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Evaluating the Performance of MIMO-OFDM System Based On Modified Newton Method for Semi-Blind Equalizer

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Abstract: ***In this paper, modern wireless broadband communication system like Multiple Input Multiple output(MIMO) combined with Orthogonal Frequency Division Multiplexing(OFDM).It employ High data rate, better spectral efficiency and high throughput quadrature amplitude modulation(QAM). MIMO-OFDM is popular because of its good quality data transmission rate and its sturdiness against multipath fading. This communication system provides unfailing communication & wide coverage. The main challenge to MIMO-OFDM system is to rescue of the Channel State Information (CSI) perfectly and coordinated between transmitter & receiver. Channel estimation technique based on semi-blind equalizer for Multiple Inputs Multiple Output (MIMO) for Rayleigh fading channel is proposed in this paper. An Modified Newton Method (MNM)for minimizing the established cost function and it has much low computational complexity than Newton method. The performance evaluation of channel estimation for semi-blind equalizer is carried out with Modified Newton Method (MNM) through matlab simulation. The performance of channel estimation techniques MNM is evaluated and results are demonstrate ,it has better performance than gradient-Newton (GN)-based concurrent constant modulus algorithm(CMA) with SDD scheme (GNCMA+SDD).***

Keywords: MIMO-OFDM, QAM, MNM, MMA, SDD

1. Introduction

1.1 OFDM :(Orthogonal Frequency Division Multiplexing)

Orthogonal frequency division multiplexing (OFDM) is based on the multicarrier communications technique. The proposal of multicarrier communications is to divide the total signal bandwidth into quantity of subcarriers and information is transmitted on each of the subcarriers. Unlike the conventional multicarrier communication scheme in which spectrum of each subcarrier is non-overlapping and band pass filtering is used to extract the frequency of interest. In OFDM the frequency spacing between subcarriers is selected such that the subcarriers are mathematically orthogonal to each other. The spectra of subcarriers overlap each other but individual subcarrier can be extracted by baseband processing. This overlapping property makes OFDM more spectral efficient than the conventional multicarrier communication scheme.

The OFDM symbol is generated as follows:
Firstly, N data complex symbols are cushioned with zeros to get NS symbols that are used to compute the IFFT. The capitulate of IFFT is the critical OFDM symbol focused around the deferment spread of the multi-way channel; a particular janitor time must be chosen (say TG). A variety of specimens comparing to this janitor time must be taken from the beginning of the OFDM symbol and added at the end of the symbol. Also, the same number of specimens must be chosen from the end of the OFDM symbol and must be embedded in the starting.

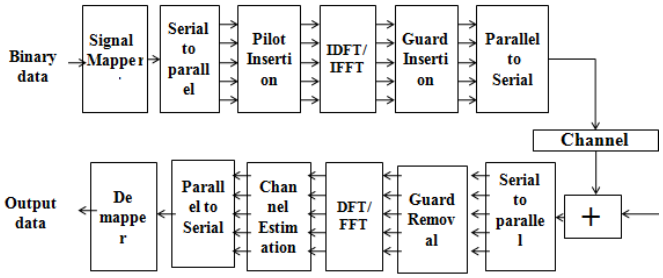


Figure 1: Block diagram of OFDM System

1.2 MIMO-OFDM System:

In a MIMO-OFDM system with N subcarriers the individual data streams passed through OFDM modulators which perform an IFFT on blocks of length N followed by a parallel to serial conversion[1]. Wireless communication related to multiple transmit and receive antennas, which is called multiple-input multiple-output (MIMO) communication, can significantly increase data throughput and link range, efficiently combat fading, and greatly improve service quality, system capacity and reliability by only exploiting the same band-width as a single-input single-output (SISO) system. More importantly, it was shown in and that in a Rayleigh flat-fading environment, if all the propagation coefficients from transmitters to receivers are statistically independent and known in advance, a MIMO system has a very large capacity that increases linearly with the smaller of the number of transmitters and the number of receivers. On the other hand, to make better use of the frequency spectrum resources, quadrature amplitude modulation (QAM) schemes have be-come popular in numerous wireless network standards, because QAM signals have high availability of

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spectrum, good performance of transmission, and relative simplicity in modulation and demodulation. Owing to the aforementioned advantages, MIMO communication systems employing high throughput QAM signals have found widespread applications.

