CHAPTER 2

LITERATURE SURVEY

A literature review is a body of text that aims to review the critical points of current knowledge including substantive as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work.

Most often associated with academic-oriented literature, such as these, a literature usually precedes a research proposal and results section. Its ultimate goal is to bring the reader up to date with the current literature on a topic and forms the basis for another goal, such as future research that may be needed in the area.

A well structured literature review is characterized by a logical flow of ideas, current and relevant references with consistent, appropriate style, proper use of terminology, and an unbiased and comprehensive view of the previous research on the topic.
2.1 MIMO SYSTEM USING EQUALIZATION TECHNIQUES

Pavani Sanghoi and Lavish Kanshol (2014) projected IEEE 802.16 normal for Broadband Wireless Access (BWA) and its associated business syndicate, Worldwide Ability for Microwave Access (WiMAX) forum promise to supply high rate over giant areas to an outsized range of users wherever broadband is unobtainable. This paper analyzes totally different repetition higher level modulations on Worldwide Ability for Microwave Access Multiple Input and Multiple Output (WiMAX-MIMO) systems with different code rates for Rayleigh channel. This paper analyses the abstraction diversity technique of MIMO systems combined with WiMAX so as to realize higher knowledge rates by lowering the Bit Error Rate of the system to realize higher performance with Rayleigh channel.

Vahid Tarokh, Hamid Jafarkhani, and A. R. Calderbank (1999) to introduce space time block code, a replacement for communication over attenuation channels exploitation scenario, in multiple transmit antennas. Information is encoded employing a space time block code and also the encoded Information is split into streams that square measure at the same time transmitted exploitation transmit antennas. We have developed the idea of space time block code writing, a straightforward and stylish methodology for transmission exploitation multiple transmit antennas in a very wireless Rayleigh/Rician surroundings. These codes have a straight forward maximum likelihood decipherment formula that is simply supported linear process. Moreover, they exploit the total diversity given by transmit and receive antennas.

Rohit Gupta, and Amit Grover (2012) planned the mobile information applications has accrued the demand for wireless communication
systems giving high output, wide coverage, and improved reliableness. The most challenges within the style of wireless communication systems square measure the restricted resources, such as affected transmission power, scarce frequency information measure, and restricted implementation complexity and the impairments of the wireless channels, together with noise, interference, and weakening effects. Multiple Input Multiple Output (MIMO) communication has been shown to be one in all the foremost promising rising wireless technologies that may with efficiency boost the info transmission rate, improve system coverage, and enhance link reliableness. By using multiple antennas at transmitter and receiver sides, MIMO techniques alter a replacement dimension the spatial dimension that may be used in several ways that to combat the impairments of wireless channels. During this article mentioned differing kinds of equalizer like Zero Forcing (ZF), Minimum Mean square Error (MMSE), and Zero Forcing (ZF), Successive Interference Cancellation (SIC), Minimum Mean square Error Successive Interference Cancellation (MMSE-SIC), and Sphere decoder. The results square measure decoded victimization the ZF, MMSE, ZF-SIC, MMSE-SIC, and Space Divisions (SD) technique. Performance of is additionally higher than alternative equalizers at the complexity term then Sphere decoder is a smaller amount advanced. The complexity of decoder goes on increasing as a tendency to move to higher modulation schemes, whereas complexity depends on however well the initial radius is chosen.

Yi jiang, Mahesh k, and Varanasi planned during this paper presents associate in-depth analysis of the Zero Forcing (ZF) and Minimum Mean Square Error (MMSE) equalizers applied to wireless Multi Input Multi Output (MIMO) systems with no fewer receive than transmit antennas. In spite of a lot of previous work on this subject, to reveal many new and stunning analytical results in terms of the well known performance metrics of output quantitative relation Signal to Noise Ratio (SNR), uncoded error and outage
chances, Diversity Multiplexing (DM) gain exchange, and secret writing gain. Contrary to the common perception that ZF and MMSE area unit asymptotically equivalent at high SNR, to show that the output SNR of the MMSE equalizer.

