ABSTRACT

The most important objective of 4G wireless system is to take care of the severe inter symbol interference (ISI) resulting from the high data rate, and to utilize the available limited bandwidth in a spectrally efficient manner. Recently, Multicarrier Code Division Multiple Access (MC-CDMA) system has been considered as the potential candidate for 4G wireless communications, to handle ISI most effectively. MC-CDMA systems can be of practical interests, the direct sequence (DS) spreading is employed together with multicarrier modulation to derive the benefits of both the techniques.

In this thesis, dynamic sub-carrier allocation technique is considered, the principle stand behind dynamic sub-carrier allocation is allocating many bits to sub-carrier with high SNR, whereas on sub-carrier with a low SNR only a few or no bits are transmitted. This adaptive sub-carrier technique is also known as Intelligent Radio Transmission Technology for wireless communications. The Root-finding algorithm and Water-filling algorithm are employed to find out the best sub-carrier among the existing sub-carriers. In the Rayleigh fading channel, the best sub-carrier is selected and data is transmitted.

The proposed MC-CDMA system is compared with the conventional MC-CDMA system. Simulations are performed in Rayleigh fading environment, with varying number of users for fixed modulation (BPSK) scheme and the results are obtained. The comparisons are made between root-finding method and water-filling algorithm and their overall capacity is studied. In the proposed MC-CDMA system, with the narrow band interference power to the signal power (JSR) ratio is varied accordingly to the channel conditions, to improve the overall system performance such as BER, system capacity and efficient power utilization.
Adaptive modulation based MC-CDMA system is a promising way to increase the data rate that can be reliably transmitted over the wireless radio channels. The present third generation (3G) systems can provide a maximum data rate of 2 Mbits/s for indoor environment which is quite less than that needed for currently evolving multimedia applications. Adaptive modulation based multi-carrier systems can achieve large user throughputs. It adaptively changes the digital modulation (mapping) format depending upon the condition of the channel. A better channel condition would imply a higher order modulation scheme and hence a higher spectral efficiency, whereas a poor channel condition selects a lower order modulation scheme to maintain the required bit error rate (BER).

The simulation of the adaptive modulation based MC-CDMA system under different channel conditions and different number of CDMA users has been carried out with modulation schemes such as BPSK, QPSK, and M-ary QAM. The obtained results clearly show that the adaptive modulation based system outperforms fixed modulation based system. Ultra wideband (UWB) communication is one of the most promising technologies for high data rate wireless networks for short range communication in Wireless Personal Area Networks (WPANs).

The IEEE 802.15.3a working group has proposed a UWB short range channel model by modifying the wide band Saleh-Valenzula (S-V) channel model. In this thesis performance of MC-CDMA over UWB channel model is compared with DS-CDMA (Direct Sequence) and OFDM (Orthogonal frequency division multiplexing) schemes using dynamic subcarrier allocation technique.