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"PERFORMANCE ANALYSIS OF EFFICIENT SPARSE CHANNEL ESTIMATION FOR MIMO-OFDM SYSTEM"

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ABSTRACT

In this paper we define estimation of sparse frequency selective channels within MIMO-OFDM systems. Recovery of the the transmitted data requires estimate of the Channel State Information (CSI). At the receiver side, CSI is obtained by employing different estimation techniques. Few of the standard technique adopted for channel estimation are Least Square (LS) ,Minimum Mean Square Estimation (MMSE) These channels are independently sparse and share a common support. The method estimates the impulse response for each channel observed by the antennas at the receiver. Estimation is performed in a coordinated manner by sharing minimal information among neighboring antennas to achieve results better than many contemporary methods. Simulations demonstrate the superior performance of the proposed method.

Index Terms— massive MIMO, OFDM, sparse channel

INTRODUCTION

Wireless communication has become one of the fastest growing industries during the last few decades. Over 2 billion users are involved and make it one of largest research and business fields [1]. With the development of mobile devices, many technical challenges have arisen such as video streaming, online-gaming and real-time video meeting. Hence, the 3rd and 4th generations of cellular systems such as WiMAX [2], LTE, and LTE Advanced [3] have been deeply studied and deployed in many developing and developed countries. However, a higher quality of service is required for the current systems, that is, higher data rate, higher spectral efficiency and more reliable link. These features must be provided with lower cost (reduced size of equipment and less energy consumption etc.

For instance, MIMO-OFDM has been employed in LTE-Advanced. A tradeoff between complexity and performance may be required in the sense that the suboptimal detection methods have lower complexity at the expense of poorer performance compared to ML receivers. In addition, hundreds of subcarriers have been exploited in such system, which makes the receiver design more complicated than narrow-band MIMO systems. Also, the wireless channels results in the distortion and superposition of the transmitted signals from multiple transmit antennas. Hence, lower-complexity and more robust channel estimation and detection techniques are critical to wireless communication systems. To obtain a higher data rate, MIMO techniques are widely used in most current wireless communication systems. There are three significant advantages of multi antenna systems: (1) energy efficiency. The signal to noise ratio (SNR) is improved; (2) diversity gain. The fading effect can be compensated for the replica of signals over Different uncorrelated channels; (3) multiplexing gain. The data rate can be increased by transmitting independent data streams through multiple transmit antennas

METHODOLOGY USED

Pilot-Based Channel Estimation for OFDM Systems

Compared to non-coherent detection, coherent detection can achieve a higher data rate and a better performance at the price of acquiring accurate channel estimates. Thus, the channel estimates become necessary. The system model becomes

$$\mathbf{y} = \mathrm{diag}\{\mathbf{F}_L \mathbf{h}_{tl}\}\mathbf{s} + \mathbf{v}.$$

Because the orthogonality between subcarriers is maintained, can be rewritten in another form:

$$\mathbf{y} = \mathrm{diag}\{\mathbf{s}\}\mathbf{h}_{df} + \mathbf{v},$$

Fundamental Pilot Allocation for OFDM systems

Block Type Pilot Allocation

The block type pilot allocation is to insert pilots periodically into all subcarriers in the frequency domain, so the channel frequency response for each subcarrier can be estimated [8, 10]. The diagram of block type pilot allocation is plotted as Fig. 3.1 Note that the quantity tp denotes the time sampling period of pilot symbols, which must be much smaller than the inverse of Doppler frequency (fd) or coherence time. Hence, the block type pilot allocation is designed for the frequency selective channel. It may employ more pilots, if the channel variation between consecutive OFDM symbols increases.

