

# Principles and Wireless Communication Technique of OFDM

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**Abstract.** OFDM (Orthogonal Frequency Division Multiplexing) is wireless data transmission of high speed with fast development in recent years and great achievements in practical applications, particularly in the field of wireless communication.

## Introduction

OFDM technique has developed greatly for wireless communication in recent years due to the advantages of multi-path effect and anti-jamming capability, and has made achievements in practical applications. As a newborn thing, OFDM needs more time for mature development and applications. Several problems about OFDM need to be solved for better rationality of the technique.

## Overview of OFDM Technique

Jamming is common in various communication systems, and it has types of inter symbol interference, frequency selective fading and multi-path effect etc. For traditional data transmission, great cost may have to be made and the final results may be limited if fading or interference is to be solved. OFDM technique, therefore, emerges. OFDM technique codes data, and then modulates the data into radio-frequency signal in a way that is different from AM/FM techniques. OFDM can send many high-speed signals when through the computer orthogonal frequency, realizing reasonable utilization of broadband [1].

By contrast with FDM, OFDM requires less for broadband due to the application of orthogonal carrier without interference, and the frequency band of a single carrier needs no protection, thus the application efficiency of spectrum gets improved. Besides, dynamic assignment of data in every information channel can be made by OFDM technique, to obtain bigger throughput and to guarantee efficiency and safety of data transmission.

## Principles of OFDM

All the carriers in OFDM are orthogonal, and every carrier cycle within the time is integer, and there are overlapping regions between spectral nulls of carriers and adjacent spectral nulls of carriers. All of this can contribute to control the carrier jamming. Besides, due to the overlapping regions between carriers, OFDM technique can improve the utilization efficiency of frequency band.

In OFDM transmission, exchange of data flow of high-speed is carried out in a parallel-serial mode in which data flow shall be assigned to communication channels of lower rate for transmission. At this time, the channel cycle can be improved too, which may result in undesirable interference on systematic codes due to the extension of wireless communication channels [2]. In addition, the guard interval is introduced, which, if exceeds the extension of multi-path delay, can furthest eliminate interference caused by signals

## **OFDM and CDMA techniques**

### **(1) Advantages and disadvantages of CDMA**

CDMA has advantages that safety is high, anti-jamming capacity is strong and the same frequency can be in different community; it has disadvantages that the downlink of CDMA system can support various modulation although, the selected schedule for every modulation should be the same meanwhile the uplink cannot support various modulation, which causes poor flexibility for CDMA.

### **(2) Advantages and disadvantages of OFDM**

OFDM has advantages that it can resist interference between signal waves, and can improve the ability of the system to resist decay; it has disadvantages that OFDM is sensitive to phase noise and frequency deviation. Frequency deviation of 1% can decrease SNR by 30dB.

CDMA is applicable to conditions where safety is highly required and broadband is lower; OFDM is applicable to conditions in which there is no phase noise or frequency deviation.

### **(3) OFDM and 4G**

The core technology of 3G mobile communication is CDMA which has been established in the global, coming into service. By contrast with 2G mobile cellular, 3G has greater improvement on transmission efficiency for business and data. However, the data transmission efficiency for 3G network cannot exceed 2 Mbps which is an ideal value. Efficiency can be easily affected by various factors during practical data transmission, and the transmission rate is much lower than the ideal value, which therefore cannot fulfill users' demands [3]. Besides, to resist more multi-path interference during concrete applications, more complex balancing and modulation are needed for CDMA, which would bring much difficulty. In order to facilitate development of 3G technology, researches and analysis on OFDM are strengthened with introduction of advantages of OFDM into the CDMA system in a proper way so that CDMA and OFDM can be integrated.

In recent years, mobile network has developed with a large scale, and users for mobile network is greatly increasing, among which frequency, as an important resource for mobile communication, is becoming a rare resource. With the developing science and technology as well as people's life quality improved, users demand more in terms of various services, service quality, transmission rate etc. Under the background, OFDM technique of 4G network shall be widely used due to its own advantages.

The transmission rate provided by 4G can reach to 100 Mb/S and even higher. It can support businesses like voice and multimedia etc. Besides, dynamic adjustment can be made for transmission rate during the data transmission as per concrete situations. In order to realize the high-speed transmission based on limited spectrum resources, the spectrum efficiency should be improved in proper ways. With OFDM technique, spectrum resources can be utilized with high efficiency, and selective fading for frequency countermeasures can be carried out; in addition, OFDM can be integrated with MIMO technique, increasing the systematic capacity with higher utilization efficiency of spectrum.

### **(4) Wireless Access to Broadband**

OFDM can realize high-speed data transmission in wireless conditions, applicable to not only WLAN, but also wireless access to broadband [4]. IEEE802.16 working group mainly takes charge of wireless access technology in concrete work, and has developed a wireless access standard of 2GHz-11GHz, that is, IEEE802.16a, which is OFDM in physical application. It can be seen through analysis that this standard not only is the new generation of wireless access technology, but also can facilitate the future cellular mobile communication.

### **(5) Digital Broadcast Television System**

Digital broadcast television is indispensable to people's life nowadays, and OFDM with its good performance has been widely used in the system of digital broadcast television, and has shown good results. Systems of DAB, HDTV and DVB all apply the modulation technology of OFDM with good performance. Therefore, the popularization and application of this technology should be paid attention. Besides, targeted researches for this technique should be strengthened in order to improve

the application effect.

## **Conclusion**

OFDM has high efficiency of utilization and a simple structure and is easy to realize; it has been widely used in many fields, particularly in wireless communication. As a newborn thing, OFDM still has deficiencies and thus needs to be improved with researches and analysis for perfection.

## **References**

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