LOW COMPLEXITY PAPR FOR SFBC MIMO-OFDM IN TIME-VARYING CHANNELS

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Abstract:In this paper an extended selecting mapping (eSLM) technique is proposed for space-frequency block coding (SFBC) multi-input multi-output orthogonal frequency division multiplexing systems and it is designated from a novel peak-to-average power ratio (PAPR) reduction scheme. In this eSLM method, the extension matrices consists of amplitude extensions and phase rotations. These are constructed to indicate the selected signal index and this will minimize the PAPR. To reduce the computational complexity, a low-complexity eSLM scheme (LC-eSLM) is developed by constructing equivalent candidate signals in the time domain. The complexity is occurred by the inverse discrete Fourier transform operation in generating the candidate signals. Hence the extension matrix in both schemes will produce the orthogonality of SFBC code by facilitating low-complexity decoding. At last from the simulation results we can observe that proposed eSLM scheme gives better results compared to SLM-based methods. Coming to cost theproposed eSLM scheme has a lower computational complexity and it requires no side information. So the computational complexity LC-eSLM scheme is lower than the eSLM scheme.

***IndexTerms* - Peak to Average Power Ratio, SFBC, Multi Input Multi Output, Blind detection.**

I. INTRODUCTION

Basically, in modern wireless communication system, an orthogonal frequency division multiplexing technique is adopted. This technique produces robustness against frequency selective fading channels and its potential for achieving high data rate. The OFDM transmission system gives high peak-to-average power ratio (PAPR), which results in severe in-band distortion inthe nonlinear region of the power amplifier. The literature contains number of PAPR reduction methods to overcome this problem, including clipping, selected mapping (SLM), companding and partial transmit sequences (PTS). To increase the requirements of mobile data access, a number of multi-input multi-output OFDM (MIMO-OFDM) schemes with space-frequency block coding(SFBC) methods are used in Long Term Evolution-Advanced (LTE-A) standard. Here MIMO is a one of the enabling technology which was developed in 5^{th} generation broad band mobile networks. But the waveform in 5G systems are not currently decided and the candidate waveforms mainly depends upon the on multicarrier waveforms, such as Filter-Bank-based MultiCarrier (FBMC), Universal Filtered Multi- Carrier (UFMC), Filtered OFDM (F-OFDM).

When the MIMO technology is introduced in the OFDM-based systems then the both spectrum efficiency and energy efficiency are improved. Now the main intent is that to reduce PAPR in MIMO-OFDM systems especially when more carriers are aggregated in theLTE-A or 5G systems. In the literature various number of methods are developed to decrease the PAPR in SFBC MIMOOFDMsystems. From all these methods, SLM is one of the effective method which reduces PAPR without distorting the MIMO-OFDM signals. For example an ordinary SLM scheme is introduced by Baek *et al.* in which different phase rotations were applied to the symbolsTransmitted by the different antennas. Coming to the simplified SLM schemes, this consists of identical phase rotations which were applied to all of the antennas. To improve the currently highest PAPRa directed SLM (dSLM) scheme is used. The literature also contains several modified SLM schemes designed to achieve low-complexityPAPR reduction in SFBC MIMO-OFDM systems by exploitingthe inherent time-domain properties of the transmittedsignals.

For all these schemes we need side information (SI) transmission for correct data detection at the receiver. This SI needs to be protected by complicated channel coding. The bandwidth is degraded and complexity is increased. Coming to Naeiny and Marvasti they presented a blind SLM (bSLM) scheme for addressing this problem by performingthe blind detection of phase rotations at the receiverside without the need for SI. Depend upon the on the maximum likelihood (ML) criteria, the bSLM schemerequires a costly joint-detection of the data symbols and phaserotations. But the scheme is applied only when the phase rotations are confined to the set $\{0, \pi\}$. This method preserves the orthogonality of original amount of SBFC scheme. As the number of candidate signals increases, the difference in thephase offset among the signals reduces, and hence the errorrate of SI detection increases. Another blind SLM (BD-SLM) based on the differential SFBC has been proposed in MIMOOFDM systems. To allow blind detection in terms ofminimum Hamming distance, selection of the phase-rotationvectors is limited.

Now to address the problem PAPR we employed an the extended SLM (eSLM) method for MIMOOFDM systems with SFBC coding which both avoids the needFor SI and preserves the orthogonality of the original SFBC code.At last the proposed eSLM scheme successfully lowers the PAPR without the need of SI. To reduce the computational complexity incurred by IDFT, a low-complexityeSLM scheme (LC-eSLM) is also proposed in which equivalentcandidate signals are generated in the time domain.The candidate signals in the LC -eSLM schemeconsists of repetitive extension factors. The proposed LC-eSLM scheme has a significantly lower complexity compared to bSLM and pSLM schemes. The existed system explanation is shown in below section.

II. EXISTED SYSTEM

From below figure (1) it shows the frame structure ofMIMO TDS-OFDM. In this structure there are two blocks one is transmitter and data blocks. First the signal is transmitted though TDS and next to data block. After transmission of signals through the blocks it is obtained at time varying MIMO channels. So this frame structure transmits the signals and obtained at time varying channels

