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REVIEW OF PAPR REDUCTION FOR STBC MIMO-OFDM SYSTEMS USING PTS SCHEME

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ABSTRACT:

Multiple Input Multiple Output (MIMO) in combination with Orthogonal Frequency Division Multiplexing (OFDM) is of great interest for researchers and research laboratories all over the world. OFDM is generally utilized in contemporary correspondence frameworks for its great strength in multipath condition, and its high otherworldly effectiveness. The limit of remote framework can be expanded significantly by utilizing Multiple Input Multiple Output, (MIMO) radio wires. The blend of MIMO and OFDM framework is observed to be exceptionally helpful. A noteworthy downside of OFDM-MIMO System is its high Peak to Average Power Ratio (PAPR) Reduction. The pinnacle intensity of a flag is a basic plan factor for band constrained correspondence frameworks, and it is important to lessen it however much as could reasonably be expected. Numerous PAPR decrease systems have been utilized to diminish PAPR. Incomplete transmit grouping (PTS) is a standout amongst the most outstanding crest to-average power proportion (PAPR) decrease methods proposed for MIMO-OFDM frameworks. Anyway the computational intricacy of conventional PTS technique is gigantic. In this paper another fractional transmit succession (PTS) procedure, in view of C-A-PTS method, for two radio wires STBC MIMO-OFDM framework, is proposed which can accomplish better PAPR execution at considerably less multifaceted nature. The primary thought behind this is to isolate the information vector, created by Alamouti calculation, into genuine and nonexistent parts and independently increased with stage factors. The ideal weighting coefficient of recieving wire two can be specifically gotten by appropriating mapping from that of reception apparatus one which drives further to lessening unpredictability calculation.

KEYWORDS: *PTS, C-A-PTS, STBC, MIMO, OFDM, PAPR*

1. INTRODUCTION

A combination of multiple input multiple output (MIMO) and orthogonal frequency division multiplexing (OFDM) (MIMO-OFDM) is an emerging technology for high speed data multi-carriers transmission in future wireless communication network systems such as digital audio broadcasting (DAB), digital video broadcasting (DVB), medical body area networks (MBANs) applications, the fourth and the fifth generation (4G,5G) of mobile network. In MIMO-OFDM framework, the yield is the superposition of numerous sub-transporters. At whatever point, the stages and frequencies of these bearers coordinate reasonably, immediate power yields may increment extraordinarily and end up higher than the mean intensity of the powerful enhancer (HPA) bringing about substantial PAPR [1]. Lot of research work has been done for solving the problem of PAPR that concerns all kind of multicarrier signals. So, many techniques have been proposed such as clipping [2], tone reservation [3], nonlinear transformations [4], coding [5], selecting mapping (SLM) [6] and partial transmit sequence (PTS). Modified approaches of PTS are proposed in that produce better results; however, the computational complexity is still remaining unsolved totally. In this paper an approach is proposed to reduce the PAPR in STBC MIMO-OFDM systems with less computational complexity. So, the mean idea is based on separating the input vector data into real and imaginary parts for computational simplification reasons and then C-A-PTS is applied individually on these parts, moreover, PAPR is conjointly optimized in real part and imaginary part for the first antenna and by symmetry property the optimum weighting coefficient is deduced for the second antenna without any extra optimization which leads to decreasing of the complexity of the computation [7]. This approach is applied in STBC MIMO-OFDM systems. The rest of the paper is organized as follows: in section II, PAPR theory in MIMOOFDM system is developed. Section III describes the proposed algorithm. The paper is concluded in section IV.

2. SYSTEM MODEL

MIMO in combination with OFDM is widely used nowadays due its best performance in terms of capacity of channels, high data rate and good outcome in frequency selective fading channels. In addition to this it also improves reliability of link. This is attained as the OFDM can transform frequency selective MIMO channel to frequency flat MIMO channels [8]. So it is generally utilized in future broadband remote framework/interchanges. Cyclic prefix is the duplicate of last piece of OFDM image which is affixed to the OFDM image that will be transmitted. It is essentially 0.25% of the OFDM image. We can say that one fourth of the OFDM image is taken as CP (cyclic prefix) and affixed to each OFDM image. IFFT is utilized at the transmitter and FFT is utilized at the recipient who substitutes the modulators and demodulators. Doing as such wipes out the utilization of banks of oscillators and intelligent demodulators. In addition the perplexing information can't be transmitted all things considered; in this way it is first changed over to simple frame which is practiced by IFFT. It essentially changes over the flag from recurrence area to time space. Before IFFT task image mapping is performed this is only the balance square. Any of the broadly utilized adjustment systems can be connected like BPSK, QPSK, QAM, and PSK and so on. Further there are higher request balances are likewise accessible which give greater limit at little cost of BER execution corruption. After IFFT square pilot inclusion is done and afterward CP (cyclic prefix) is included. Figure 1 beneath demonstrates the square graph comprising MIMO and OFDM. Any reception apparatus design for the MIMO can be utilized by the framework necessity. Higher the arrangement more will be the limit and more will be the computational intricacy of the handset plan. It is seen that on account of assessing channel the computational intricacy is expanded. Mapper characterizes the adjustment to be utilized. Image encoder takes the state of the STBC (Space Time Block Code) if spatial decent variety is to be utilized and it takes the state of the de-multiplexer/multiplexer if spatial multiplexing is to be utilized.

