A Review paper of OFDM with Channel Estimation in Greedy Algorithms

Rosy Dhiman[#1], Mamta Arora[*2]
[1]Research Scholar, [2]Assistant Professor, ECE Department Chandigarh University,
Gharuan Mohali, Chandigarh, Punjab-140413, India

Abstract: *In this paper the Orthogonal Frequency Division Multiplexing (OFDM) is used to improve the spectral efficiency and produces a high speed of data rate. The channel estimation is used to estimate the properties of channel and reduces the complexity. Channel estimation is important parameter to improve the performance and efficiency. The greedy algorithms are used to optimize the problems when signal are not received in actually manner (signal are not received in directly). Therefore, all techniques are playing a great role to system performance. This paper provides a review of OFDM system with channel estimation in Greedy Algorithms.*

Keywords: *OFDM System, Pilot, Sparse channel, Channel Estimation*

I. INTRODUCTION

In a basic Communication System, the data are modulated from a single carrier frequency. The available bandwidth are occupied by a each symbols and a system is known as inter-symbols-interference (ISI) in case of frequency selective channel [1]. The first Generation (1g) of wireless communication system is Telephone Technology (Mobile Communication) was introduced in the 1980s and all use Analog Technology. The technologies are Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS).Second Generation (2g) telephone technology is based on global system for mobile communication (GSM) and launched in Finland in the year 1991[2]. 2G Technology is more efficient and hold sufficient security for both the sender and receiver. All text messages are digitally encrypted. The benefit of 2G technology is the voice clarity and reduces noise in the line. In Third Generation, the augmented bandwidth, multiple mobile applications and clarity of digital signals, then 3G is the gateway [2]. GSM technology able to transfer circuit switched data over the network. The spectral efficiency of 3G technology is better than 2G technologies. 3G technologies are used in TDMA and CDMA. The 3G technology is allowed to more coverage. The 4G technology are latest version of the 3G technology with more bandwidth. The 4G technologies are high quality of video and audio as compared to 3G technology. The advantage of 4G is more spectrum optimization, more network capacity, and high data rate [2].

Orthogonal frequency division multiplexing (OFDM):-OFDM is a modulation technique for the latest version of wireless communication system and telecommunication standard. The more cellular telecommunication standard example is LTE and WiMax [3]. Orthogonal Frequency Division Multiplexing is a multicarrier modulation technique that divides a high data rate modulating stream into parallel low data rate of stream using FFT, and in this way is less sensitive to frequency selective fading. In OFDM the spectrum is overlapped but the signal is Orthogonal. Different symbols are transmitting over different subcarrier. OFDM [4] has multicarrier property and is robust in the faded mobile wireless environment. In almost all wireless applications, the main criteria for the quality of the transmitted message are that it should have good and acceptable quality, for which bit error rate (BER) is important. Channel state information is an important parameter for improving the performance and efficiency of an OFDM system. The performance of OFDM depends on the accurate channel estimation [4]. The benefit of OFDM is spectral efficiency/bandwidth efficiency. The more data is transmitted in the form of noise, the spectral efficiency will measured in Bps/Hz like C = B x log (1+S/N) [6].

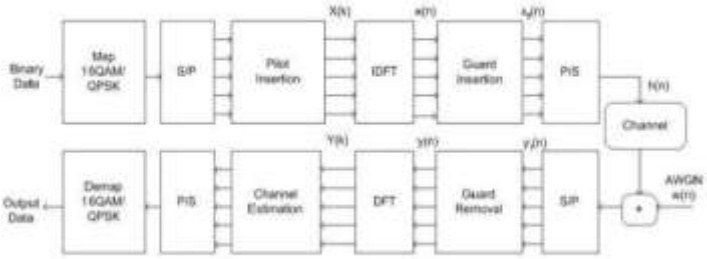

Fig1.1 OFDM system [6]

***Channel Estimation*:-**The Channel Estimation is to estimate the property of channel. In the Channel Estimation it reduces a complexity. It overcomes this problem the matrix inversion needed for every OFDM data symbols [5]. Channel estimation is a coherent detection; coherent receivers must know the carrier phase information. Hence the data is transmitting over a channel impulse response for compensation [7]. It is able to estimate the original

transmitted OFDM symbol; we need accurate channel state information [4]. Channel state information can be obtained by using transmitted data and pilot tones and the important parameter to improve a channel performance and efficiency [7].

$$Y = Xh + n$$

However, Y is the received vector, X is a matrix from the transmitter, h is a channel attenuation vector, and n is a vector of i[8].

