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Reduce Phase Noise with Feedback Frequency Selection for Wireless Communication

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Abstract

IM creates completely new dimensions for data transmission. Since the indices of these building blocks can be used to transmit information through an on/off keying mechanism, IM schemes can transfer the saved transmission energy from the inactive transmit entities to the active ones, and this results in an improved error performance compared to the traditional schemes that use the same total transmission energy. From another perspective, IM schemes can convey information in a more energy-efficient way by deactivating some of the main elements of the system, while still exploiting them for data transferring purposes.

We proposed a novel technique for co-channel interference reduction for multiple input/multiple-output systems for channel fading with different diversity scheme. Our technique basically a adaptive variation of diversity scheme and reduced the ratio of outage probability of power of signal. Our analysis generalizes prior work in that we place no restrictions on the number or power of the interferers, or on the number of antennas at the transmitter and receiver. Our results indicate that, for adaptive interference power, system performance degrades when there are dominant interferers. In addition, for an adaptive of transmit and receive antennas, outage probability and average bit error rate decrease when the transmitter and receiver have the same number of antennas.

Keywords: - Wireless Communication, MIMO, IM, Energy, Bit flip.

Introduction

Self-heterodyne (self-het) OFDM was discussed by Shoji et al. to cope with high level oscillator instabilities in 60 GHz wireless communications using quadrature amplitude modulation (QAM)/OFDM signaling. In a self-het OFDM system, the local radio frequency (RF) carrier is transmitted with the information subcarriers. This guarantees that the carrier phase is perfectly synchronous with the subcarriers and it provides complete immunity against PN. Moreover, a square-law circuitry (self-mixing) is used, instead of a super-heterodyne structure, to down-convert the RF signal[1-3]. Thus the processes of local carrier generation, carrier frequency correction and carrier phase recovery can be omitted. This greatly reduces the complexity of the self-het OFDM transceivers compared to conventional OFDMs using super-heterodyne receivers. There have been a number of research developments on self-het OFDM for additive white Gaussian noise (AWGN) and two-ray channels. Very recently, Fernando et al extended the self-het OFDM system to frequency selective fading channels and applied coding techniques to further improve the system performance. However, the disadvantage is that self-het OFDM uses at most 50% of the available spectrum[4,5,6].

To improve spectral efficiency, while maintaining the simplicity of the RF front-end receiver and PN immunity, they consider self-coherent OFDM, a popular technique in optical communications, originally discussed by Tetsuya Miyazaki. Self-coherent OFDM jointly transmits a carrier and information subcarriers separated by a guard band, much smaller than self-het OFDM, to ensure phase synchronization between transmitter and receiver. In optical communications, the homodyne detection with a polarization-modulation technique was used to generate a pilot carrier at the transmitter and a pilot-carrier combining module at the receiver.[10-12]. The rest of paper organized as section II. Adaptive model. In section III discuss the proposed algorithm in section IV result and performance analysis, and finally discuss conclusion and future work.

II. ADAPTIVE MODEL

Multiple diversity adaptive FFT arrays have been considered for enhancing the number of simultaneous users accessing networks. It is suggested that each user is tracked in azimuth by a narrow signal for both user-to-receiver and receiver-to-user transmissions. The directive nature of the signal ensures that in a given system the mean interference power experienced by any one user, due to other active users, would be much less than that experienced using conventional wide coverage receiver-station FFTs. It has already been stressed that high capacity cellular networks are designed to be interference limited, so the adaptive FFT would considerably increase the potential user capacity. This increase in system capacity of the new receiver-transmitter FFT architecture of an FFT array [7-9]. The results show that this type of receiver- transmitter FFT could increase the spectral efficiency of the network by a factor of 30 or more. These results were obtained for a hypothetical fast frequency hopping code division multiple network, assuming uniform user distribution and complete frequency reuse for the omnidirectional FFT case, i.e., adjacent cells are co-channel cells. Complete frequency reuse is then assumed for each of the signal formed by the adaptive array, i.e., adjacent beams are co-channel. Further, it was shown that a similar enhancement of efficiency can be obtained for either an idealized multi signal FFT[13-15].

