Chapter 2

Literature Survey

2.1 Literature Review

The rapid emergence and evolution of information has revolutionized our lives, and it has greatly increased the pace of scientific research and the lives of people. Today, we use a huge amount of data, which is transmitted through various wireless communication systems. A basic wireless communication system, as depicted in Figure 2.1, which consists of following important components: data acquisition, data compression, data transmission, differential detection or CSI and coherent detection, data decompression. Information is first acquired for transmission at the transmitter. Then, for efficient transmission, data compression is required. To obtain the transmitted data after transmission, differential detection or coherent detection is used at the receiver. Finally, decompression is used to obtain the useful data. Differential detection not demanded channel state information (CSI), but it does require a elevated signal-to-noise ratio (SNR) at the receiver information. Coherence detection, on other hand, necessitates the use of the CSI that is used to diminish the impact of the physical channel while communication.

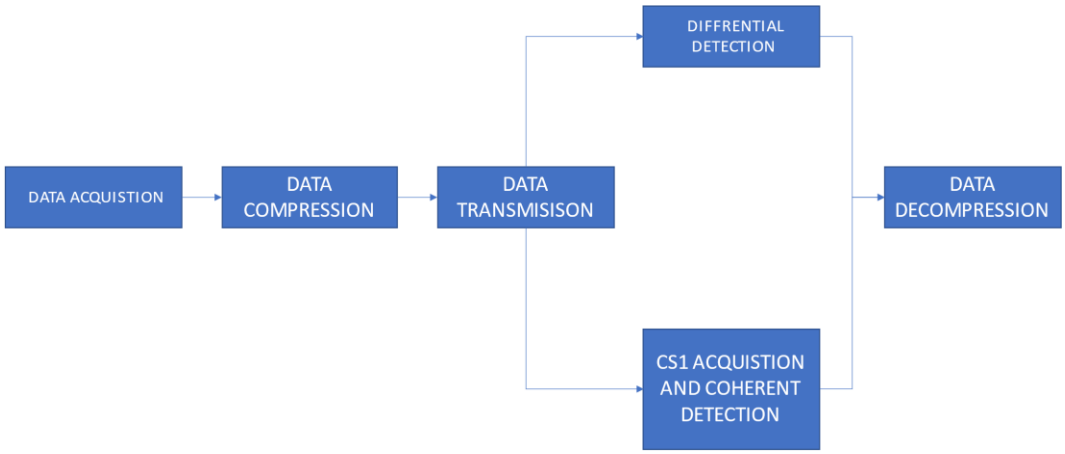

Figure 2.1 Basic Wireless Communication System

One of the most common techniques used for channel estimation is the detection of coherence. This method is utilised to minimize the impact of the channel during

transmission. Channel estimation is necessary at the receiver for coherent detection to be a successful instrument for obtaining CSI. There are two main categories of channel estimation techniques: training-based [47] [48] [49] and blind channel estimation [50] [51] [52]. Training-based methods are more regularly followed to estimate the channel. Unlike blind channel estimation, a training-based method can fully utilize the pilots' training sequence [35] [53] [54] and statistics properties [51] [52] to achieve effective channel estimation. The following are works on channel estimation that are related to each other.

2.1.1 Related works on Channel Estimation

For a TBCE, channel model for MIMO-OFDM systems was already established using Zero Forcing (ZF), Least Square (LS), and Minimum Mean Square Error (MMSE) methods [53] [55]. The outcomes demonstrate a evaluation of above-mentioned techniques using a BER Vs SNR plot. Significant investigation and development has also been done on channel estimation, especially in the massive MIMO environment, notably in relation to the TBCE, by evaluating the performance of different algorithms based on the quantity of total antennas as well as effectiveness of the system [56] [57]. Different algorithms are used in the estimation techniques. In the next part, this system outperforms conventional MIMO systems. The results of these studies revealed that the BCE method performed better than the traditional technique when it comes to the channel estimation. This is because the natural restrictions of a channel are more important than the pilot sequences.