MMSE Channel Estimation

The MMSE estimate using the rough channel estimate hdf obtained by LS channel estimation is given by

$$\tilde{\mathrm{h}}_{df} = \mathrm{W}\hat{\mathrm{h}}_{df}$$

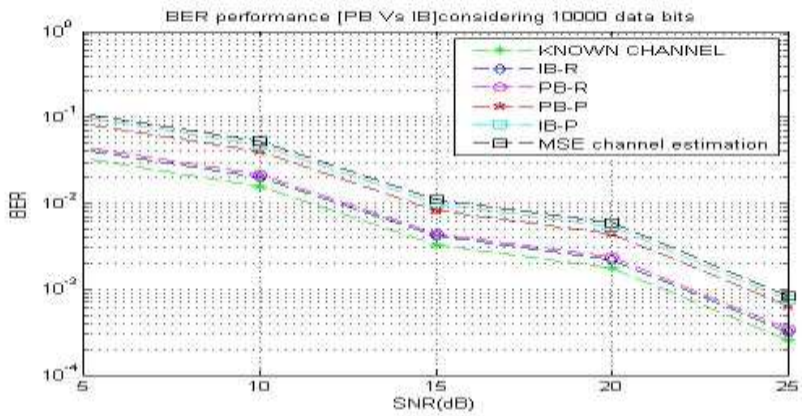
Where the weight matrix W denotes the MMSE filter. The MMSE filter can be represented by

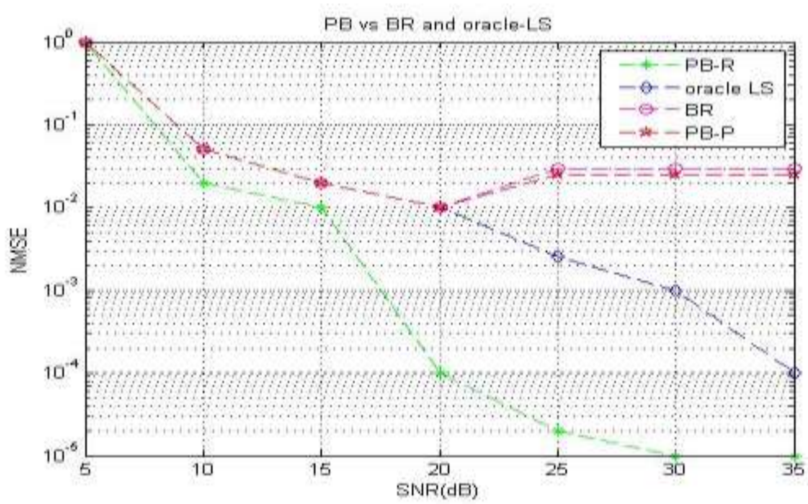
$$\mathrm{W} = \mathrm{R}_{\mathrm{h}_{df}\hat{\mathrm{h}}_{df}}\mathrm{R}^{-1}_{\hat{\mathrm{h}}_{df}\hat{\mathrm{h}}_{df}}$$

RESULT

MSE Performance of PB-R, PB-P, LS and their comparison

In this experiment, we benchmark the performance of the proposed algorithms against BR and oracle-LS. Here the signal is passed through a channel of length L = 32. Moreover, we use K = 8 pilots. Fig. shows that the proposed PB-R algorithm has the best performance among all algorithms.





SNR(db)	BER					
	Known channel	IB-R	PB-R	PB-P	IB-P	MSE
5	.033	0.04125	0.04455	0.04745	0.04849	0.04989
10	0.0158	0.01975	0.02133	0.02334	0.02633	0.02913
15	0.0033	0.004125	0.004455	0.004853	0.004963	0.005163
20	0.00177	0.0022125	0.002389	0.002589	0.002799	0.003199
25	0.00025	0.0003125	0.0003375	0.0003555	0.0003655	0.0003858

CONCLUSION

A channel estimation procedure in the massive-MIMO setup which is agnostic to the distribution of channel taps is proposed. It uses a modified version of SABMP to exploit the sparse common support property and share information in a stage wise manner to perform channel recovery. As per our analysis and study this approach has results in lower communication and computational complexity and also better BER performance compare to other techniques. These methods for channel estimation for 5G system have shown the superiority over other methods

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