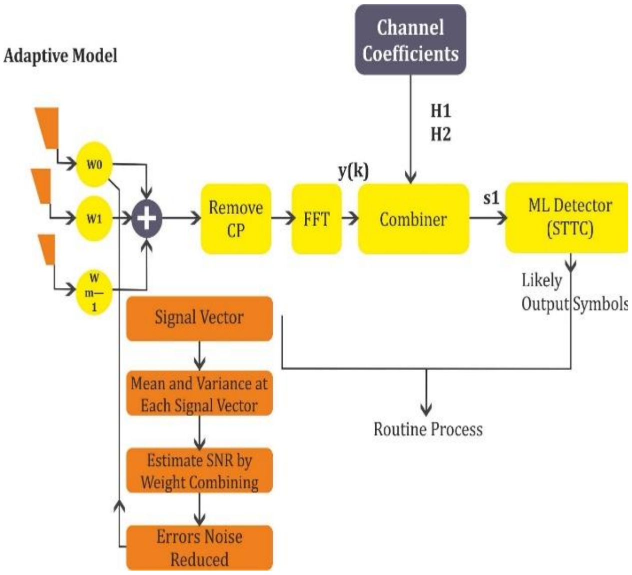

Figure 1: shows that model of FFT adaptive.

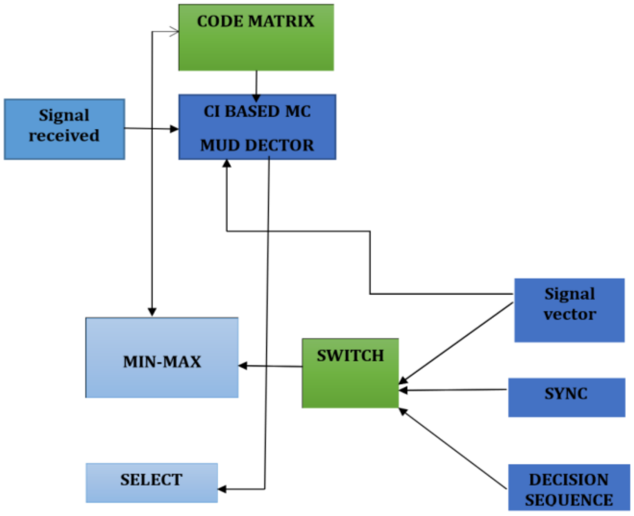

Figure 2: shows that adaptive model.

III. PROPOSED ALGORITHM

İn this dissertation we proposed a adaptive model for noise reduction in transmitter/receiver diversity (TRD) in MIMO system. İf number of antenna and frequency selective channel are increase the rate of noise also increase, increasing rate of noise degraded the performance of MIMO system. We consider the system where the transmitter has n_t antennas and the receiver has n_r antennas. For practical purposes, it is common to model the channel as frequency flat whenever the bandwidth of the system is smaller than the inverse of the delay spread of the channel; hence wideband system operating where the delay spread is fairly small may sometimes also be considered as frequency flat. Now we describe all phase step given below

1. Let $h_{m,n}$ be a complex number corresponding to the channel gain between transmit antenna *n* and the receive antenna *m*. If at a certain time instant adaptive signals $\{x_1, x_2, \ldots, x_{nt}\}$ are transmitted via the n_t antennas, the received signals at antenna *m* can be expressed as

$$y_m = \sum_{n=1}^{n_t} h_{m,n} x_n + e_m \quad \text{....................(1)}$$

where e_m is a noise term, The relation in is easily expressed in a matrix framework. Let *x* and *y* be n_t and n_r vectors containing the transmitter and receiver data, respectively. Define the following $n_r \, \mathrm{x} \, n_t$ adaptive channel gain matrix:

$$H = \begin{bmatrix} h_{1,1} \dots\dots\dots h_{1,nt} \\ \dots\dots\dots\dots\dots\dots \\ . \\ h_{nr,1} \dots\dots . h_{nr,nt} \end{bmatrix}$$

