Performance Analysis of OFDM System by Using Romp Channel Estimation Method

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ABSTRACT: The demand for high data rate and high user mobility has driven present day wireless communications into another time, in which best in class advances are created to encourage the satisfaction of such requests, and additionally to ensure the nature of service of transmissions under unfriendly channel conditions. In past large amount of work has been made on the past years on channel estimation in OFDM systems still it is considered as area of concern in wireless communication. Orthogonal Frequency-Division Multiplexing (OFDM) is currently viewed as a possible contrasting option to the customary single carrier modulation procedures for high data rate communication systems, for the most part due to its intrinsic balance effortlessness. Channel estimation can be performed for analyzing effect of channel on signal by either inserting pilot tones into all of the subcarriers of OFDM symbols with a specific period or inserting pilot tones into each OFDM symbol. Decision-directed and pilot-symbol-aided methods are two different ways for channel estimation. Pilot-symbol-aided channel estimation can be further divided in two types: block- type-pilot channel estimation and comb-type-pilot channel estimation. Different types of channel estimation technique with virtual sub carriers are discussed in this paper.

KEYWORDS: OFDM, AWGN, Channel Estimation, Pilot carrier, QAM, MMSE

1. INTRODUCTION

Orthogonal frequency Division Multiplexing (OFDM) is a very attractive technique for high bit-rate transmission in 4G wireless communication systems, where bandwidth is very precious, and service providers are continuously met with the challenges of including more number of users with in a limited allocated bandwidth. Orthogonal Frequency Division Multiplexing (OFDM) is modulation technique most widely used for high-bit-rate wireless communication. Especially the wireless local area network systems such as WiBro, WiMax, WiFi and the emerging fourth-generation mobile

systems are all of used of OFDM as the core modulation technique. Wireless communication systems use two different signaling schemes which are: coherent and general signaling schemes. Coherent signaling scheme such as Quadrature Amplitude Modulation (QAM) requires channel estimation and tracking of the fading channel. In a general modulation scheme such as Differential Phase Shift-Keying (DPSK) no channel estimation is required. DPSK is used for low data rate wireless transmission. For example European Digital Audio Broadcast (DAB) uses DPSK modulation scheme. For more efficient digital wireless communication systems, the coherent modulation scheme such as QAM is appropriate [7]. In OFDM system, the channel is usually assumed to have a finite impulse response. To avoid the inter-symbol interference, a cyclic extension is put between the consecutive blocks, where the cyclic extension length is longer than the channel impulse response. There are two different ways for channel estimation such as Decision-directed and pilot-symbol-aided methods. Pilot-symbol-aided channel estimation can be further divided in two types: block- type-pilot channel estimation and comb-type-pilot channel estimation. In the block-type-pilot method, all sub-carriers are reserved for the pilot within a specific period. The estimation of the channel for the block-type-pilot arrangement can be based on Least Square (LS) or on Minimum Mean Square Error (MMSE). In the comb-type-pilot method, one sub-carrier is reserved as a pilot for each symbol. The estimation of the channel for the comb-type-pilot arrangement can be based on linear interpolation, second order interpolation, low-pass interpolation or on time domain interpolation. The MMSE estimator performance is good but its complexity is high. Contrary the LS estimator complexity is low but its performance is poor [2]. For reducing complexity of the both estimators we proposed two different algorithms which reduce complexity without compromise in performance or with slightly lower performance.

1.1 Wireless Channels

The key distinction between wireless and wire line communications lies in the physical properties of the channels. When a radio-frequency (RF) signal is transmitted over a wireless channel, due to the presence of multiple propagation paths between the transmitter and receiver, there are multiple copies of the transmitted signal at the receiver. The multiple paths arise due to reflections, scattering, diffractions from objects in the environment as illustrated in

Fig. 1.2. The combination of multiple copies of the transmitted signal affects many characteristics of the received signal. In general, the effects of a wireless channel can be categorized into two types: large-scale fading (or path loss, attenuation) and small-scale fading (typically referred simply to as fading). The large-scale fading is due to signal attenuation by large objects such as buildings, hills, etc.