2.1.2 Review on work related to OFDM-MIMO

In reference [58], diversity plan utilizing two transmitting and single receiving antenna has been presented. This plan provided identical order of diversity as a maximal ratio combining at the destination, with single and double antenna at input in this new scheme, there is no need of any bandwidth expansion. Another framework for radio connections estimations together with radiation and space for investigating wireless transmission in broadband framework has been proposed in [59]. The author described various benefits of the created estimation framework with accomplishing of channel estimation with rate of 2 GHz.

Authors in [60] have focused upon novel approach in that multi antenna method is united with MCM in broadband to alleviate inter symbol interference as well as improve

framework capacity. This framework utilizes different space codes for various antennas combination. At the destination, different decoders have used. From [61], an approach by considering time variant channel on interference in MCM is briefed. The author has presented the comparison Analysis of simulated with hypothetical results. The author has considered power and interference as a prime factor. In Reference [62] the enhancement in the field of MIMO space time coded systems was developed. They also show the different advantages of MIMO as well as spatial multiplexing and space-time coding schemes. At long last, the work addresses current queries relating to the mixing of MIMO links in sensible remote framework and standards.

A framework of radio receiver and its simulated results has been presented in [63]. The author additionally tried several systems to enhance the transmission of data in form of diversity and equalization. The author has utilized SSC type of diversity approach. In [64], the electromagnetic field pattern of transmitter and spreading of energy in surroundings on which the capacity of system depends has been focused. The author has also presented the constraints on which execution of designed algorithm depends. The author utilized the hypothetical systems for multiple antennas to execute propagation in fading environment. The main objective here to find out basic parameters of limits related to capacity of MIMO and to examine execution of this approach related to transmission of MIMO technology in different surroundings. Reference [65], presented a review of fundamentals on combination of MCM and multiple antenna approach. The author has presented the different aspects such as design of receiver, comparison of system based on users, execution of hardware etc. Multiple antenna remote innovation is utilized as a part of broadband framework and show different interference and fading. OFDM is subsequently an appealing method for adapting to ISI.

In [66], the evolution of the OFDM has been presented. Also combination of the OFDM with MIMO has been shown. This work has also displayed the limitations of the rank-deficient situations, wherever the quantity of client's antennas at input cross the quantity of antennas at the destination. Then scope of classic multiuser detectors (MUDs) has also been reviewed. An additional section goes for distinguishing approach based on detection process using GA that discovered various uses in remote framework lately. Also, they have reviewed the different GA-assisted optimization procedures that were as of late proposed additionally for work in multiuser MIMO-OFDM. OSTBC antenna selection and MRT antenna selection model by utilizing Rayleigh channel has been discussed in [90]. The proposed model is simple and achieved the maximum performance.

A relative analysis of spatial type of multiplexing in full mode with multiple antenna technique for the purpose of diversity has been given in [67]. To achieve this analysis the authors have set up trade of the spatial multiplexing and antenna diversity at entry side. In [68], a simple MIMO-OFDM remote communication framework in view of the examination of the dedicated principles and framework for MCM and multiple antenna novelty has been developed. Both framework joins along, remote framework has excellent execution once quantity of antenna is extensive and also alternate limits are indistinguishable, however framework execution would start decreasing with the start of increase in carrier. Framework has great execution in case of number of antenna is larger at destination in comparison of input section with all aspects remains same. Be that as it may, the increment of the carrier number can diminish the framework execution, as a result of the obstruction between every sub- carrier will more with quantity expands. Reference [69], focusses upon the difficulties for remote communication plan originates from the unfavorable attributes related to interference, jamming and fading of remote communication during transmission. Main aim of the 4G mobile transmission framework is to provide new features and solutions in order to enhance the transmission speed of the mobile device. For instance, by tackling the remaining issues of the 3G framework, the 4G platform will be able to provide an advance feature.

In [70], a system to analyze MIMO-OFDM framework utilizing a digital modulation M-ary technique by taking Rayleigh type of channel into consideration for advancement in the field of communication has been developed. The type of technique used is QAM. In [71], mix of OFDM and MIMO appears extremely encouraging once going for the outline of high-rate remote mobile framework has been presented. Also, they delineated the planning of the transmitter section and receiver section of the system. In this work many ways are described related to diversity.