2. Then we have y = Hx + e ....(2)
   where e = $[e_1 \dots\dots e_{nr}]^T$ is a vector of noise samples. If several consecutive vectors {x_1,..,x_N} are transmitted, the corresponding received data can be arranged in a matrix
3. We can expressed as adaptive signal as Y = [y_1 ...... y_N]........................(3)
4. We can write as Y = HX + E.................................(4)
5. We can characterize channel selective as adaptive channel as follows:
   $$H \quad (z^{-1}) \quad = \quad \sum_{l=0}^{L} H_l z^{-l}$$
   ....(5)
   where H_l are the $n_r \, \mathrm{x} \, n_t$ adaptive channel matrices corresponding to the time delays *l* = 0, ..,L. Here the channel is assumed to have (L+1) number of taps. Also, L = 0 corresponds to channel fading model.
6. Now we can define selective of adaptive chhanel are y = GX + e........................(6)
   where
   x = [x^T(- L) . . . x^T(N_0 + L -1)]^T

   y = [y^T(0) . . . y^T(N_0 + L -1)]^T

e = [e^T(0) . . . e^T(N_0 + L -1)]^T and

G=

$$\begin{bmatrix} H_L H_{L-1} \dots\dots H_1 H_0 0 \dots\dots\dots\dots\dots\dots\dots 0 \\ 0 H_L H_{L-1} \dots\dots\dots H_1 H_0 \dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 0 \\ 0 \dots\dots\dots\dots\dots H_L H_{L-1} \dots\dots\dots\dots\dots H_1 H_0 \end{bmatrix}$$

7. Finally select the transmitted signal

Find the value of outage probability and BER in consideration of SNR value.

IV. RESULT & PERFORMANCE ANALYSIS

Eb/N0	4	6	8	10	12	16	18
Modify PN	0.9	0.6	0.1	0.06	0.02	0.007	0.0002
Conv. PN	0.94	0.7	0.4	0.01	0.007	0.004	0.002
Conv. PN + LMMSE	0.95	0.75	0.7	0.75	0.3	0.27	0.24
Self-het PN	1.05	1.005	1.0	0.5	0.4	0.1	0.8

Table 1: Comparative performance of Modify PN, Conventional PN, Conventional PN + LMMSE, Self-het PN versus Eb/N0.

Eb/N0	5	10	15	20	25	30	35
Modify PN	0.5	0.3	0.09	0.07	0.06	0.004	0.0001
Conv. PN	0.94	0.7	0.4	0.01	0.007	0.004	0.002
Conv. PN + LMMSE	0.95	0.75	0.7	0.75	0.3	0.27	0.24
Self-het PN	-	1.002	0.89	0.68	0.47	0.0255	0.0017

Table 2: Comparative performance of Modify PN, Conventional PN, Conventional PN + LMMSE, Self-het PN versus Eb/N0.

Eb/N0	5	10	15	20	25	30	35
Modify PN	0.4	0.1	0.05	0.001	0.0005	0.0001	-
Conv. PN	0.7	0.5	0.1	0.05	0.001	0.0005	-

Conv. PN + LMMSE	1.2	0.7	0.5	0.13	0.06	0.002	0.0007
Self-het PN	1.3	1.18	0.7	0.57	0.16	0.06	0.002

Table 3: Comparative performance of Modify PN, Conventional PN, Conventional PN + LMMSE, Self-het PN versus Eb/N0.

η	0.1	0.3	0.6	0.9	1.2	1.5	1.8
5 dB	1	0.1	0.06	0.05	0.04	0.05	0.04
10 dB	0.06	0.32	0.33	0.41	0.29	0.35	0.301
20 dB	0.01	0.005	0.0045	0.00401	0.0038	0.0035	0.28
30 dB	0.001	0.006	0.0045	0.00041	0.0037	0.0027	0.00039
40 dB	0.00006	0.00004	0.00045	0.00375	0.00040	0.00045	0.00489

Table 4: Comparative performance of η versus Eb/N0.