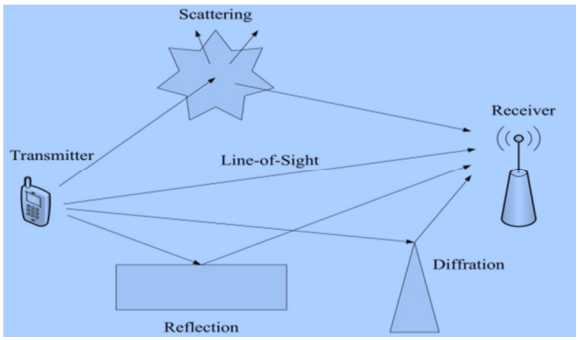

Figure 1.Example of wireless channel.

The small-scale fading is due to the constructive and destructive combinations of the multiple signals arrived over different propagation paths at the receiver. Dealing with small-scale fading is one of the most challenging issues in designing a robust wireless communication system. Hence, in what follows, we discuss a channel model for the wireless link that is affected by the small-scale fading.

2. OFDM Systems

OFDM is a multicarrier transmission method proposed in the mid-1960. In a frequency-particular channel, the postpone spread of the channel impulse reaction presents between image impedance (ISI) in a solitary carrier framework, which causes extreme framework execution corruption if not dealt with. OFDM adequately counters the channel postpone spread by changing over the channel into various covering however commonly orthogonal sub channels in the frequency domain. The spectrum of an OFDM signal is appeared in Figure 1.3 for instance. The fundamental flap of each subcarrier lies on the nulls of all different subcarriers so that there is no common obstruction. OFDM was as of late broadly perceived as a perfect technique for rapid wireless data transmission, for the most part because of the accessibility of fast usage of FFT by present day VLSI outline. OFDM has been effectively received in numerous frameworks, for example, Digital Video Broadcasting-Terrestrial (DVB-T),

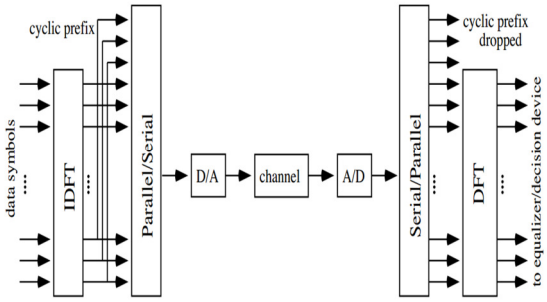

Figure 2. An OFDM systems.

Asymmetric Digital Subscriber Line (ADSL), and in wireless LAN standards, for example, IEEE 802.11a and IEEE 802.11g.

OFDM is additionally being considered as a promising contender for future era fast digital correspondence frameworks, for example, IEEE 802.

The communications channels in wireless conditions are portrayed by the impression of the transmitted radio signal from the articles in the earth. In case of an observable pathway (LOS) communications, the optional reflections from the articles in the earth may negligibly affect the execution of the radio correspondence. However in numerous situations, there is either no LOS segment or the reflections from the articles are too solid to ever be overlooked.

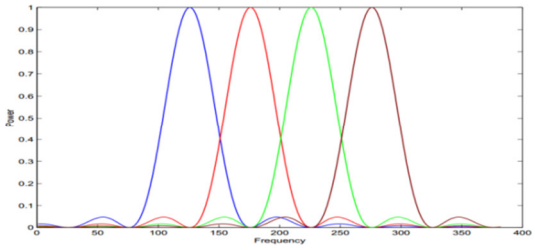

Figure 3. Power Spectrum of Sub Carrier in an OFDM system.