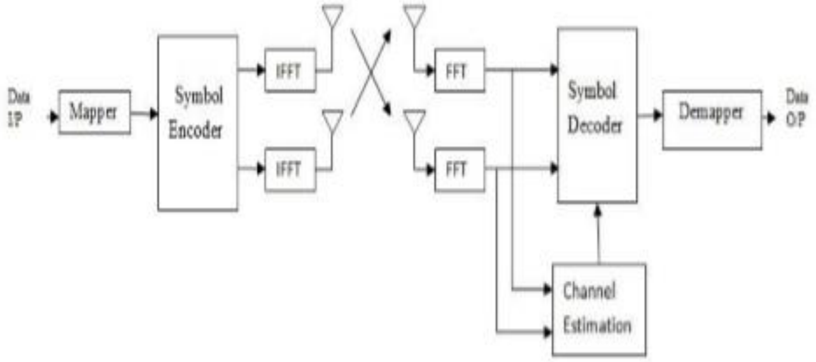

Fig. 1 MIMO-OFDM system model

The received signal at j^{th} antenna can be expressed as

$$R_j[n.k] = \sum H_{ij}[n,k]\, X_i\, [n,k] + W[n,k] \qquad (1)$$

Where H is the channel grid, X is the information flag and W is clamor with zero mean and fluctuation. Likewise bi[n,k] speaks to the information square ith transmit radio wire, nth schedule opening and kth sub channel file of OFDM. Here I and j indicated the transmitting recieving wires record and accepting radio wire file separately.

The MIMO-OFDM system model [9] with NR receives antennas and NT transmits antennas can be given as:

$$\begin{bmatrix} Z_1 \\ Z_2 \\ \vdots \\ Z_N \end{bmatrix} = \begin{bmatrix} H_{1,1} & H_{1,2} & \cdots & H_{1,NT} \\ H_{2,1} & H_{2,2} & \cdots & H_{2,,NT} \\ \vdots & \vdots & \ddots & \vdots \\ H_{NR,1} & H_{NR,2} & \cdots & H_{NR,NT} \end{bmatrix} \begin{bmatrix} A_1 \\ A_2 \\ \vdots \\ A_{NT} \end{bmatrix} + \begin{bmatrix} M_1 \\ M_2 \\ \vdots \\ M_{NT} \end{bmatrix} \quad (2)$$

Where, Z represents O/P data vector, H denotes Channel matrix, A denotes I/P data vector and M represents Noise vector. The wireless channel used is AWGN channel. After receiving the signal the CP is removed then the pilots are also removed from main signal received. After this the signal that is in time domain can be again converted to frequency domain by taking FFT of the received signal.

The sequence on each of the OFDM block is then provided to channel estimation block where the received pilots altered by channel are compared with the original sent pilots. Channel estimation block consists of the algorithms that are applied to estimate the channel.

3. PTS SCHEMES

I. SISO PTS SCHEME

In the SISO-PTS scheme, the original data sequence in the frequency domain is partitioned into M disjoint, equal length sub blocks Xv (v = 1, 2... M) as follows.

$$X = \sum_{v=1}^{M} X_v \quad (3)$$

By multiplying some weighting coefficients to all the subcarriers in every subblock, we can get the new frequency sequence.

$$X' = \sum_{v=1}^{M} b_v X_v \quad (4)$$

Finally, at each transmitting antenna, there are (V-1) sub blocks to be optimized, and the candidate sequence with the lowest PAPR is individually selected for transmitting. Assume that there are W allowed phase weighting factors. To achieve the optimal weighting factors for each transmitting antenna, combinations should be checked in order to obtain the minimum PAPR [10].

II. ALTERNATE PTS (A-PTS)

In, the idea of alternate optimization is introduced, and it can be also applied to PTS in multiple antennas OFDM systems, denoted as alternate PTS (A-PTS). Different from ordinary PTS, phase weighting factors are needed only for half of the sub blocks in A-PTS. That is to say, starting from the first sub block, every alternate sub block is kept unchanged and phase weighting factors are optimized only for the rest of the sub blocks, which leads to the reduction of computational complexity. In this way, the computational complexity is greatly reduced at the expense of PAPR performance degradation [11]. Employed spatial sub block circular permutation for A-PTS scheme to increase the number of candidate sequences which improves the PAPR performance further.

