

## Review on OFDM: Concept, scope and its application

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**Abstract:-** Orthogonal frequency division multiplexing(OFDM) is the case of multicarrier transmission in which a single data stream is transmitted over a number of subcarriers of lower rate. OFDM is a modulation format that is being used in latest wireless and telecommunications standards. OFDM has been adopted in the Wi-Fi arena where the standard like 802.11a, 802.11n, 802.11ac. It has been chosen for the cellular telecommunication standard 4G LTE. OFDM has been adopted for a number of broadcast standards from DAB digital radio to the digital video broadcast standards, DVB. OFDM effectively reduce the inter-symbol interference(ISI) caused by the delay spread of wireless channels. OFDM has been used in both wired and wireless communication medium. One of the major drawback of OFDM is its peak to average power ratio(PAPR). In this paper we are going to discuss basics of OFDM techniques, scopes, losses and its application.

**Keywords:-**orthogonal frequency division multiplexing (OFDM), bit error rate(BER), intersymbol interference(ISI), peak to average power ratio(PAPR).

### I. INTRODUCTION

**OFDM** is multicarrier multiplexing access Technique for Transmitting Large data over Radio waves[1]. Next mobile Generation system is expected to provide high data rate to meet the requirement for future multimedia applications. Minimum data rate required for the 4G System is 10-20Mbps & at least 2Mbps in moving vehicles. And modulation technique adopted by 4G mobile system is OFDM.[2]

As a promising technique, OFDM is used in various communication applications such as Digital Video Broadcasting (DVB), Digital Audio Broadcasting (DAB) and Wireless Local Area Network (WLAN)[3]. OFDM is a "Multi-carrier Modulation Scheme".It is much easier to use single carrier transmission scheme because of its simplicity. But the main problem of single carrier transmission is ISI (Inter Symbol Interference). OFDM is used to reduce the shortages of single carrier transmission. OFDM is a good solution for high speed digital communication.[4] The basic principle of OFDM is to transmit data in parallel streams.The chance of ISI is less in OFDM system.The major drawback of OFDM is its high peak to average power ratio (PAPR), which makes it sensitive to non-linear effect of power amplifier. OFDM is extensively used in wired and wireless broadband message systems due to its resistance to

inter symbol interference caused by a dispersive channel. OFDM has the added advantage of requiring a simple one tap equalizer at the receiver. OFDM is now progressively being considered as a inflection technique [5] for optical systems, it has better visual power efficiency than conservative intonation schemes such as on-off-keying and pulse place modulation. In conventional OFDM, the transmitted signals are bipolar and complex, but bipolar signals cannot be transmitted in an intensity modulated/direct detection optical wireless system, because the intensity of light cannot be negative. OFDM signals designed for IM/DD systems must therefore be real and non-negative. In modulations, evidence is mapped on to changes in frequency, phase or amplitude (or a combination of them) of a transporter signal. Multiplexing deals with share/lodging of users in a given bandwidth (i.e. it deals with distribution of accessible reserve).OFDM is a mixture of modulation and multiplexing. In this method, the given resource (bandwidth) is common among individual controlled data sources. Normal modulation techniques are solitary transporter intonation techniques, in which the incoming info is modulated over a single transporter. OFDM is a multicarrier intonation technique, which employs several transporters, within the billed bandwidth, to convey the information from source to purpose. Each transporter may employment one of the several accessible digital modulation techniques (BPSK, QPSK, QAM etc..).