Xing Zhang, Zhaobiao cardinal and Wenbo Wang, (2008), a framework is bestowed to investigate the performance of Multiuser Diversity (MUD) in Multiuser Point to Multipoint (PMP) MIMO systems with antenna choice. Supported this framework, the tight closed form expressions of outage capability and average image error rate area unit derived for the multiuser transmit antenna choice with Maximal Ratio Combining (MRC) system, by a tendency to the characteristics antenna choice gains, MIMO antenna configurations and weakening gains impact on the system performance, with a stress on the study of multiuser diversity influence. From each theoretical and simulation results, shows that in Multiuser MRC systems associate in diversity order equals to the quantity of transmit antennas, range of receive antennas and range of users are achieved, different users plays a key role within the system performance and may be viewed as equivalent “virtual” transmit antennas, that is that the supply of the multiuser diversity inherent exists within the multiuser system. This type of diversity is often expeditiously extracted within the style of multi antenna systems. The outage capability will increase with the rise of mean of effective average SNR achieved from the full K users and reduces with the rise of variance of the effective SNR and to get the next outage capability, the quantity of receive antennas ought to be no over that of transmit antennas.

Karmjeet Singh, and Rajbir Kaur (2013), MIMO Multi Carrier CDMA system has been used. The usage of multiple antennas can significantly improve the performance of wireless communication system and this system also derives simulation through MATLAB of average
bit error rate verses bit energy to noise ratio of multicarrier code division multiple access over Rayleigh channel using QPSK modulation additive white Gaussian noise.

Atul Singh Kushwah (2014) the performance of 2 cross 4 MIMO-MC-CDMA system in MATLAB which highly reduces BER is analyzed. MIMO and MC-CDMA system are combined to reduce bit error rate in which MC-CDMA is multi user and multiple access schemes which is used to increase the data rate of the system. MC-CDMA system is a single wideband frequency selective carrier which converts frequency selective to parallel narrowband flat fading multiple subcarriers to enhance the performance of system. MC-CDMA system further improved by grouping with 2 cross 4 MIMO system which uses ZF decoder at the receiver to decrease BER with Half rate convolution ally encoded Alamouti Space Time Block Code (STBC) is used as transmit diversity of MIMO through multiple transmit antenna. Importance of using MIMO-MC-CDMA using convolution code is firstly to reduce the complexity of system secondary to reduce Bit Error Rate (BER) and lastly to increase the gain. In this paper system performance in diverse modulation techniques like, 8-PSK, 16-QAM, QPSK, 32-QAM, 8-QAM and 64-QAM in Rayleigh fading channel using MATLAB are analyzed.

Tamilarasan and Nithyanandan (2014) during this paper the transmission rate, transmission range and transmission reliability is achieved by the usage of Multiple Input Multiple Output (MIMO) assisted Multicarrier Code Division Multiple Access (MC-CDMA) systems. The MC-CDMA combined with the MIMO technique, has become a core technology for future mobile radio communication system. However, possible potential gain in spectral efficiency is challenged by the receiver ability to accurately detect the symbol due to Inter Symbol Interference (ISI).
Multipath propagation, mobility of transmitter, receiver and local scattering cause the signal to be spread in frequency, different arrival time and angle, which results in ISI in the received signal. This will affect overall system performance. The use of MC-CDMA mitigates the problem of time dispersion. However, still it is necessary to remove the amplitude and phase shift caused by channel. To solve this problem, a multiple antenna array can be used at the receiver, not only for spectral efficiency or gain enhancement, but also for interference suppression. This can be done by the, efficient channel estimation with strong equalization. This work proposes MIMO MC-CDMA system, Minimum Mean Square Error (MMSE) equalization with pilot based channel estimation.

Chiung-Jang Chen and Li-Chun Wang (2008) planned Despite its low complexity the zero forcing receiver is understood to suffer from noise sweetening to revive the spatially multiplexed information in an exceedingly single user MIMO system. In this paper, a tendency to gift associate degree analytical framework to assess the performance of the zero forcing receiver operational within the multiuser MIMO system with user planning. Exploitation the order statistics technique, a tendency to derive closed-form expressions for the sum-rate capability of the Multiuser MIMO system employs the straight forward spatial multiplexing at the transmitter and zero-forcing process at the receiver with variety of planning algorithms. Performance analysis of the inexpensive and effective transmission strategy that employs the straightforward spatial multiplexing.


