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Pre-Equalization Technique in Multi-Carrier CDMA Method for Frequency Selective Fading over Wireless Communication Channels

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Abstract: ***Wireless message is a technique of broadcasting data from one place to another place, with no using other bond like cables, wires or other similar items. The issues occurred in wireless communication technology are the error rates are obtained in the differential detection for any combination of Doppler spread is high. To solve the above issue, consideration of the frequency selective slow fading channels for the lower error rate is taken. A novel Joint Pre-Equalization for Multi-carrier CDMA System over Frequency Selective Wireless Communication Channels is proposed. This paper introduces another look at the issue of cloud signals over direct fading channels. The possibility of Frequency Selective slow fading channels, those channel drive reaction changes at a rate impressively slowly completed the transmitted baseband signs. In the frequency domain, selective entails that the bandwidth of the base band signal of the channel is much greater than Doppler spread of the channel. In our proposed work for joint pre-equalization the technique Multi-carrier CDMA is used for high speed data transmission in wireless communications for reducing the bit error rate. The proposed Multi-carrier CDMA uses two sophisticated technology for reducing error rate that was included for example orthogonal frequency division multiplex (OFDM) and also the code division multiple access (CDMA).***

Index Terms: ***MC-CDMA (Multi-carrier Code-Division Multiple Access), Frequency selective Fading, OFDM (Orthogonal Frequency Division Multiplexing).***

I. INTRODUCTION

Wirelessly performing and delivering the data Communications is one of the types of Wireless Communication. This is a huge phrase that integrates every actions and varieties of linking and conversing among two or more apparatus using a wireless sign by wireless communiqué equipment and gadgets. It efforts as following methods electromagnetic waves that can transmit with a permit tool inside the air in corporeal surroundings or ambience. The sending apparatus may be a correspondent or a transitional apparatus with the capability to broadcast wireless data's. The correspondence among two components happens when the goal or accepting middle of the way device catches these signs, making a remote correspondence connection between the sender and receiver device. The remote correspondence is advantageous. It is utilized for radio projects, cell phones and PC systems. Advanced signs are less influenced by obstruction than simple signs. The first time delay estimation is based on the iterative electromagnetic concept compared to the exhaustive grid search technique by a considerably condensed computational rate. Since it transforms the multidimensional grating seek problem keen on similar easy searches above identical single dimensional gaps, the compacted possibility function by the importance sampling (IS) method with no entailing any initialization which enlarges an irreducible fault base in quantity to the regularized Doppler frequency, achieve higher data transmission efficiency. Discrete Fourier Transform (DFT) outputs are used to approximate the noise discrepancy in the Cyclic Prefix (CP) interval. Analytical results show that the noise discrepancy obtained in a quasi - static fading channel is an unbiased estimate. For MU - MISO BC, BIA is a promising technique without CSIT. The hardware rate and power utilization of the assorted ADC design is high. However, the concert grows appear at the outflow of a linear enlarge in hardware costs and circuit power consumption, and thus massive MIMO would be extra gorgeous if small price, power proficient resolutions are obtainable. In the occurrence of sluggish and speedy fading causes, the concert of wireless body sensors in terms of channel capacity and bit error rate (BER) is lower. BER encompass also been copied for the direct OFDM broadcast and the conformist Alamouti OFDM, a completely supportive OFDM, is enhanced than direct OFDM broadcast as of equally perceptions, particularly at low power and lower noise ratio. System in slighter surroundings since the bandwidth necessitated to determine all multi paths in occasion is contrariwise relative to the cubic root of the amount of the surroundings, like as interiors of cars or within CPU comforts, frequency selective fading would be a very high concern. Constraints of the variants from claiming spread range schemes that is more multicarrier regulation systems calculations offer effectiveness and the time taken to execution when there is a need of aid zero esteemed inputs/outputs to those IFFT/FFT of the modem. Timing and carrier synchronization is a basic requirement that is discussed in the following sections.

