ABSTRACT

CERTAIN INVESTIGATIONS ON PAPR REDUCTION TECHNIQUES AND ADAPTIVE RESOURCE ALLOCATION ALGORITHMS FOR OFDM SYSTEMS

Orthogonal Frequency Division Multiplexing (OFDM) technology promises to be a key technique for achieving the high data capacity and spectral efficiency requirements in the present as well as future broadband wireless communication systems. WLAN standards such as IEEE 802.11a provides the data rate of 2Mbps whereas, the OFDM based WLAN standards such as IEEE 802.11 b/g provides data rate of 54 Mbps. However, future wireless communication systems will require WLANs with data rates greater than 100 Mbps. Hence, there is a need to improve the spectral efficiency and data capacity of OFDM systems in WLAN applications and mobile networks.

In this thesis, different algorithms have been proposed to improve the system performance of OFDM systems and comparative analysis is done with the existing algorithms. To reduce the PAPR with better BER performance than the existing algorithms, a novel PAPR reduction technique is proposed for OFDM systems. In this proposed technique, a better reduction in PAPR is achieved by combining precoding technique with nonlinear companding transform technique. Though, the proposed technique reduces the PAPR, it is not efficient enough to maximize the spectral efficiency. So, to maximize the spectral efficiency of the OFDM system, an adaptive modulation with CFO correction algorithm has been proposed.

In the proposed adaptive modulation with CFO correction algorithm, the CFO is estimated and corrected before the CSI estimation. CFO is estimated using the Maximum Likelihood (ML) estimator and direct correction method has been employed to cancel the estimated CFO. Based on the new CSI, this proposed algorithm selects the modulation technique (constellation size M) adaptively. The proposed algorithm greatly maximizes the average spectral efficiency compared to the conventional adaptive and non adaptive modulation techniques. Eventhough it maximizes the spectral efficiency, system capacity is not improved significantly. So, an efficient ARA algorithm for multiuser OFDM system has been proposed to maximize system capacity and to achieve good QoS.

In this proposed efficient ARA algorithm, two types of users: Guaranteed Performance (GP) and Best Effort (BE) users are considered. To achieve good QoS, GP users are given priority in assigning subchannels to that of BE users. GP users are considered first to allocate power to satisfy their data rate requirements and then the rest of the power is allocated among the subchannels of BE users using the adaptive bit loading algorithm. Also this proposed algorithm for SISO OFDM system has been modified suitably for the multiuser MIMO-OFDM systems using Frobenious norm criteria. Finally, two ARA algorithms have been proposed in this thesis to increase the system capacity and BER performance with zero MAI. In these proposed algorithms, Block Diagonalization (BD) is employed to mitigate MAI. BD with adaptive bit loading and power allocation has been done with the constraint of data rate which improves the BER performance greatly than the existing algorithms. Thus, these proposed algorithms can be employed in future wireless communication systems for better and improved performances.