2.2 OFDM SYSTEM USING QAM TECHNIQUES

Chen Ye et al. (2014) proposed a novel segmental partial transmit sequence scheme for the Peak-to-Average Power Ratio (PAPR) reduction in Quadrature Amplitude Modulation based Orthogonal Frequency Division Multiplexing (QAM-OFDM) systems. The key idea of the Partial Transmit Sequence (PTS) scheme is to divide the overlapped QAM-OFDM signals into a number of segments, and then some disjoint sub blocks are divided and multiplied with different phase rotation factors in each segment. The received signals are recovered perfectly at the receiver. Compared with the conventional PTS scheme directly employed in QAM-OFDM systems, the PTS scheme could offer better PAPR reduction with lower computational complexity. But the data rate was decreased due to zeros inserted operation and also smaller ‘L’ value.

Young-Jeon Cho et al. (2012) proposed a new Partial Transmit Sequence (PTS) scheme with low computational complexity. Here two search steps are taken to find a subset of phase rotating vectors showing good Peak-to-Average Power Ratio (PAPR) reduction performance. The first steps, sequences with low correlation are used as phase rotating vectors for PTS scheme, which are called the initial phase vectors. In the second step, local search is performed based on the initial phase vectors to find additional phase rotating vectors which show good PAPR reduction performance. Numerical analysis shows that this PTS scheme achieves better PAPR reduction performance with significantly reduced computational complexity than the existing low complexity PTS schemes.

Al-Dalakta et al. (2012) proposed an efficient technique for reducing the Bit Error Rate (BER) of Orthogonal Frequency Division
Multiplexing signals transmitted over nonlinear solid state power amplifiers. It was based on predicting the distortion power Solid State Power Amplifiers (SSPA) generate due to the nonlinear characteristics of such devices. Similar to the selective mapping or partial transmit sequence schemes, the predicted distortion is used to select the set of phases that minimize the actual SSPA distortion. Simulation results confirmed that the signal to noise ratio that is required to obtain a BER of $10^{-4}$ using the proposed technique was less by about 8 dB when it was compared to the standard PTS utilizing 16 partitions. Moreover, complexity analysis demonstrated that this system offers a significant complexity reduction of about 60% compared to state of the art methods.

Robert J. Baxley et al. (2007) compared Selected Mapping (SLM) and Partial Transmit Sequence (PTS) are two existing distortion less Peak-to-Average Power Ratio (PAPR) reduction schemes that have been proposed for Orthogonal Frequency Division Multiplexing (OFDM). Previously, it was argued that SLM and PTS have comparable PAPR reduction performance but that the latter has lower computational complexity because it uses fewer IFFTs. In this paper, we show that the overall computational complexity of PTS is only lower than that of SLM in certain cases, and that SLM always has better PAPR reduction performance. It compared the two schemes using three different performance metrics by assuming a given amount of computational complexity that can be afforded. Using the metrics, it shown that SLM outperforms PTS for a given amount of complexity.

Skrzypczak et al. (2006) proposed the selective mapping technique to reduce the large Peak to Average Power ratio in OFDM/QAM system. OFDM/QAM is now a recognized alternative to conventional OFDM for the transmission of signals over multi-path fading channels. Indeed with
OFDM/QAM an appropriate pulse-shaping can be introduced to fight against time and frequency dispersion. In order to reduce the occurrence of large Peak to Power Ratios (PAPR) that are inherent to multi carrier modulations, a PAPR reduction method was proposed. This technique was an adaptation to OFDM/QAM of the selective mapping technique already used for OFDM. It was shown that, as with OFDM, the performance increases with the number of SLM codes, but was also dependent upon the length of the OFDM/QAM pulse shape.