3. PROPOSED APPROACH

The time of OFDM hail began starting with serial should parallel converter. The information is fit as a fiddle What's more compelling reason with changeover under parallel association, since QAM (Quadrature plentifulness Modulation) module obliges parallel promise should methodology information. These parallel changed in information is mapped should fitting picture, with the help from claiming plentifulness

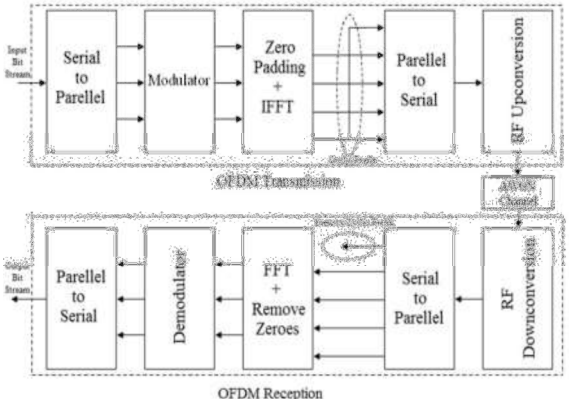

Figure 4. OFDM System Block Diagram

alter mapping bank. Those parallel portraits are changed starting with repeatable space under occasion when territory, utilizing IFFT module. Eventually Tom's perusing furthermore by, the indications are consolidated for a cyclic prefix What's more changed again under serial course for action, preceding being transmitted. Those got information may be over serial course for action, since FFT information will be done parallel, a module which utilization to transforms again from serial should parallel is obliged. Preceding applying information of the FFT unit, cyclic prefix may be exhausted. Yield starting with FFT is demodulated, utilizing de-mapping module. Should demodulate the subcarriers utilizing QAM controls, reference phase What's more sufficiency of the gathering about stars, looking into every subcarrier are obliged. Those yield of de-managing module will be

transformed over go on serial association, through parallel on serial converter, should get the transmitted information [2].

ROMP Channel Estimation

4. RESULTS AND DISCUSSION

Channel proto typical is set to the normal which is executed in MATLAB. For each simulation, we compute Sparse Channel, SL0, LSE, OMP and ROMP based Estimation.

Table 1: Network Parameters

No of Subcarrier	128
No. of block in each channel	1
Modulation order	4
Sample Time	10-7
Length of Guard interval	16
SNR	15db
No. of iteration	100

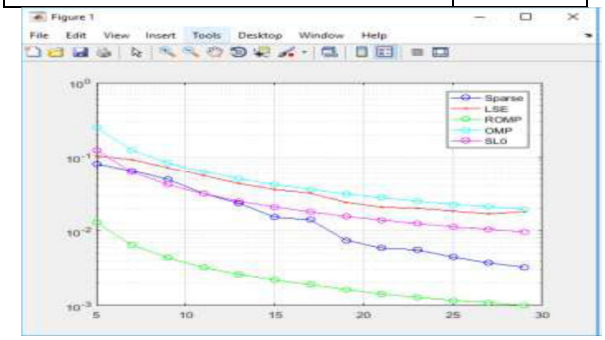

Figure 4: All Channel Estimation BER Performance

Table 2: Comparative Analysis

Method	BER
Sparse	0.0043
SL	0 0.0091
LSE	0.0391
OMP	0.0182
ROMP	**0.00017**

5. CONCLUSION

In this work, we need examined different estimators for square kind pilot course of action. Those estimators in this ponder might make used to proficiently estimate those channel over an OFDM framework provided for a specific learning over channel facts. The LSE estimators Accept a from the earlier learning about commotion difference Furthermore channel covariance. Moreover, its intricacy may be extensive contrast with those OMP estimator. To secondary SNRs those LSE estimator is both straightforward Furthermore sufficient. The cavort estimator need useful execution at secondary unpredictability. Those OMP estimator need low complexity, Anyway its execution is not Similarly as great Concerning illustration that cavort estimator fundamentally during low SNRs.

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