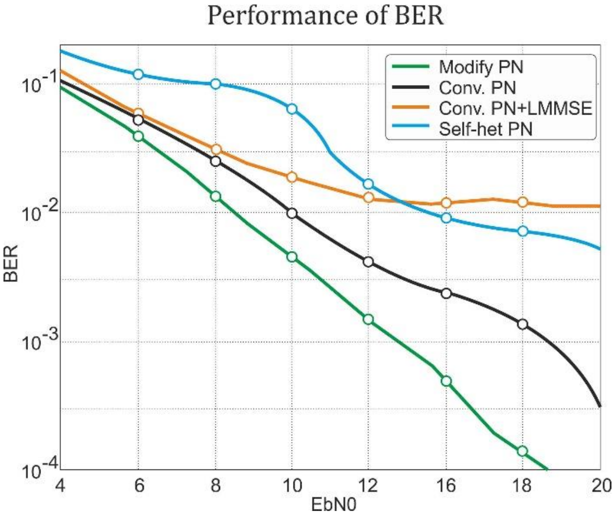

Figure 3: Comparisons of BER performance among modify PN, self-het OFDM, self-coherent OFDM with under sampling down-conversion technique and conventional OFDM with super-heterodyne receiver over AWGN channels.

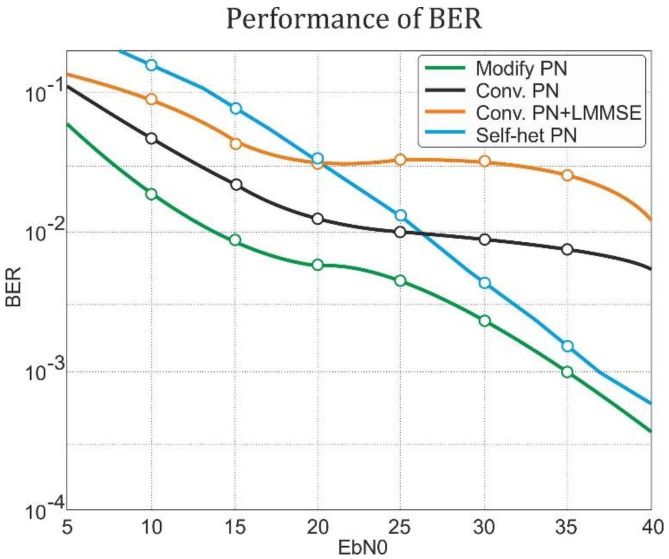

Figure 4: Comparisons of BER performance among modify PN, self-het OFDM, self-coherent OFDM with under sampling down-conversion technique and conventional OFDM with super-heterodyne receiver over frequency-selective channels.

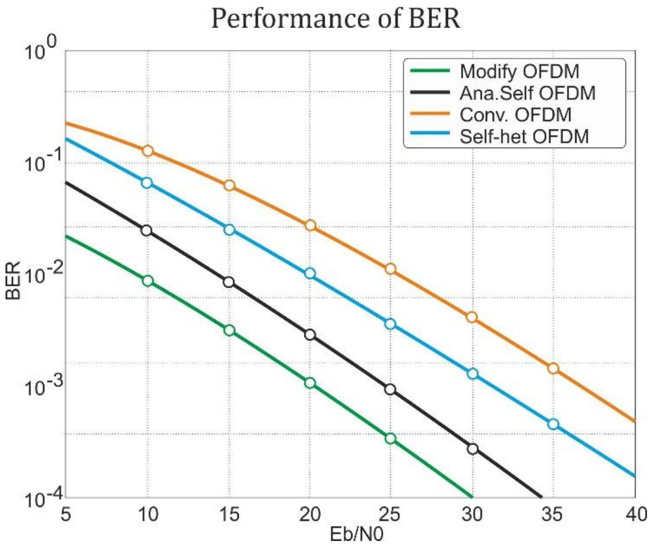

Figure 5: Comparisons of BER performance among modify PN, self-coherent OFDM, self-het OFDM, and conventional OFDM in both AWGN and Rayleigh channels.