Types of Channel Estimation:-

The arrangement of pilot is depending upon, two different types of pilot structure are considered: Block type, Comb type.

TABLE I.

Block, Comb type pilot with comparison

Block Type	Comb Type
In block type Time domain allocation and 1D estimator are used.	In the comb type 1D and frequency domain allocation are used.
All pilot use as a block type symbol. The block type used for slow fading channel.	The comb type used for fast fading channel. And all subcarrier use as a specific periods.
Estimation may be based on LS, and MMSE modified MMSE.	Estimation may be based on LS, ML and PCMB.
In block type interpolation are not required.	In comb type interpolation are required.
Don't effect of the spectrum efficiency.	Reduce Spectrum efficiency.
The slow fading channel is used.	The fast and slow fading channel is used.

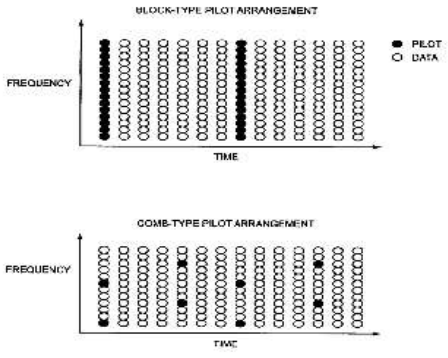

Fig1.2 Block Type and Comb Type [10]

Training based channel estimation

Training based channel estimation used to provide a good performance. However, efficiency are reduces with the help of overhead using a training symbols. Such as preamble or pilot tones that are transmitted in addition to data symbols. If the training symbols are available in channel estimation the least-square (LS) and minimum-mean-square-error (MMSE) techniques are used.

DFT-Based channel estimation

The DFT-Based channel estimation technique is used to improve the performance of LS and MMSE. It effects the channel estimation noise at outside the channel. This technique is used for to reduce noise.

Semi-blind channel estimator

It is another class of the channel estimators that are not utilizes the part of signal corresponding the training symbols but also a part of the data symbols.

Blind channel estimation

Blind channel estimation is the statistical properties of received signals to estimate the channel without using the pilot signal and preamble. In blind channel estimation technique are not using the overhead training signals. However, the statistical properties need a large number of received symbols. Furthermore, their performance is usually not good then the training technique. It consists of a zero-memory nonlinear estimator, adaptive algorithm and filter.

Pilot based channel estimation

In a pilot based channel estimation only used a few subcarriers for the initial estimation process. Depending on the stage where the estimation is performed, estimation process using the time domain and the frequency domain technique.

Greedy Algorithm with OFDM system:-

The greedy algorithm is used to solve the optimization problem with the help of the OFDM system. When the signal is complex it solves in the easy way. E.g. multipath fading, when the signal is received directly (LOS) there is no attenuation, noise etc.

II. LITERATURE SURVEY

In this section we describe the previous work and their methodology with different types of technique with OFDM system. There are several researchers proposed OFDM system with different types of greedy deterministic technique and simulate the proposed work. There are different studies based OFDM greedy Deterministic techniques given below:

[Seyye Hadi, et.al, 2015][1] In proposed work the greedy deterministic algorithms based on the OFDM

system. In this technique they optimize the value with the help of pilot. The pilot are references signal to used in transmit and receiver side. The purposed algorithm is deterministic which do not need to send pilot pattern as side information to the receiver. In this algorithm to solve the optimization problem e.g. AdHoc WSN. In Proposed work to using the three algorithm and they define the properties and compare the all channel. In addition, a minimum distance term is introduced, when the distance of both pilot are multiple integrals and it lead to fast the runtime and low complexity. It recovery this all problems with the help of channel estimation methods. The three algorithms are used in OFDM and compare the BER and SNR.

[Jung-Chieh, Chen et.al, 2013][3] In this paper the main problem are OFDM with sparse channel estimation in a pilot. To reduce a complexity and increases the accuracy with OFDM system and also increase the spectral efficiency. In a simulation result the pilot are using an OFDM to provide better performance as compared to the other computational method like equi-spaced scheme and random method.

[Chenhao Q et.al, 2012][4] This paper the deterministic pilot allocation for sparse channel estimation in OFDM systems is investigated. Thus the greedy algorithms are used in sparse channel estimation to provide a low value and the signal is optimize them. For those cases the CDS is unavailable, we have using a scheme and it is based on the discrete stochastic from the near-optimal pilot pattern via online training. It is based on the rule of minimizing the coherence of DFT sub matrix. Simulation results are validate from the proposed scheme, which is faster convergent more efficient than the exhaustive search.