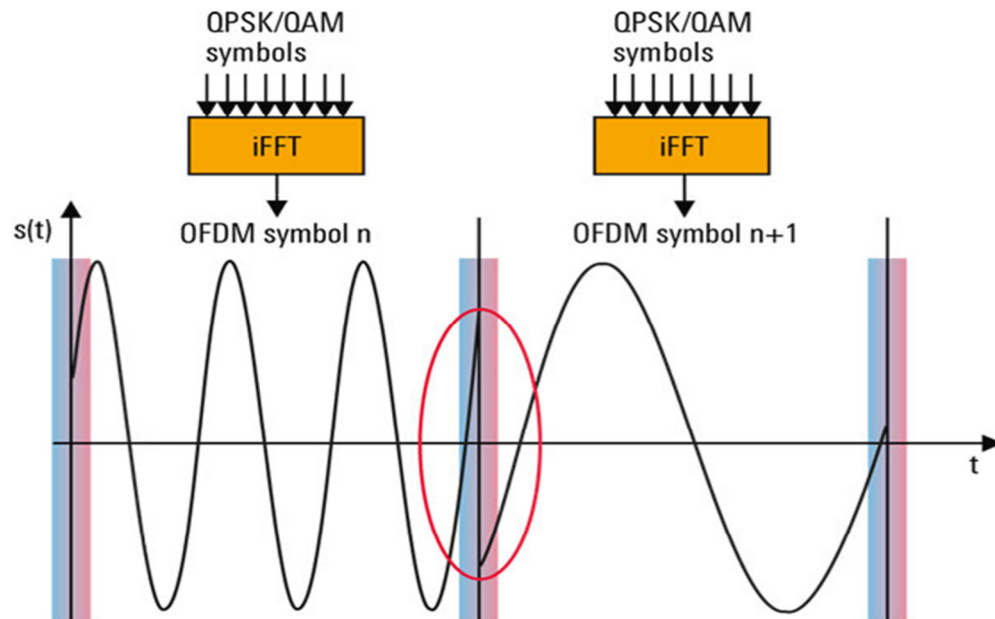


Fig. 1.1 Architecture of OFDM

## II. Why OFDM use?

Because OFDM is very effective for message over channels with frequency discriminating disappearing (different frequency mechanisms of the signal experience different vanishing). It is very hard to handle frequency selective fading in the receiver [6], in which case, the design of the handset is enormously complex. Instead of trying to moderate frequency selective fading as a complete (which OFDM mitigates the difficulty by converting the whole frequency selective declining channel into small flat declining channels by employing simple error correction and equalization schemes.

## III. Advantages of OFDM

The major advantage of OFDM is its robustness against multi path spread. Thus, it is appropriate to be implemented in wireless environments. The introduction of [7] cyclic prefix made OFDM system confrontation to time dispersion. OFDM sign rate is low since a data torrent is divided into several parallel streams before broadcast. This make the vanishing is slow enough for the channel to be considered as constant during one OFDM symbol interval.

- Makes efficient use of the spectrum by letting overlap.

- By separating the channel into narrowband flat vanishing sub channels, OFDM is more impervious to frequency selective fading than single carrier systems are.
- Channel equalization develops simpler than by using adaptive equalization systems with single carrier systems [6].
- Provides good guard against co-channel interfering and impulsive parasitic noise.

## IV. Disadvantages of OFDM

One of the major drawback of orthogonal frequency division multiplexing (OFDM) system is its high peak to average power ratio (PAPR), which force the transmitter's power amplifier to run with in non-linear operating region. This lead to significant power distortion at the output stage of power amplifier.[8]

Another disadvantage of orthogonal frequency division multiplexing (OFDM) is that is sensitive to carrier frequency offset and drift. Single carrier systems are less sensitive

## V. Applications of OFDM system

OFDM is one of the most prominent technique for growing request of large data rate transmission in both wired and

wireless mode of communication. The various application of OFDM system are given blow.[9]

- Digital audio broadcasting(DAB)
- Cellular telecommunications standards LTE/LTE-A
- In the WI-FI arena where the standards like IEEE 802.11a, 802.11n, 802.11ac etc.
- Wireless local area networks
- Wireless ATM transmission system.