As in [72], use of OFDM in IEEE 802.11a standard has been focused. Secondly with the use of additive white Gaussian noise type of channel, the performance of different coding schemes has been discussed. Besides, the framework execution of all operating states characterized includes m-ary digital modulation techniques respectively. Analysis in multi antenna framework in combination with MCM by considering the different type of channels such as AWGN and fading has been focused in [73]. The author presented the first analysis of AWGN channel with M-Ary modulation approach in different PSK mode. The second analysis performed with fading channel and type of modulation scheme is QAM. The whole simulation is done using MATLAB. MIMO-OFDM accuracy

is measured using BER parameter. From simulation results OFDM is found out to be good method for WLAN method.

In [74], simulation analysis with different digital modulation approach has been discussed. The author has focused on various parameters like bit error rate to signal to noise ratio analysis in remote communication framework. In [75], the authors of a proposed Space Time Coding method for multiple multi-input/multiple-output (M-Ary) channels discussed the various aspects of this technique. They presented the results of their study in simulated form. After the analysis of the data, the authors concluded that the optimal modulation for the channel is provided by using BPSK modulation. Multiple antennas may be utilized to frame numerous channels to expand the capacity and information rate. In spatial multiplexing to achieve higher rate and excellent performance, multi antenna can utilize on the up side. In MIMO framework the data may be sent and achieved from numerous antennas at same time. Reference [76], provides a thorough examination of different digital modulation strategies as well as its applications in SISO as well as MIMO remote frameworks, with a focus on implementation technique.

2.1.2.1 Review on work related to Massive MIMO

In [77], authors have focused upon very large MIMO with its different mathematical parameters for advancement in the existing technology. This includes base centric architecture in the range of millimeter for the development of new approach in the field of communication. The design of framework provides the information related to framework spectrum utilization for invention of new approach. Reference [78], gives the design of antenna framework with different specifications such as band range of 28 GHZ, three printed inverted antenna. A specification of one antenna is equal to 0.85 x 0.85. Author has measured various parameters like ECC, DG, MEG and ME in this proposed approach. The author has proved that proposed approach is an effective approach for long run 5G MIMO conversation tasks. In [79], the given work is based on printing in three dimensional. The author has assumed an antenna element with specification of 27.2mm x 17mm. According to author, the process of printing of this assumed element may be completed inside half of an hour. The traits of 3- Dimensional printed antenna are investigated. Antenna consists of two orthogonal polarized dipoles. Long way subject radiation patterns of the antenna in each horizontal and vertical plane are measured in an anechoic chamber. Simulations of all parameters of assumed element in proposed framework have been carried out by utilizing a high frequency constitution simulator (HFSS).

2.1.2.2 Review on work related to NOMA

The authors of [80], presented a comprehensive study of emerging communication techniques. NOMA access is portrayed as a key component of future wireless net- works, and the design of next-generation multiple access approaches is influenced by its ideas. Wireless caching, Millimeter-wave communications, multiple input multiple output techniques, cooperative relaying and are all examples of how the NOMA can be applied to more sophisticated communication techniques. Finally, this work claims the simulation to cover most important study tests and promising future directions in NOMA.

The grouping of multi antenna NOMA techniques and multi-input multi output presented by the authors in [81] shows a significant potential for improving spectral efficiency. The paper also covered the various aspects of the MIMO-NOMA technique. These include the clustering, power allocation, and formulation restrictions. The importance of successive interference cancellation in MIMO-NOMA systems is explained finally. Reference [82], IDMA (where I stands for Interleave) for NOMA method that support multiple data access for huge number of users in related band width. It deals with IDMA and uses VLSI to achieve maximum data rate lesser quantity of complex design transceiver. The detection concept for IDMA multi-user model is described along with IDMA scheme.

The authors of [83] explained the NOMA working as a resolution to extend spectral efficiency when receivers allow experiencing interference in multiple accesses. OMA has a very low latency, a large number of device connections, and a elevated spectral efficiency. The goal in this work is to develop an integrated arrangement for NOMA that includes uplink as well as downlink transmissions. The authors in [84] discusses about an arrangement for Transmit Precoding through Zero Forcing code. Beam space MIMO achieves its current goal by reducing radio frequency chain numbers. Nonetheless, the current beam space MIMO's important limit and the number of maintained users cannot exceed RF. In the proposed MIMO-NOMA system, beam space MIMO is paired with NOMA to breach the limit.