[Vineetha Mathai et.al, 2013][10] OFDM is a modulation technique for the latest version of 4G wireless communication system in high bit rate transmission system. The bandwidth is precious and it provides a more number of users in channel estimation [5]. OFDM is a multicarrier modulation technique which provides high speed of data streams of a multipath fading that causes a inter-symbol-interference (ISI). When a cycle prefix is added the ISI is removed. Channel estimation is required and analyzes the effect of channel on the transmitted symbols [2]. Channel estimation is used in blind channel estimation and pilot based channel estimation. The blind channel are used large data and low coverage area. Hence, it against to the real-time channel estimation. So the block type is used.

[Osvaldo et.al 2004][6] In proposed work the pilot is based on channel estimation for OFDM system. The OFDM systems are used fast fading channel, thus a Channel estimation and tracking is carried out by transmitting signal, known the pilot symbols in given positions. This explains with using the two steps. Firstly, the pilot subcarrier is obtained in least-squares (LS) estimator and the secondly is blind training estimator. Thus the estimator is interpolated and smooth over a entire frequency-time domain. In this paper, to add a intermediate step in channel estimation, to increase the accuracy of OFDM with pilot subcarriers.

[Jan-jap et.al 1995][9] Channel estimation and equalization is an essential problem in OFDM system design. This compensation are requires, to estimate the channel response that is available. Often a impulse response is derived from training sequence or pilot symbols, but it is also possible to use non pilot aided approaches like blind equalizer algorithms. In OFDM design a one fundamental issue are there of a channel estimation. Thus the non-coherent detection technique is used, and almost the losses are 3-4 dB compared to coherent detection. If a coherent OFDM system is adopted, the channel estimation is required and thus a pilot tone is used for channel estimation.

[Chang, et.al. in 1966][2] In this paper the OFDM used in fading channel. When the signal is not received in directly (non-line of sight). Thus the problems are there, to overcome this problem to use in multi-fading channel. In recently the OFDM system are selected in the high performance of the channel with pilot signal. The benefit of OFDM is bandwidth saving as compare as the FDM system. The orthogonal frequency division multiplexing are high data rate and high spectral efficiency. Finally the results, a performance of OFDM depends on the accurate channel estimation. It significantly reduces the implementation complexity of OFDM modems.

III. CONCLUSION & FUTURE SCOPE

A review of different channel estimation technique is discussed. Different channel estimator like blind channel, semi-blind channel and discuss how to improve their performance and how to effect that using a noise. When apply the DFT on the estimated output of these algorithms the results can be improved. DFT based channel estimation technique allows the reduction of noise component owing to operation in the transform domain and thus providing higher estimation accuracy. In future work, we used a Neural Network.

REFERENCES

[1] Seyyed Hadi." A Greedy Deterministic Pilot Pattern Algorithms for OFDM Sparse Channel Estimation" Springer, 2015.
[2] Chang "Synthesis of band limited Orthogonal Signals for multichannel data transmission" Bell System Technical Journal.vol.46, December 1996.
[3] Chen "An efficient pilot design scheme for sparse channel estimation in OFDM system" IEEE, 2013.

[4] C. Qi and L. Wu,“ A study of deterministic pilot allocation for sparse channel estimation in OFDM systems,” IEEE Commun. Lett. vol. 16, no. 5, pp. 742–744, May 2012.
[5] D. Hu“ Semi-blind pilot decontamination for massive MIMO systems” *IEEE Trans. Wireless Commun.*, vol. 15, no. 1, pp. 525–536, Jan. 2016..
[6] Osvaldo” Pilot-Based Channel Estimation for OFDM by tracking the delay-subspace” IEEE, VOL.3, NO.1,JAN 2004.
[7] C. Carbonelli “Sparse channel estimation with zero tab detection” IEEE Trans. Wireless Commun., vol. 6, no. 5, pp. 1743–1753, May 2007.
[8] C. Qi “Optimized a pilot placement for sparse channel estimation in OFDM systems” IEEE Signal Process. Lett., vol.18,no.12, pp. 749–752, Dec. 2011.
[9] Jan-Jaap Van De Beek,“On channel estimation in OFDM systems”, In Proc. VTC'95, volume 2, pages715{719, Rosemont, IL, July 1995. IEEE.
[10] V. Mathai “Comparison And Analysis Of Channel Estimation Algorithms In OFDM Systems”, IJOSTR, vol. 2, no. 3, pp. 76- 80, 2013.
[11] L. Tong “Blind channel identification and equalization based on second-order statistics: A time domain approach,” *IEEE Trans. Inf. Theory*, vol. 40, no. 2, pp. 340–349, Mar. 1994.