## VI. CONCLUSION

Orthogonal frequency division multiplexing(OFDM) is the only way to full-fill the demand of high data rate wireless communication. Conventional single channel is also another way to transmit high data rate information, but it require high transmission bandwidth than the coherence information's bandwidth. This problem can be solved by multicarrier techniques. In this paper we present the basics idea behind the orthogonal frequency division multiplexing(OFDM), its scopes, advantages, disadvantages and applications in various fields. There are some limitations of this system like peak to average power ratio(PAPR), sensitive to frequency errors, which can be reduced by the use of suitable techniques like selective mapping, clipping and filtering, peak windowing etc.

## REFERENCES

- [1] Ahmed, Bannour, and Mohammad Abdul Matin. "Coding for MIMO-OFDM in Future Wireless Systems." Springer International Publishing, 2015.
- [2] Sukhpalsingh, Harmanjotsingh. "Review paper on OFDM-concepts and applications." 2015 international journal of engineering development and research |volume 3,issue 3| ISSN: 2321-9939.
- [3] Han, SeungHee, and Jae Hong Lee. "An overview of peak-to-average power ratio reduction techniques for multicarrier transmission." *Wireless Communications, IEEE* 12.2 (2005): 56-65.
- [4] Karimi, Bashir Reza, MojtabaBeheshti, and Mohammad JavadOmid. "PAPR Reduction in MIMO-OFDM Systems: Spatial and Temporal Processing." *Wireless Personal Communications* 79.3 (2014): 1925-1940.
- [5] Vishal Pasi, PrateekNigham andDr. VijayshriChaurasia. "Review on OFDM a brief survey." *International journal of scientifics and research publications*, volume 3, issue 11,November 2013.
- [6] Shi, Zhenguo, et al. "Improved spectrum sensing for OFDM cognitive radio in the presence of timing offset." *EURASIP Journal on Wireless Communications and Networking* 2014.1 (2014): 1-9.
- [7] Mishra, Amit, Rajiv Saxena, and Manish Patidar. "OFDM link with a better performance using artificial neural network." *Wireless personal communications* 77.2 (2014): 1477-1487.
- [8] Kamruzzaman, M. M. "Performance of turbo coded wireless link for SISO-OFDM, SIMO-OFDM, MISO-OFDM and MIMO-OFDM system." *Computer and Information Technology (ICCIT)*, 2011 14th International Conference on. IEEE, 2011.
- [9] ManushreeBhardwaj, ArunGangwar and DevendraSoni. "A review on OFDM: Concept, Scope and its applications." *IOSR journal of mechanical and civil Engineering*, Volume 1, issue 1(may-june 2012).
- [10] Da Costa Pinto, Fabio, et al. "A low cost OFDM based modulation schemes for data communication in the passband frequency." *Power Line Communications and Its Applications (ISPLC)*, 2011 IEEE International Symposium on. IEEE, 2011.
- [11] Nuwanpriya, Asanka, et al. "Position modulating OFDM for optical wireless communications." *Globecom Workshops (GC Wkshps)*, 2012 IEEE. IEEE, 2012.
- [12] Sumathi, K., and M. L. Valarmathi. "Resource allocation in multiuser OFDM systems—A survey." *Computing Communication & Networking Technologies (ICCCNT)*, 2012 Third International Conference on. IEEE, 2012.
- [13] Dissanayake, SarangiDevasmitha, and Jean Armstrong. "Comparison of ACO-OFDM, DCO-OFDM and ADO-OFDM in IM/DD Systems." *Journal of lightwave technology* 31.7 (2013): 1063-1072.
- [14] B. Benarji , Prof G. SasibhusanaRao and S.PallamSetty "BER Performance of OFDM System with various OFDM frames in AWGN, Rayleigh and Rician Fading Channel." "International Journal of Computer Sciences and Engineering" Volume 3, issue 4 (2015).
- [15] AnuragPandey and Sandeep Sharma, "BERperformance of OFDM System in AWGN andRayleigh Fading Channel" *International Journal of Engineering Trends and Technology*, ISSN: 2231-5381, Volume 13, Number 3, July 2014, pp. 126-128.