# ADVANCEMENT IN WIRELESS COMMUNICATION

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*Abstract*— **In this paper the information about the advancement in wireless communication is given and it is also given that when requirement of high speed of data rate is increases then how the technology changed because of number of users also increases with time. So it is a challenging work for the researchers to give a total satisfaction to their users with reliability. This paper gives you a knowledge about how different combination of different multiple access techniques and modulation with different receivers gives the satisfactory performance among the users.**

## 1. INTRODUCTION

Even before 3G systems were being deployed, researchers started the investigation on possible techniques for 4G systems. The explicit 4G standard is still not confirmed. In june 2003, ITU approved the recommendation ITU-R M.1645 “Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000[6].The document states the capabilities as well as possible technologies for 4G systems. An important feature of 4G wireless systems includes:

a) 4G needs to support data rates of up to 100 mdps for high mobility such as mobile access and up to 1 Gbps for low mobility such as local wireless access.
b) 4G users of packet-based architecture which will offer increased system security and reliability, intersystem mobility.
c) 4G satisfies future requirements for universal network that will provide high data rates and a seamless interface with a wireline backbone network.

The above features impose technical challenges on system design. There are some promising technologies (mainly related to physical layer) for 4G wireless systems such as sophisticated forward error correcting codes (e.g., [7],[8],[9]),CDMA with improved detection algorithms (e.g.[10],[11],[12]), multicarrier modulation including orthogonal frequency division multiplexing(OFDM) and adaptive resource management. At the moment there are many research institutions and industrial companies which investigate the appropriateness of different techniques for the 4G air interface.

## 2. OFDM-CDMA SYSTEM MODEL

OFDM-CDMA combines advantages of both OFDM and CDMA provides an effective solution for multiuser communication over multipath channel in cellular environments with sufficient guard interval, OFDM can completely remove ISI. Compared with orthogonal multiple access schemes, CDMA provides an effective solution to the cross cell MAI(multiple access interference) problem. Meanwhile due to its spread spectrum nature, CDMA is more robust against channel fading.

## 3. Interleave division multiple access

Multi-user detection (MUD) is a potential solution to the MAI problem. In the past MUD was viewed as a costly option, but the situation has changed recently with progress in iterative processing techniques [1]. In particular, the interleave division multiple access (IDMA) scheme[2-4] allows a very low cost chip by chip (CBC) MUD algorithm to be used. The related complexity (after being normalised to each user) is independent of the number of users, indicating its potential for practical use. A disadvantage of IDMA is that its receiver complexity still increases linearly with the number of paths which can be a concern for very wideband systems.

### 3.1 IDMA TRANSMITTER AND RECIEVER

In this section, we introduce the basic principles of IDMA. Our focus is the detection algorithm for IDMA scheme in complex multipath fading channel described in [22]. IDMA is a recently proposed multiple access scheme, in which user specific interleavers are adopted as the only mechanism for user separation. IDMA can be regarded as a particular case of chip interleaved CDMA [21]. As so IDMA inherits many advantages of CDMA. Thanks to random interleaving and chip by chip (CBC) iterative multiuser detection algorithm, the IDMA scheme is applicable to cancel MAI and ISI effectively and support system with large numbers of user in multipath fading channel.

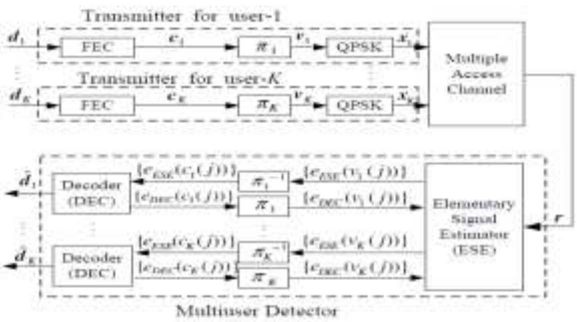


**Fig-1 transmitter and reciever structure of an IDMA scheme for k simultaneous users**

 

The upper part of figure shows the transmitter structure of the IDMA scheme with k simultaneous users. Let $d_k$ be the data stream of user k. This data stream is encoded by forward error correction code , generating a chip sequence $c_k$ (here "chip" is used instead of "bit" as the FEC encoding may include spreading or repetion coding.). Then $c_k$ is permuted by user specific interleaver-k to produce chip sequence $v_k$. After quadrature phase shift keying (QPSK) symbol mapping, the symbol sequence $x_k$ is produced. Where j is the frame length.

