representation of the work is as follows

Among all structures the Gabor type obtains better stability because it has ability to give statistics in terms of Global as well as local which helps to built better system. The Gabor type supports the both standard and bi orthogonal OFDM. Various factors like bandwidth efficiency, PAPR, Robustness, Spectral efficiency, channel equalization are taken into consideration for WH type for future research. The future scope deals with MCM by using all parameters in detailed way.

(6) A discrete wavelet transform (DWT) for MP4 using VLSI architecture is proposed BY C. SEE JUNG, L. MOON HO, P. JU YONG in the year 1997 and in this work author proposed a new concept of DWT based high speed VLSI architecture where the similar computations for every octave taken into consideration for computations. The proposed method is designed to take separate odd and even values separate octaves in the parallel approach. Compare to conventional transform based architectures DWT based VLSI structure offers high speed system and they are computed with 100% utilization as $N/2$ cycles. The image transmission in applications like wireless communications and DSP require high speed processing which is achieved in reliable way by the proposed work [13].

5 CONCLUSION

In this work the analytical performance of wavelet based orthogonal division multiple has better performance than traditional discrete Fourier transform OFDM. In this paper a novel wavelet based OFDM model is presented which is mainly intended to provide good Orthogonality and better spectral efficiency using various modulation techniques, the unique thing in the usage of wavelet based OFDM is it does not need any spectral efficiency and absence of the cyclic prefix increases bandwidth efficiency when bandwidth increases simultaneously spectral efficiency increases. The BER performance is performed on different modulations namely QAM, QPSK.

REFERENCES

- [1] A. Ian F., G. David M., R. Elias Chavarria, "The evolution to 4G cellular systems: LTE-advanced", Physical communication, Elsevier, vol. 3, no. 4, pp. 217-244, Dec. 2010.
- [2] B. John A. C., "Multicarrier modulation for data transmission: an idea whose time has come", IEEE Communications magazine, vol. 28, no. 5, pp. 5-14, May 1990.
- [3] L. Jun, T. Tjeng Thiang, F. Adachi, H. Cheng Li, "BER performance of OFDM-MDPSK system in frequency selective rician fading and diversity reception" IEEE Transactions on Vehicular Technology, vol. 49, no. 4, pp. 1216-1225, July 2000.
- [4] K. Abbas Hasan, M. Waleed A., N. Saad, "The performance of multiwavelets based OFDM system under different channel conditions", Digital signal processing, Elsevier, vol. 20, no. 2, pp. 472-482, March 2010.
- [5] K. Volkan, K. Oguz, "Alamouti coded wavelet based OFDM for multipath fading channels", IEEE Wireless telecommunications symposium, pp.1-5, April 2009. [6] G. Mahesh Kumar, S. Tiwari, "Performance evaluation of conventional and wavelet based OFDM system", International journal of electronics and communications, Elsevier, vol. 67, no. 4, pp. 348-354, April 2013.

[7] J. Antony, M. Petri, "Wavelet packet modulation for wireless communication", *Wireless communication & mobile computing journal*, vol. 5, no. 2, pp. 1-18, March 2005.

[8] L. Madan Kumar, N. Homayoun, "A review of wavelets for digital wireless communication", *Wireless personal communications*, Kluwer academic publishers- Plenum publishers, vol. 37, no. 3-4, pp. 387-420, May 2006