Arbitrary Multiplexing Rates for Video Broadcasting

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Abstract-MIMO-OFDM can not only effectively enhance the transmission rate and capacity of the wireless communication system but also effectively combat multipath fading and inter-symbol interference (ISI). MIMO-OFDM technology has become one of the most proming solutions in the high data rate wireless channel transmission. In the OFDM system with transmit diversity, when the receiver knows the channel information better, the space-time codes can be decoded effectively. In order to enhance frequency efficiency, the receiver also needs to know the channel information for coherent demodulation. So channel estimation is directly related to the system performance.

In this paper, we present an improved DFT-based channel estimation method. The conventional discrete Fourier transform (DFT)-based approach will cause energy leakage in multipath channel with non-sample-spaced time delays. The improved method uses symmetric property to extend the LS estimate in frequency domain, and calculates the changing rate of the leakage energy, and selects useful paths by the changing rate. The computer simulation results show the improved method can reduce the leakage energy efficiently, and the performance of the improved channel estimation method is better than the LS and conventional DFT algorithm.

Keywords: MIMO-OFDM, LS, DFT, LMMSE, Wireless communication

I.INTRODUCTION

MIMO-OFDM can not only effectively enhance the transmission rate and capacity of the wireless communication system but also effectively combat multipath fading and inter-symbol interference (ISI). MIMO-OFDM technology has become one of the most proming solutions in the high data rate wireless channel transmission. In the OFDM system with transmit diversity, when the receiver knows the channel information better, the space-time codes can be decoded effectively. In order to enhance frequency efficiency, the receiver also needs to know the channel information for coherent demodulation. So channel estimation is directly related to the system performance by now, many channel estimation algorithms have been presented. Least squares (LS) approach is introduced in.

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The LS estimation is the simplest channel estimation. This algorithm has lower complexity. However, it has larger mean square error (MSE) and easily influenced by noise and intercarrier interference.

Linear minimum mean square error (LMMSE) algorithm is introduced in. LMMSE algorithm is a simplified algorithm of Minimum Mean Square Error (MMSE). Although they can achieve better performance than LS, they have higher computational-complexity and need to know the channel statistics which are usually unknown in real system. In and, the algorithms of reducing the complexity of the LMMSE are proposed. But these two modified methods still require exact channel covariance matrices.

In this paper, we focus on DFT-based channel estimation method. This algorithm can make good compromise between performance and computational complexity. Most of the published work on DFT-based channel estimation assumes each path delay is an integer multiple of the sampling interval in multipath channel. However, it is difficult to ensure this condition in real system because of the complexity and incomprehensibility of the transmission channel. In nonsample- spaced multipath channels, the channel impulse response will leak to all taps in the time domain. Reference propose a method to reduce leakage power by calculating energy increasing rate. Another approach is also proposed by extending the LS estimate with a symmetric signal of its own in. Based on these two methods, we propose a new method to solve the problem of energy leakage.

II.REVIEW OF OFDM

A. OFDM

OFDM is becoming widely applied in wireless communications systems due to its high rate transmission capability with high bandwidth efficiency and its robustness with regard to multi-path fading and delay. It has been used in digital audio broadcasting (DAB) systems, digital video broadcasting (DVB) systems, digital subscriber line (DSL) standards, and wireless LAN standards such as the American **IEEE**® Std. 802.11™ (WiFi) and its European equivalent HIPRLAN/2.

It has also been proposed for wireless broadband access standards such as **IEEE** Std. 802.16™ (WiMAX) and as the core technique for the fourth-generation (4G) wireless mobile communications. The use of differential phase-shift keying (DPSK) in OFDM systems avoids need to track a time varying channel; however, it limits the number of bits per symbol and results in a 3 dB loss in signal-to-noise ratio (SNR). Coherent modulation allows arbitrary signal constellations, but efficient channel estimation strategies are required for coherent detection and decoding.

There are two main problems in designing channel estimators for wireless OFDM systems. The first problem is the arrangement of pilot information, where pilot means the reference signal used by both transmitters and receivers. The second problem is the design of an estimator with both low complexity and good channel tracking ability. The two problems are interconnected. In general, the fading channel of OFDM systems can be viewed as a two-dimensional (2D) signal (time and frequency). The optimal channel estimator in terms of mean-square error is based on 2D Wiener filter interpolation. Unfortunately, such a 2D estimator structure is too complex for practical implementation.