Seung Hee Han et al. (2004) proposed a modified selective mapping technique to reduce the high peak-to-average power ratio (PAPR) of the transmitted signal which is a major drawback of orthogonal frequency division multiplexing (OFDM). In this technique, we embed the phase sequence, which was used to lower the PAPR of the data block, in the check symbols of the coded OFDM data block. It was shown that it achieved both PAPR reduction from the SLM technique as well as error performance improvement from the channel coding with no loss in data rate from the transmission of side information. In addition, approximate expression for the complementary cumulative distribution function (CCDF) of the PAPR of the modified SLM technique was derived and compared with the simulation results.

Leonard J. Cimini et al. (2000) proposed a scheme called Partial Transmit Sequences to reduce the Peak to Average Power Ratio of an Orthogonal frequency-division multiplexing(OFDM). OFDM is an attractive technique for achieving high-bit-rate wireless data transmission. However, the potentially large Peak-to-Average Power Ratio (PAPR) has limited its application. Recently, two promising techniques for improving the PAPR statistics of an OFDM signal have been proposed: the selective mapping and partial transmit sequence approaches. Here present suboptimal strategies for
combining partial transmit sequences that achieve similar performance but with reduced complexity. Based on simulation results, showed that these suboptimal strategies, which are less complex and more easily implemented, suffer little performance degradation.

Wang et al. (2014) proposed the Segmental Clipping for the PAPR reduction of the Orthogonal frequency division multiplexing with offset Quadrature Amplitude Modulation Technique which has drawn significant interests in recent years. However, most of the existing OFDM Peak-to-Average Ratio (PAPR) reduction schemes cannot be used in the OFDM-QAM system directly. Here, a modified scheme called overlapped segmental clipping (OS-Clipping) was proposed to deal with the high PAPR problem specifically in the OFDM-QAM system. For the proposed OS-clipping scheme, the input signals were divided into a number of overlapped segments and then the clipping operation was processed on each segment. Simulation results show that the modified scheme used in the OFDM-QAM system provided better performance than conventional clipping scheme directly used in the OFDM-QAM system, and even outperforms conventional clipping scheme applied in the OFDM system.

2.3 CHANNEL ESTIMATION USING DIFFERENT MODULATION TECHNIQUES

Guosen yue., (2004) proposed OFDM, the objective is still to transmit a high-rate stream using multiple subcarriers. OFDM overcomes the problem of the large bandwidth requirement imposed by guard bands. Instead of using $K$ Local Oscillators (LOs) and $K$ multipliers in modulation, OFDM uses a mathematical technique called Discrete Fourier Transform (DFT) to generate the subcarriers. The subcarriers generated this way do not need additional guard bands and can be placed closer together in the frequency
domain. The subcarriers are also orthogonal to each other over a set duration of an OFDM symbol. In addition, DFT and its inverse can be efficiently computed, eliminating the need for separate Radio Frequency (RF) components for separate subcarriers.

Singla (2012) proposed the first operational cellular communication system was deployed in the Norway in 1981 and was followed by similar systems in the US and UK. These first generation systems provided voice transmissions by using frequencies around 900 MHz and analogue modulation. The objective of the 3G was to develop a new protocol and new technologies to further enhance the mobile experience. In contrast, the new 4G framework to be established will try to accomplish new levels of user experience and multi-service capacity by also integrating all the mobile technologies that exist to achieve the proposed goals, a very flexible network that aggregates various radio access technologies, must be created. This network must provide high bandwidth, from 50-100Mbps for high mobility users, to 1Gbps for low mobility users, technologies that permit fast handoffs, an efficient delivery.

Rajput (2012) proposed the main purpose of bandwidth utilization efficiency is to provide services so that users can get higher data rates and wider coverage. However there is no single network that can provide this kind of services 4G network is expected to integrate CDMA,OFDM, MC CDMA, Ultra Wide Band (UWB) and higher data rates and wider coverage can be achieved. In this integration, the users will be served by either one of those networks. As a result, an important problem occurred in which in these overlapping areas most of the network resources is not fully utilized since only one of those networks serve the users. The bandwidth utilization efficiency is so important for operators, because the wireless communication cost and their profit are based on the network
resources. The highest benefit from the available network resources is a key issue in the wireless communication networks. In the research, we focus on the two bandwidth integration of Wireless Local Area Network (WLAN) and CDMA2000 networks to efficiently utilize the two network resources. This chapter reviews the relevant literature to explain the existing researches.