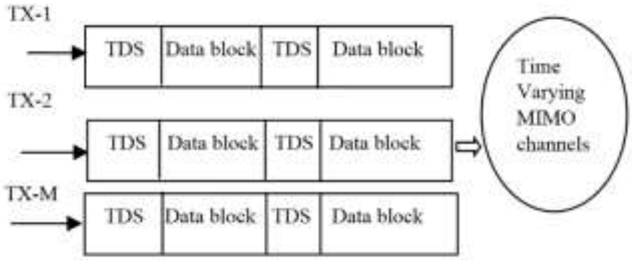

Fig. 1. Frame structure of MIMO TDS-OFDM

Up to now we have discussed about the transmitted signal in existed system. Now let us discuss about the received block in existed system. In received block consists of received TDS and received data blocks. This blocks will transmit the signal in a sequential manner. In this we assumed channel estimation in two ways one is time invariant and linear time varying part. The combination of signals will be followed by the ICI mitigation. This ICI mitigation takes the signals from frequency domain symbols and the combination of time invariant part and linear time varying part. The output from this two blocks gets equalized by the process of equalization. After the process of equalization data streams will be obtained. From figure (2) we can observe the entire process. But thisexisted system does not gives good performance and the complexity obtained is very less. So to overcome this problems a new system is proposed which is discussed in below section

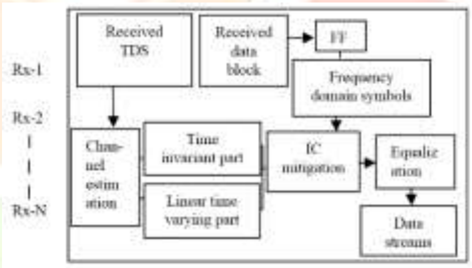

Fig. 2. Receiver side of MIMO TDS-OFDM with ICI mitigation

III. PROPOSED SYSTEM

The below figure (3) shows the architecture of proposed system. Basically, at first we proposed a technique that iseSLM-based transmitter for SFBCMIMO-OFDM systems. This system consist of two transmitter antennas and the data symbols are encoded pair wisely with Alamouti space frequency encoder. To reduce PAPR, in the eSLM scheme, the signal passes from**X**1 and **X**2 through *V* extension matrices. This extension matrix will enable the PAPR to be effectively reduced without the needto transmit additional side information**.**Because the signals of the two antennas are transmitted simultaneously, the overall PAPR of SFBC MIMO-OFDMshould be considered jointly over the two antennas.
The main advantage of extension matrix is to provide the pairwise orthogonality between the original encoded signals **X**1 and **X**2 is preserved following multiplication withthe extension matrix and the second one is the extension matrix enables the receiver to indicate which candidate is chosenwithout the need of SI, and hence the spectrum efficiencyis improved. But this scheme does not reduce PAPR. So a new system is proposed which is shown in below figure (3). The proposed technique generates equivalent candidatesignals in the time domain. After applying data modulation and SFBC encoding, each of the codewords **X**1 and **X**2 is partitioned by 2*M* disjointsub-vectors. In each sub vector nonzero entries are equally spaced by 2*M* elements.To generate time-domain candidate signals, each sub-vector is passed through IDFT prior to phase rotation. At last The time-domain signals corresponding to each transmit antenna are passed through a Candidate Signal GeneratingBlock (CSGB) to generate *V* candidate signals.

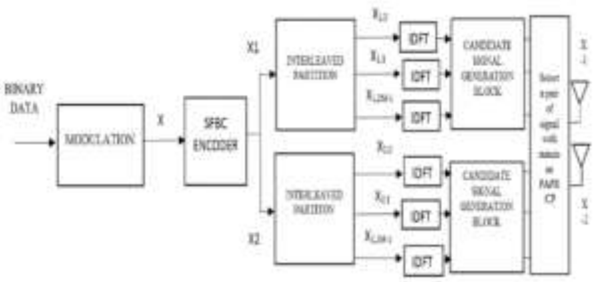

Fig. 3. Proposed LC-eSLM scheme in a SFBC MIMO-OFDM system

IV. RESULTS

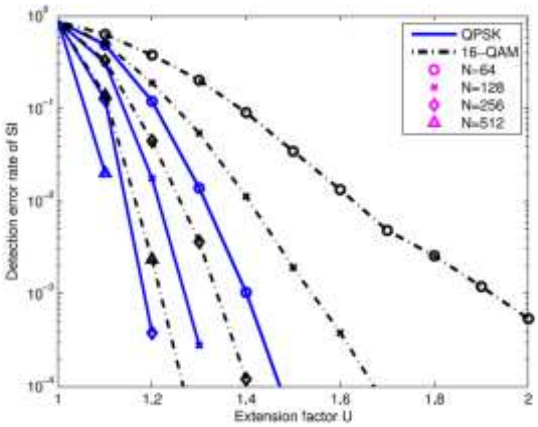

Fig. 4. Error probability of the index detection when SNR is 10 DB

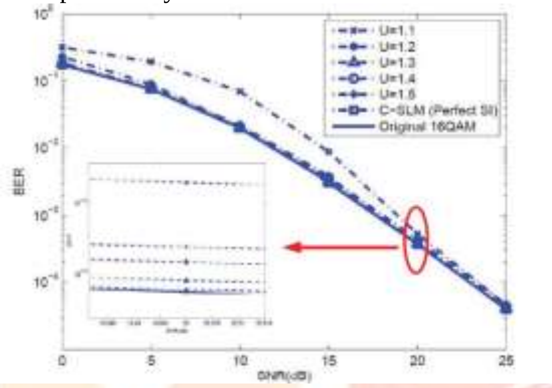

Fig. 5. Comparison of BER performance for various values of *u*

V. CONCLUSION

As discussed earlier that in this paper we use two PAPR reduction schemes they are eSLM and LC-eSLM. These two schemes are used in SFBC MIMO OFDM systems. This schemes gives an effective reduction in PAPR without the need for side information. As well as the both methods retain the orthogonality of SFBC code. Here the low complexity linear operations are performed at receiver side. At last the proposed LC-eSLM scheme provides good trade-off between computational complexity and PAPR reduction performance. It provides an attractive solution for PAPR reduction in FBC MIMO-OFDM systems.

VI. REFERENCES

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