The combination of high data rates and low bit error rates in OFDM systems necessitates the use of estimators that have both low complexity and high accuracy, where the two constraints work against each other and a good trade-off is needed. The one-dimensional (1D) channel estimations are usually adopted in OFDM systems to accomplish the trade-off between complexity and accuracy. The two basic 1D channel estimations are block-type pilot channel estimation and comb-type pilot channel estimation, in which the pilots are inserted in the frequency direction and in the time direction, respectively. The estimations for the block-type pilot arrangement can be based on least square (LS), minimum mean-square error (MMSE), and modified MMSE. The estimations for the comb-type pilot arrangement includes the LS estimator with 1D interpolation, the maximum likelihood (ML) estimator, and the parametric channel modeling-based (PCMB) estimator. Other channel estimation strategies were also studied, such as the estimators based on simplified 2D interpolations, the estimators based on iterative filtering and decoding, estimators for the OFDM systems with multiple transmit-and-receive antennas, and so on.

III.A Digital Implementation of a Baseband OFDM System

A. Overall Block Diagram of the OFDM System

The basic idea underlying OFDM systems is the division of the available frequency spectrum into several subcarriers. To obtain a high spectral efficiency, the frequency responses of the subcarriers are overlapping and orthogonal, hence the name OFDM. This orthogonality can be completely maintained with a small price in a loss in SNR, even though the signal passes through a time dispersive fading channel, by introducing a cyclic prefix (CP). A block diagram of a baseband OFDM system is shown in Figure 1.

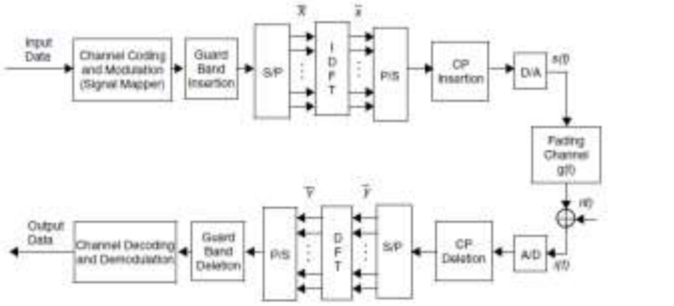

Fig 1 A Digital Implementation of a Baseband OFDM System

The binary information is first grouped, coded, and mapped according to the modulation in a "signal mapper." After the guard band is inserted, an N-point inverse discrete-time Fourier transform (IDFTN) block transforms the data sequence into time domain (note that N is typically 256 or larger). Following the IDFT block, a cyclic extension of time length TG, chosen to be larger than the expected delay spread, is inserted to avoid intersymbol and intercarrier interferences. The D/A converter contains low-pass filters with bandwidth 1/TS, where TS is the sampling interval. The channel is modeled as an impulse response g(t) followed by the complex additive white Gaussian noise (AWGN) n(t), where αm is a complex values and $0 \leq \tau mTS \leq TG$.

B. Implementation Results

The Block Diagram used for the simulation is shown below in Fig.2 the input signal taken is 16 QAM signal. The input signal is added with zero padding in order to reduce the Inter Symbol Interference (ISI). Then the signal is transmitted via a channel whose impulse response is already known. The signal is corrupted by noise when it is passing via the channel.

In the Receiver the Zero Padding has to be removed and then the estimation of the signal is performed. The Transmitted signal is obtained by estimating the signal form the received samples. From the estimated value the output is obtained by using the proper equalizer. In this project Linear Zero Forcing Equalizer is used.

The performance of the system is evaluated by using the MSE values that calculated for various scenarios. The Bit Error Rate for the Equalizer is said to be less .Hence the equalizer used is said to be optimal one. Each and every Component used in the project is discussed below.

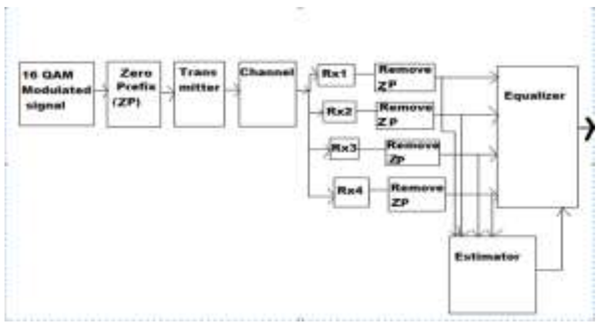

Fig.2 System Block Diagram for Simulation.