III. COOPERATIVE AND ALTERNATE PTS (C-A-PTS)

Based on the A-PTS and C-PTS schemes, the C-A-PTS is proposed to reduce the computational complexity in STBC MIMO-OFDM system. On the one hand, apply the APTS algorithm in a single antenna, and employ the linear property of inverse discrete Fourier transform (IDFT) to increase the number of candidate sequences so as to achieve better PAPR performance. On the other hand, utilize the conjugate and symmetric property to get the weighting coefficient of the other antennas in order to reduce the complexity. According to the linear property of IDFT, it can be deduced that the conjugate operation in frequency domain s equivalent to the circular permutation and conjugate operation in time domain. The characteristics can be exploited to ameliorate the PAPR performance. At antenna 1, we adopt the optimal alternate PTS scheme to get the optimum weighting coefficient a (av: v = 1, 2... M) which achieves the minimum PAPR value. The linear property of IDFT is used for all the odd sub blocks (except the first one) to increase the number of the candidate signals. The transformed data in time domain can be obtained by performing the circular permutation and conjugate operation on all the odd sub-blocks (except the first one) instead of the IDFT or IFFT operation. Since the odd sub-blocks (except the first one) are transformed, the number of candidate sequences is increased which improves the PAPR performance of the single antenna, while the number of complex multiplications is not increased. It has been proved that the data on two antennas have the same PAPR statistical characteristics simultaneously. The correlation is utilized to reduce the complexity of MIMO PTS plan. The optimum weighting coefficient of antenna 2 can be directly obtained by appropriate mapping from that of antenna 1. Moreover the process of IFFT operation and optimum PTS weighting coefficient search can be omitted for the data at antenna 2. A block diagram of the C-A-PTS scheme with two transmit antennas is shown in Figure 2.

Next, the conversion of the optimum weighting coefficient is discussed. In order to maintain the conjugate and symmetric relations between the two antennas after scrambling sequence methods, we should convert the optimum weighting coefficient a(opt) at antenna 1 into that of antenna 2 denoted as b(opt) by the inverse conjugate and symmetric transformation. For example, when the optimum weighting coefficient a (opt) is [1, 1, j, -j], the optimum weighting coefficient for antennas 2 is b (opt) = [1, 1, -j, j].The advanced C-A-PTS scheme can be also applied to the STBC MIMO-OFDM system with more transmit antennas.

Based on C-A-PTS, an approach to solve the contradiction between the PAPR performance and computational complexity in STBC MIMO-OFDM system is proposed. Let us consider a STBC MIMO-OFDM system that employs Alamouti scheme. The coding matrix is:

$$G = \begin{pmatrix} x_1 & -x_2^* \\ x_2 & x_1^* \end{pmatrix} \qquad (5)$$

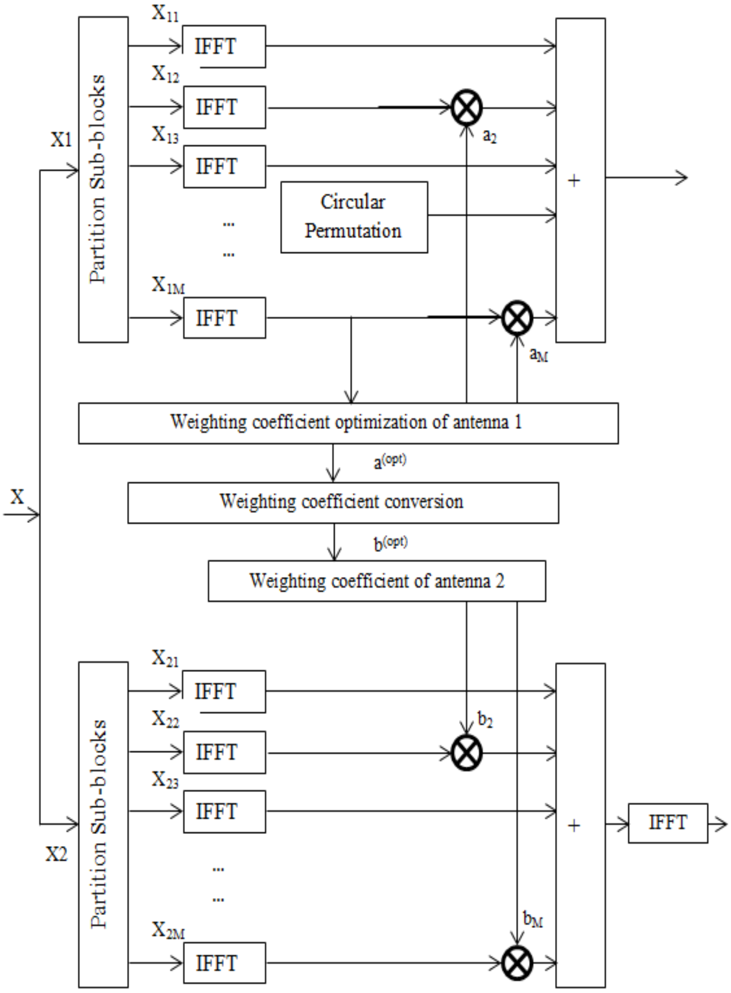

Fig. 2 Block diagram of the C-A-PTS scheme with two transmit antennas

4. CONCLUSION

An extended approach cooperative and alternate partial transmit sequence named C-A-PTS was proposed for STBC MIMO-OFDM - 4G which makes uses of conjoint optimization of the PAPR for both real and imaginary parts. A high PAPR, between the two antennas, is selected to be transmitted. The proposed method performs well in terms of simulation results as well as the complexity of computation.

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