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II. RELATED WORKS

Sun. S. Y, Hu. Y. L, Chen. H H, & Meng. W. X, (2016) had suggested a combined pre-equalization with adaptive combining method. It creates utilize of additional diversity gains athwart constituent codes in a CC-CDMA scheme with an assist of pre-equalization and adaptive combining. Ma, Tian Ming (2017) had proposed to raise the data transmission efficiency and further improve the system performances over frequency selective fading channels. Sheng, Bin (2016) had proposed a non-data-aided (NDA) scheme to evaluate the noise variance for orthogonal frequency division multiplexing (OFDM) scheme in frequency-selective channels. Sipal. V, Gelabert. J, Allen. B, Stevens.C, & Edwards. D (2011) had proposed that the Frequency selective fading increases the probability of error in wireless transmission. To allow process in the occurrence of frequency-selective fading, wireless systems contain calculates to conquer it. Li, Bin, Mengwei Sun, Xiaofan Li, Arumugam Nallanathan, and Chenglin Zhao (2015) had proposed an iterative algorithm that is further designed for addressing the sequential importance selection techniques, thus the dynamic non-Gaussian multipath carrier and primary states are supposed recursively. Lodhi. A, Said. F, Dohler. M, & Aghvami. A. H. (2005) had proposed a comparison, cyclic delay diversity that is an attractive loom to accomplish spatial and multipath diversity. Its minimalism and conformability by present benchmarks creates it attractive for multicarrier systems, earlier investigation advice that CDD is only beneficial by an outer channel code for OFDM schemes. Chern, Shiunn-Jang, and Chung-Yao Chang (2003) had suggested robust LCCM IQRD-RLS algorithm may be utilized to evaluate the weights of the mixing procedure to conflict the multiple access interference (MAI) efficiently and is extra vigorous beside the defective channel estimation error. Yu, Jung-Lang, Chun-Hsien Wu, and Ming-Feng Lee (2012) had proposed the blind channel estimation technique and the corresponding mean square error (MSE) consideration.Yang, Wanchen, et al (2013) had proposed a new edge-fed patch antenna element using artificial magnetic conductor structures (AMCs).

III. JOINT PRE-EQUALIZATION TECHNIQUES FOR MULTI-CARRIER CDMA

In the projected work, we will be conducting a profoundly investigation on the issues of Multi-carrier CDMA system over frequency selective slow fading channels. Slow fading has an advantage while comparing other fading channels slow fading has low Doppler spread. The symbol period is much lesser than its coherence time. The Impulse response changes much slower than the transmitted signal.

Multi Carrier Code Division Multiple Access is an exceptional strategy for fast remote information transmission. In the Multi-carrier CDMA structure, Two propelled innovation was incorporated, for example, orthogonal frequency division multiplexing (OFDM) and the code division multiple access (CDMA), with the goal that it profits by the strength of OFDM next to multipath condition and from the capacity of multiuser multiplexing administrations that is achieved via CDMA system. In order to support high data rates services, several 4G systems utilizes Multi-carrier CDMA to minimize the inter symbol interference (ISI) that occurs when transmission through multipath wireless channels. Our approach also applies to the topology of micro strip antenna, showing enhanced diversity and significant savings in overall optimization costs compared to other methods.

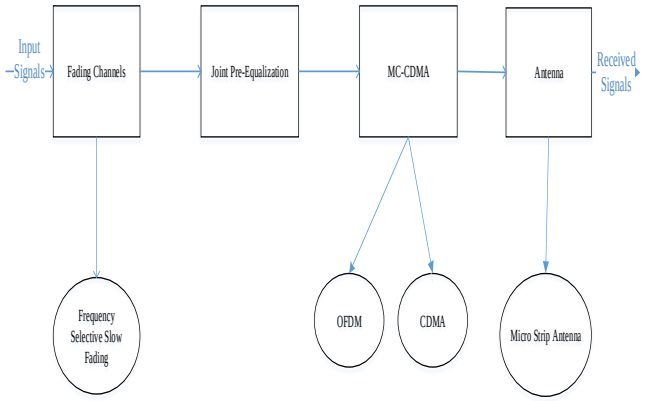

Fig.1 Process Flow of proposed MC-CDMA Architecture

The process flow of the proposed architecture is as shown in figure 1. The main issue in joint pre-equalization for Multi-carrier CDMA systems over frequency selective fading channels are to reducing the error rate of signals. To overcome the error rate of signals frequency selective slow fading channel have been implemented. While reducing the error rate in signals the data transmission in wireless communication is slow, to increase the data transmission of Multi-carrier CDMA technique have proposed. We have used two advanced technology for reducing error rate that was included such as orthogonal frequency division multiplex (OFDM) and the code division multiple access (CDMA).

System model

The proposed new channel pre equalization techniques for the Multi-carrier CDMA systems that solve the channel estimation, ensure a high bit error rate performance, minimize transmitted signals and lead to a very low computational complexity increase. In a transmitter, pre - equalization is used either to enhance diversity gain or to compensate for channel selectivity leveraged by a parameter control. Multi - carrier CDMA has been receiving a lot of interest from the research community over the past few years, particularly in wireless communication data transmission.

Multi-carrier CDMA in Frequency Selective Slow Fading

There are numerous conceivable approaches to translate and execute Multi-carrier CDMA. The approach utilized here to acquaint it is with consolidate coordinate arrangement CDMA (DS-CDMA) and OFDM.