$$X_k = X_k^{Re}(j) + ix_k^{im}(j) \qquad \text{(i)}$$

### 4. OFDM-IDMA Technique.

The OFDM-IDMA scheme presented [5,6], combines most of the advantages of the multiple access scheme mentioned above (such as OFDMA, CDMA, OFDM-CDMA and IDMA) and avoids their individual disadvantages. With OFDM-IDMA ISI is resolved by an OFDM layer and MAI is suppressed by an IDMA layer, both at low cost. These two main obstacles removed, OFDM IDMA offers many attractive features including:

- Then achievable throughput of OFDM-IDMA is considerably higher than that reported for a CDMA and OFDM-CDMA in literature.
- If the entire bandwidth resource in a cell can be allocated to a single user, OFDM-IDMA can achieve a very high single user throughput using a superposition coding technique [8]. This property is crucial for packet mode transmission. It is difficult to achieve very high single user throughput with the existing CDMA or OFDM–CDMA techniques.
- The power efficiency of OFDM-IDMA can be greatly enhanced by use of an unequal power control strategy inherited from IDMA [2].

### 4.1 OFDM-IDMA Principles

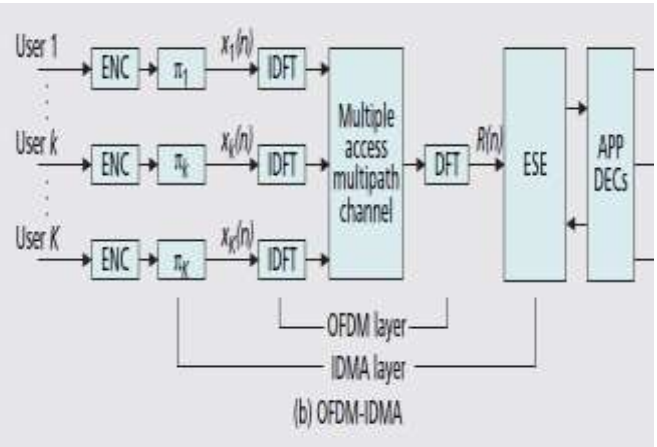


**Fig 2**

The IDMA reciever complexity over multipath channel is related to the channel length, recently OFDM-IDMA was proposed [5,6] as an alternative to plain IDMA over multipath channels. OFDM-IDMA inherits most of the merits of OFDM and IDMA. The key advantages of the channel length and the number of users, which is significantly lower that of other alternatives.

Fig.1 shows the transmitter / reciever structure of OFDM-IDMA system with k users. The coded signals are first interleaved by user specific interleavers$\{p_k\}$. Then the resultant signals, again denoted by $\{X_k(n)\}$are modulated on to subcarriers by using IDFT. Each subcarrier can be represented by

$$R(n) = \sum_{k=1}^{K} H_k(n) x_k(n) + Z(n) \qquad \text{(2a)}$$

$$= H_k(n) x_k(n) + \Xi_k(n), \qquad \text{(2b)}$$

Where $H_K$ (n) is referred to as the channel gain of the $n^{th}$ subcarrier for user k ,Z(n) denotes AWGN at subcarrier n , and $X_K(n)$ represents the interference plus noise component in R(n) with respect to user k at subcarrier n. From the central limit theorem , $X_K(n)$ can again be approximated by a gaussian random variable.

Suppose that the aggregate rate R is fixed and each user has a single –user rate R/K will be low. A simple and convenient way to realize a low rate code is concatenating a common FEC code ( such as a rate ½ convolutional or turbo or LDPC code) with a repetition code. In this case, the repetition coding acts similarly as the spreading operation for CDMA. The outputs of a repetition encoder are dispersed over different subcarriers after IDFT. At the receiver, the inputs to a repetition decoder are collected from different subcarriers and combined. As a result the frequency selective part of fading is averaged out when the rate of repetition coding is sufficiently low and the average channel gains of subcarriers become the dominating factor, hence achieving frequency diversity.

The availability of a fast performance prediction technique is crucial for search-based system optimization. In particular, it has been shown in [2] that the spectral and power efficiency of IDMA can be greatly enhanced by using an unequal power allocation strateg. The same principle also applies to OFDM-IDMA and the optimization techniques developed in[2] Can be used.

### CONCLUSION

The optimized OFDM-IDMA scheme possesses several attrctive properties, including

- Very high spectral efficiency
- Flexibility in multi-user as well as single-user mode transmission.

 

- Multi- gain in fading channels.
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