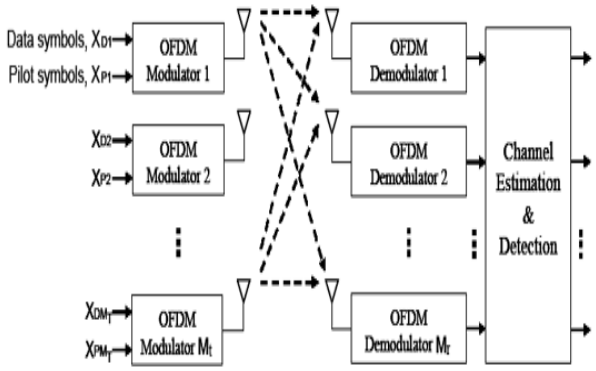


Figure 2: MIMO-OFDM System

2. Modified Newton Method

To ensure that the tap weights rapidly converge to the optimum value, we propose a novel MNM. Give an objective function $f(x)$, where **x** is a vector variable. Assume that the gradient of $f(x)$ can be decomposed into the following form

$$\nabla f(x) = A(x)x - b(x) \quad (1)$$

where $A(x)$and $b(x)$ are a positive definite matrix function and a vector function with respect to **x**, respectively. Let a search direction $\mathbf{d}_k$ be described by

$$d_{k'} = X_{k'-1} - A^{-1}(X_{k'-1})b(X_{k'-1}) \quad (2)$$

Where k' is the iterative index.

$$w_{n,d,k+1} = w_{n,d,k} + \mu SDD\boldsymbol{P}_{\boldsymbol{K}}X(k)\frac{\sum_{q=1}^{4} I(y_n](k)-s_q)\exp(-|y_n(k)-s_q|^2/2\sigma^2)}{\sum_{q=1}^{4}\exp(-|y_n(k)-s_q|^2/2\sigma^2)} \quad (3)$$

3. Performance Analysis

In the MIMO system, we are more apt to display the MSE, SER and MD of all N users rather than the individual user's performance. The MSE, SER and MD are respectively defined as

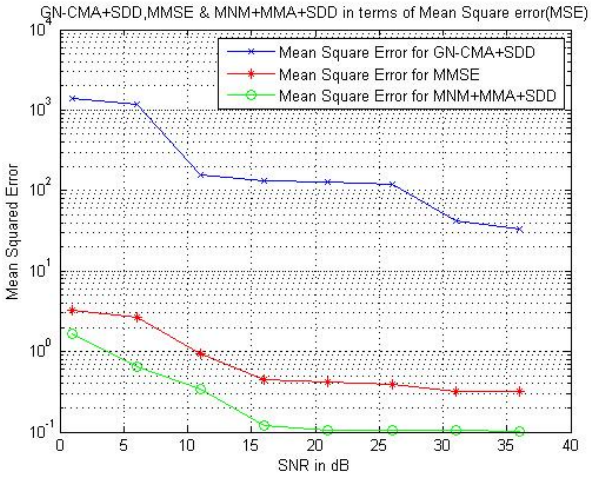
$$MSE = \frac{1}{N}\sum_{n=1}^{N} MSE_n \quad (4)$$

$$SER = \frac{1}{N}\sum_{n=1}^{N} SER_n \quad (5)$$

$$MD = \frac{1}{N}\sum_{n=1}^{N} MD_n \quad (6)$$

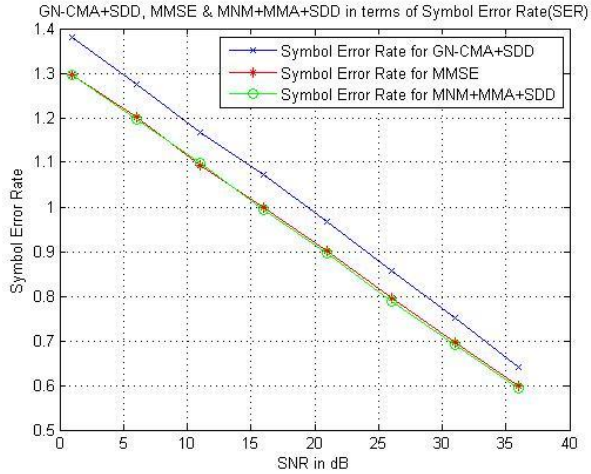
4. Simulation Results

4.1 MSE along with SNR



The performance of Mean Square Error for GN-CMA+SDD, MMSE and MNM+MMA+SDD

4.2 SER along with SNR



The performance of Symbol Error Rate for GN+CMA+SDD, MMSE and MNM+MMA+SDD

5. Conclusion

The MNM is quadratically convergent. A novel MMA+SDD+CF has been introduced for improving the performance symbol error rate. It has high computational precision. Combination with novel MNM the algorithmic complexity is reduced obviously. However, the computational complexity of the proposed method will increase with the increasing of the order of QAM signal, while that of the other methods remains nearly unchanged.

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