Like OFDM, the Multi-carrier CDMA flag is comprised of a progression of equivalent sufficiency subcarriers. Dissimilar to OFDM, where each subcarrier transmits an alternate image, Multi-carrier CDMA transmits similar information image over each N^{th} subcarrier.

OFDM

OFDM is a propelled change plot in which a wideband banner is part into different narrowband signals.

Since the picture term of a narrowband banner will be greater than that of a wideband banner, the measure of time scattering caused by multipath defer spread is reduced. OFDM has gotten unmistakable quality with the scaling of remote exchanges and wideband structures because of its inborn ability to modify for multipath joined OFDM with code division multiplexing and proposed another adjust plan namely Multi-carrier CDMA. This adequately mitigates multipath impedance while giving numerous entrance ability, and minimizes the error rate. Despite the fact that OFDM is a multiplexing procedure, it is at times alluded to as to weak.

CDMA

Code Division Multiple Access (CDMA) is a multiplexing procedure where various clients at the same time and non concurrently get to a channel by balancing and spread their data bearing signs with pre relegated signature arrangements. In any case, the blend of OFDM flagging and CDMA plot has one noteworthy favourable position that it can bring down the image rate in each subcarrier with the goal that a more drawn out image length makes it less demanding to semi synchronize the transmissions.

Ergodic Capacity

The situation where the Channel State Information (CSI) is known at the receiver that is known at the beneficiary for each time moment. This is the ability to use channel estimation systems by and by. In addition, this is known to be transmitted at Transreceiver. At the transmitter, the CSI cannot be accessible; the source information is transmitted at a steady rate. Since no CSI is accessible at the transmitter, the broadcast of information occurs in all fading states as well as profound fading where the information is lost and the compelling limit is substantially reduced. The Shannon limit of a fading ring channel with beneficiary CSI for a normal power limitation P is given

$$(ErgodicCap\ acity): C_{erg} = \int_0^{\infty} B\log(1+y)P(y)dy \qquad (1)$$

Outage capacity

Outage capacity is used for slowly varying channels where the instantaneous SNR γ is assumed to be constant for a large number of symbols. Hence, in deep fades these schemes allow the data to be lost and a higher data rate can be there by maintained than schemes achieving Shannon capacity, where the data needs to be correctly received over all fading states

$$OutageCapaity: S_{out} = (1-P_{out})B\log_2(1+\gamma_{\min}) \qquad (2)$$

Specifically, a intended Pout parameter is selected indicating the likelihood that the system may be out of order is the likelihood that the system will be unable to decode the transmitted symbols successfully. Corresponding to this outage probability, there is a minimum received SNR, given by $p_{out} = p(\gamma < \gamma \min)$. In support of received SNRs below the received symbols cannot be successfully decoded with probability 1, and the system affirm an outage. Since the instant CSI at the transmitter is not known, this scheme is transmitted using a constant data rate $S_{out} = B\log_2(1+\gamma_{\min})$ which is γ min successfully decoded with probability $1-P_{out}$.

IV. EXPERIMENTAL RESULTS & DISCUSSION

This segment describes the proposed method's experimental results and compares existing methods such as Differential Based Method (DBM) and Non Data Assisted (NDA) with proposed work. NDA method has many data-aided (DA) Signal to Noise Ratio (SNR) estimators in the sense that known data transmission (such as a sequence of training) is used to facilitate the estimation process. The periodic transmission of known data, the problem of NDA limits the system BER, NMSE performance. SNR estimates were also considered in terms of both the performance limits and the estimation procedures. The proposed work is implemented by using the MATLAB tool. The results prove the feasibility and efficiency of the proposed work and the table 1 shows the simulation parameters that are used for analyzing the experimental result of the proposed work.

Table.1 Simulation Parameters and Values

Parameters	Values
N –No of subcarriers	128
Ncp- Cyclic prefix length	16
Ts- Sampling period of channel	1e-3
Fd- No of pilot symbols	0
Np- No of pilot symbols	4
M-No of symbols for FSK modulation	2

While comparing other fading channels slow fading has low Doppler spread. It's time for coherence is longer than the period of symbols. Impulse response changes much slower than the transmitted signal. Based on the analysis of the Multi - carrier CDMA systems on different fading channels, the frequency selective slow fading Input Signal is given in the below figure 2. The relation between NMSE with SNR in OFDM is shown in the following figure 5. It should be noted that the fading channel will be generated as intercarrier interference (ICI) for each OFDM symbol.