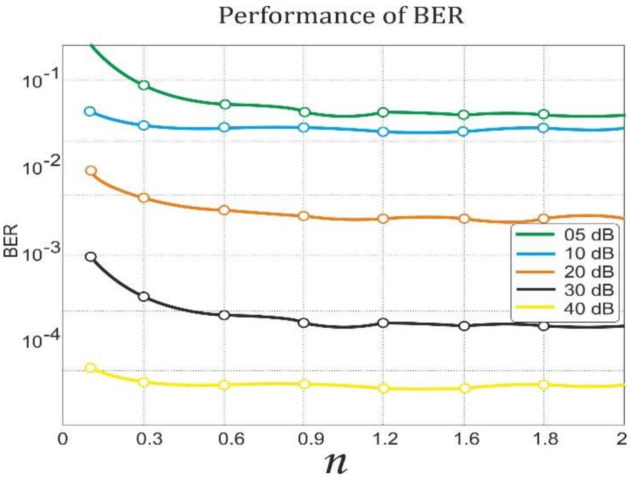

Figure 6: Effect of power ratio of the carrier and subcarriers Î· on BER performance when Eb/N0 is 5dB, 10dB, 20dB, 30dB and 40dB.

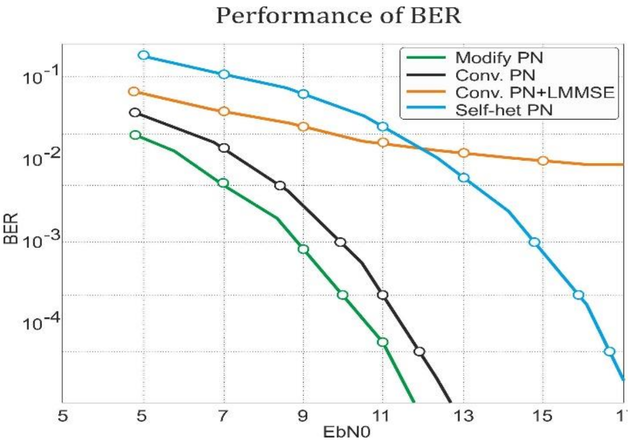

Figure 7: Comparisons of BER performance among modify OFDM, self-het OFDM, self-coherent OFDM and conventional OFDM both with under sampling down-conversion technique over AWGN channels.

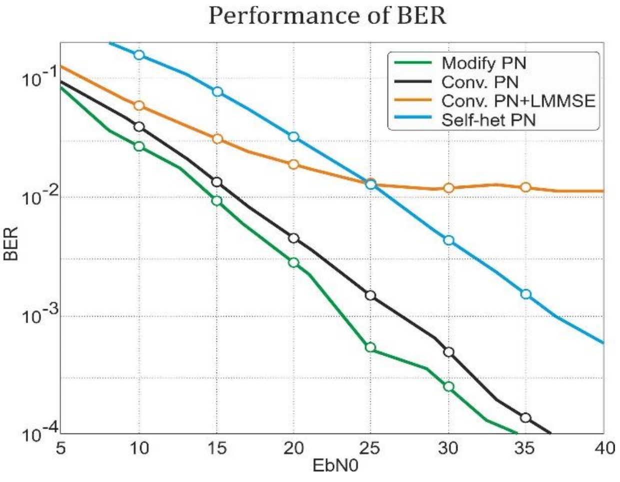

Figure 8: Comparisons of BER performance among modify PN, self-het OFDM, self-coherent OFDM and conventional OFDM both with under sampling down-conversion technique over frequency-selective channels.

V. Conclusion & future Work

The index modulation with MIMO system enhanced the process of spectrum uses and reduces the values of noise and interference. the processes of local carrier generation, carrier frequency correction and carrier phase recovery can be omitted. This greatly reduces the complexity of the IM-OFDM transceivers compared to conventional OFDMs using super-heterodyne receivers. In this paper we proposed a novel technique for reduction of co-channel interference and improve the utility of transmit/receive diversity in presence of channel fading. Our method reduced co-channel interference and improve the performance of MIMO system. Our simulation result shows the better performance in compassion of Conventional PN, Self-Het PN and Modify PN.

Interferers causes the most degradation to system performance. This may follow from the fact that a single high-power interferer has more variation and therefore more impact on BER than a sum of many lower-power interferers. This result indicates that reducing the effects of dominant out-of-cell interference can significantly enhance performance in cellular systems.

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