Antony Jamin, Petri Mahonen (2005) as proved by the success of OFDM in mobile communication, multichannel modulation has been recognized as an efficient solution for mobile communication. Waveform bases other than sine functions could similarly be used for multichannel systems in order to provide an alternative to OFDM. The highly unpredictable and random nature of the transmission channel in mobile communication system makes it even more difficult to build a robust communication system. A detailed analysis of the various impairments faced by a mobile communication system has been reported. Wavelet Packet Modulation (WPM) is a high-capacity, flexible, and robust multiple- signal transmission technique in which the message signals are waveform coded onto wavelet packet basis functions for transmission. The vast improvement in the mobile communication system under WPM has also been reported in this paper.

Jaspinder Singh, Er. Ravinder kumar, Mukesh kumar (2012) proposed the advancements in broadband and mobile communication has given many privileges to the subscribers for instance high speed data connectivity, voice and video applications in economical rates with good quality of services. The bit error rate performance of Wi-MAX has been carried out for different modulation techniques like BPSK, QPSK, QAM 16, and QAM 64. The performance evaluation of various aspects of the simulated model is obtained by plotting graphs between Bit Error Rate and Signal to Noise Ratio for different modulation techniques. Orthogonal frequency division multiple access uses adaptive modulation technique on the physical
layer of Wi-MAX and LTI uses the concept of cyclic prefix that adds additional bits at the transmitter end. The signal is transmitted through the channel and it is received at the receiver end. Then the receiver removes these additional bits in order to minimize the inter symbol interference, to improve the bit error rate and to reduce the power spectrum. In this paper, we investigated the physical layer performance on the basis of Bit Error Rate, Signal to Noise Ratio, power spectral density and error probability.

2.4 PURPOSE OF THIS STUDY

The design of proposed multiple access system with higher order modulation techniques over varying channel conditions. To estimate the channel and adaptively vary the modulation to achieve better signal to noise ratio.

There are various schemes discussed by many researchers, but not fully utilised the available techniques to maximise the output in terms of signal quality, which is the much needed in times to come. In this research work it is planned to design an efficient and effective strategy to improve the system performance by considering the transmission techniques, channel condition and reception (by different combining techniques).

- The transmission mechanism is coined after studying related research works, to select the suitable modulation over channel conditions. In this work high order say 64,128,256 QAM is considered for bulk/higher transmission rates in multiple access scenario. Also advanced QPSK modulation techniques are employed to study the effectiveness of the system.
The channel effect plays a critical role in determining the effects of the system performance. But in real scenario, the dynamic assignment of carrier is important to achieve better SNR.

The overall latency in channel estimation is to be reduced and relatively detection techniques in the receiver side have to be implemented with least error.

2.5 MOTIVATIONS

The dynamism in multiple access techniques, with higher bandwidth and data rate is critical in future technology, as Internet of Things (IoT), Data Analytics, Ultra High definition demands to transmit information with least error and high accuracy, the proposed system provides a solution for it.

- To design a frequency division multiple access system with multiple carriers for effective communication.

- Combination of Modulation techniques along with multiple access techniques, leads to more complex and complicated system. The trade off between two entities has to be achieved for better system performance.

- To simulate a system with the combination of different levels of modulation and various reception techniques in the receiver section.

2.6 CONCLUSION

In this chapter, the performance analysis of various equalization techniques has been reviewed. The need for modulation techniques with the help of MC-CDMA and OFDM system has been discussed.
By reviewing the earlier approaches discussed in the literature the following problems have been identified in channel estimation and receiver section in wireless communication systems.

- The earlier approaches equalization techniques using in MIMO system to reduce the BER and increase the signal to noise ratio.

- MC-CDMA and OFDM is introduced to reduce the overall throughput and BER performance.

- A different type of modulation techniques is used to reduce the BER and PAPR reduction.

- The overall performance is to improve higher data rate communication in the modern 5G wireless networks.

By keeping all the issues mentioned here, the various methods for the development of modulation techniques in wireless communication systems by providing channel estimation assignment schemes.