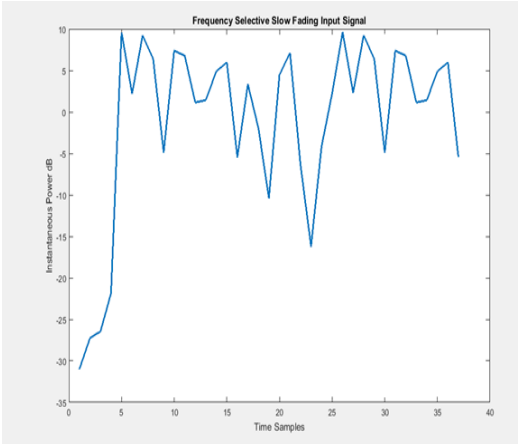

Fig.2 Frequency Selective Slow Fading Input Signal

Since the speed is low, however, the ICI power can be ignored. Due to very low-SNR procedure, then the noise becomes very low as well as the NMSE increases quickly. The estimated noise variance should be increased in order to reduce NMSE.

The below figures 3 and 4 shows the capacity of CDMA and OFDM in frequency selective slow fading Input signal Ergodic capacity and outage capacity respectively.

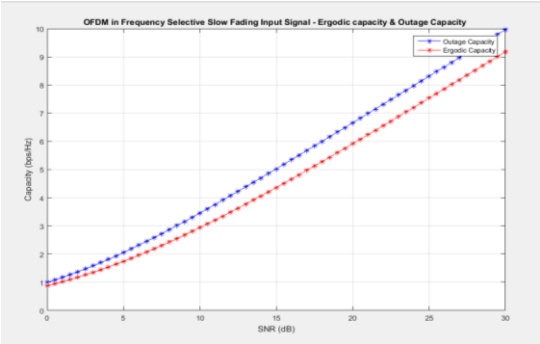

Fig.3 OFDM in Frequency Selective Slow Fading Input Signal-Ergodic capacity and Outage Capacity

The tap correlations for different transmissions are not constrained and antenna - pairs are equal and the capacity has been analyzed and a closed form solution for ergodic channels is obtained which can be efficiently calculated.

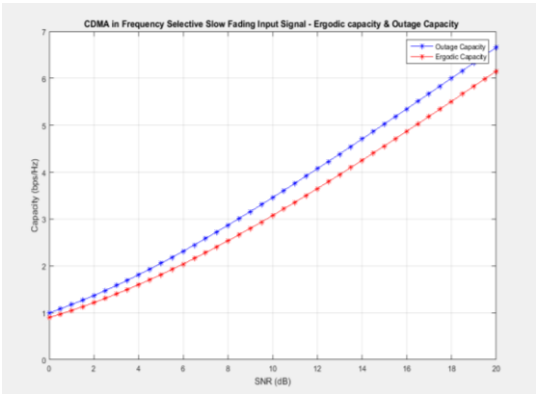

Fig.4 CDMA in Frequency Selective Slow Fading Input Signal-Ergodic Capacity and Outage Capacity

Comparative Analysis & Discussion: In order to illustrate the advantages of the proposed method, compare the error rate performance of FSSF (Frequency Selective Slow Fading) with the existing algorithms such as DBM and NDA.

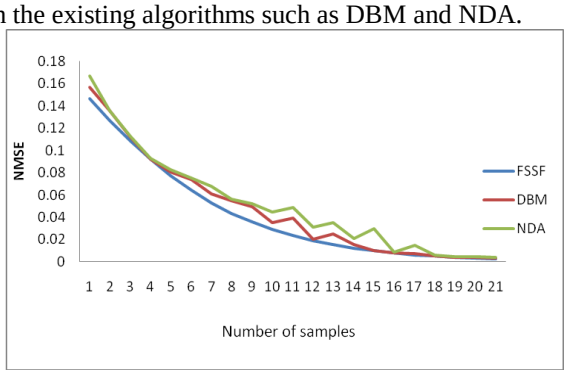

Fig.5 Comparison of NMSE between Existing and Proposed Work

As shown in the figures 5, the error rate of FSSF is less than DBM and NDA, especially when equalizer was applied. While comparing the existing method, the proposed method shows better accuracy and low error rate. The Differential Based Method (DBM) is the most common method for estimating noise variance within NDA systems

V. CONCLUSION

Thus the idea of frequency selective, slow fading channels, transforms the transmitted baseband signs at a much slower pace. In the wireless communication domain, selective entails that the Doppler extend of the channel is very lower than the bandwidth of the base band gesture. In our proposed work for joint pre-equalization the technique MC-CDMA is used for lofty speed data communication in wireless communications for reducing the bit error rate. Thus the proposed Multi-carrier CDMA system used two advanced technology for reducing error rate that was included. The proposed approach shows superior variety and momentous reductions of largely optimization rate match up to with the other schemes.

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