IV.SOFTWARE REQUIREMENT AND DISCRIPTION

The operating system used is Windows 7 and the tool used is Matlab of version 7.10. MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation. Matlab is a data analysis and visualization tool which has been designed with powerful support for matrices and matrix operations. As well as this, Matlab has excellent graphics capabilities, and its own powerful programming language. One of the reasons that Matlab has become such an important tool is through the use of sets of Matlab programs designed to support a particular task.

V.EXPERIMENTAL RESULTS

A. FOR SINGLE INPUT SIGNAL

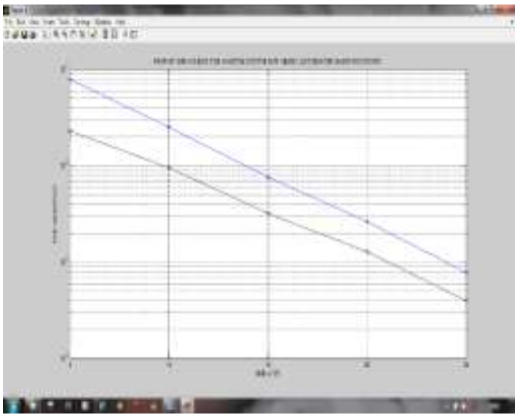

Fig 3. Plot of SNR vs MSE for an OFDM System with MMSE Estimator based Receivers for single Input

B. FOR MULTIPLE INPUT SIGNAL

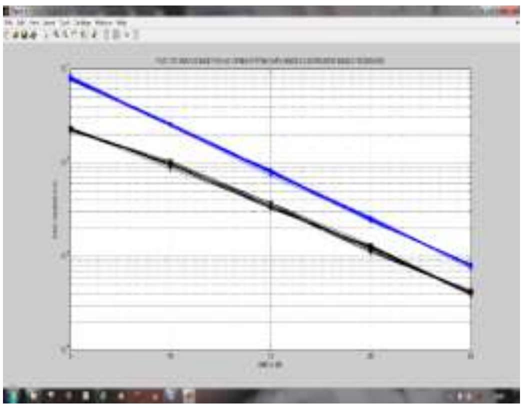

Fig 4 Plot of SNR vs MSE for an OFDM System with MMSE Estimator based Receivers for multiple Input

C.SNR vs Two MSE

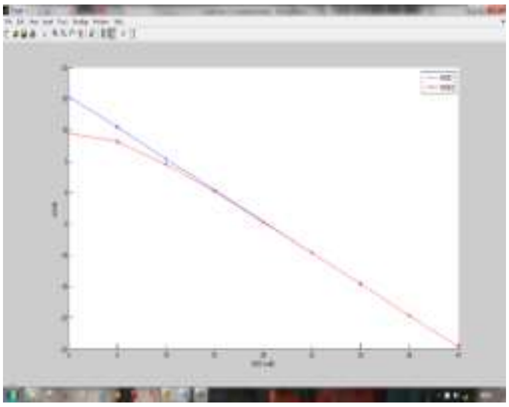

Fig.5 SNR vs Two MSE

VI.CONCLUSION AND FUTURE WORK

In this paper, an improved DFT-based channel estimation method in non-sample-spaced multipath channel for MIMO OFDM system is proposed. The improved method uses the symmetric property and calculates the changing rate of the leakage energy in order to select useful paths. Simulation results show that the improved method can reduce the leakage energy efficiently. And the MSE and BER performance of the improved method are both better than LS estimation and conventional DFT-based channel estimation method. The improved method achieves a satisfying trade-off between complexity and performance.

In this Project the original reformulation of the SS-based estimation procedure for the blind identification of OFDM-based SIMOFIR channels is proposed. This technique of MNS turn souttobea power fultool that can be applied to other OFDM-based SIMO systems. So far these techniques are used in the Third Generation (3G) broadband wireless systems. This can be used for Fourth Generation (4G) broadband wireless systems that will perform multimedia transmission to mobiles and portable personal communications devices, i.e. EuropeanMEMOprojectandforIEEE802.16.

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