ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 6, Issue 8, August 2017

Review on Relative Analysis of MIMO Detection Under Imperfect CSI Based on Bayesian Model

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Abstract— MIMO (OFDM) is vastly used in wireless networks. Its superiority relies on the fact that information can be split in large amount of frequencies. Each frequency is called information subcarrier. OFDM exhibits excellent annotation in channel fades and interferers as only a few subcarriers can be affected and consequently a small part of the original data stream can be lost. Orthogonality between frequencies ensures better spectrum management and obviates the danger of intersymbol interference. However, an essential problem exists. OFDM systems have high Imperfect CSI. Also, power amplifiers must work in a larger linear dynamic region. In this review paper we present two new techniques for reducing Imperfect CSI Based on Bayesian Model, that can be added in any OFDM system

Keywords: CSI ***OFDM,***

I. Introduction

Orthogonal Frequency Division Multiplexing (OFDM) has been distinguished between other types of data transmission and reception schemes, for its excellent tolerance towards multipath fading and for supporting even higher data rates. OFDM has been a primary part of interest in many scientific researches and it has been included and implemented in various standards and application fields. Digital Audio Broadcasting (DAB), Terrestrial Digital Video Broadcasting (DVB-T), Wireless Local Area Network (WLAN – IEEE 802.11), High-Performance LAN type 2 (HIPERLAN/2), Broadband Wire- less Access (BWA – IEEE 802.16), Mobile Broadband Wireless Access (802.20), wimax, Broadcast Radio Access Network (BRAN), Digital Subscriber Lines (DSL) and Multimedia Mobile Access Communication (MMAC) have all adopted OFDM [1].

II. Problem Review

The key feature of splitting data in various orthogonal information carriers along with the fact of introducing a guard band called cyclic prefix for avoiding ISI, characterizes a strong candidate transceiver for all future wireless applications. The main drawback is Imperfect CSI. This essential problem of subcarriers power fluctuation imposes undesirable complexity in Digital to Analog converters as they must operate in a wider dynamic range. Also the power amplifier, located on the transmitter part, must operate in a very large linear region for preventing spectral growth and consequently out-of-band noise. All previous demands relevant to existence of high Imperfect CSI , increase the overall cost of an OFDM system.

III. Problem Difination

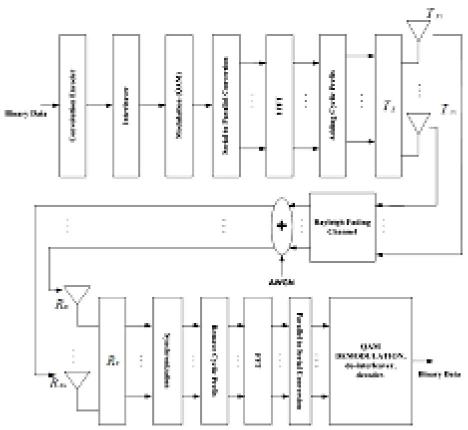
Many schemes for reducing Imperfect CSI have been proposed and are worth mentioning not only for their innovations but also due to hard work that appears to have been done by all authors. Clipping is very simple and has a quick implementation [2]. Unfortunately it causes out- of-band radiation. Even if digital filtering is used for reducing radiation [3] which is very proper to do, BER deteriorates. Constellation shaping using SLM method in conjunction with Hadamard code [4] offers good results but complexity of this method is relatively high compared to others, like Low Complexity Technique which utilizes simple algorithm [5]. The latest still requires magnifier in receiver. Also in-depth BER performance is not mentioned. But, we must not omit the fact that its Imperfect CSI performance is fine. Another scheme is Imperfect CSI reduction with Huffman Coding [6] but it introduces the necessity of transmitting the encoding table to receiver. Even if bandwidth will not be affected, a serious drawback remains. System complexity is high. Another excellent idea is about recovering the clipped part of the OFDM signal [7], but it has restrictions, like trading-off between low CR and increasing the amount of the copied signal which in turn introduces redundancy in the transmitted data. Using a root commanding transform technique still requires expander in the receiver and exhibits good trade-off between imperfect CSI and SER. SER Performance appears to be good but not innovative. Other technique using combined interleaving and commanding [6][7] exhibits good CCDF performance but introduces the necessity of k interleaves in transmitter's part. Also side information must be sent to receiver containing identities of corresponding interleavers. This deteriorates simplicity of system design.

IV. Problem Analysis

The review first part of our work involved with the study of selected companders and was focused especially in two already known schemes which are soft reduction and μ-algorithm. We selected these as they are simple techniques compared to others. We didn't use the expanded parts of these algorithms in the receiver in order to avoid overall complexity. Then we conducted various simulations ending up in finding two new strong candidates for Imperfect CSI reduction without deteriorating BER system performance. In the third part of our study final simulations of an OFDM system (with IFFT subcarriers) were conducted. This system was consisted of a convolutional encoder [10] and a viterbi decoder along with other blocks.

V. OBJECTIVES

Our platform which is used as a basic simulation testbed, forms an OFDM system. All system delays were computed in order to apply a perfect synchronization between transmitter and receiver. Also, each time we added or removed blocks we calculated the power characteristics of the new generated OFDM signal, in order our simulations to produce the highest possible accurate results. Transmitter system under test was constituted of a random generator, a convolutional encoder, a QPSK modulator, a serial to parallel converter, an oversampling procedure using double zero padding, an IFFT block, a cyclic prefix generator and an unbuffering procedure. All inverse computations were implemented in receiver's part. Specifically for implementing convolutional encoder we used a design with one input, six shift registers and two adders complying with industry standard rate of 1/2 [1]. The review simulation system that we developed is proposed to produce to from 64 to 8192 subcarriers in IFFT output. Table characteristics of up to 4096 subcarriers system were used from our previous study on noise effects in large number of subcarriers [2][3]. Simulation testbded of 8192 subcarriers in IFFT output was conformed accordingly to table structure of previous paper. Our system design appears in Figure 1.



VI. DESIGN ANALYSIS

The proposed scheme μ-Law Soft Reduction – μlsr introduces the attachment of a new compressor after Cyclic Prefix function[4][5]. Companded output can be represented by following equations without the need of expanding it in receiver's part. By using Soft Reduction (SR) in the output of Cyclic Prefix, signal peaks which exhibited larger values than others in relation to threshold, were attenuated in a greater extend [6]. Imperfect CSI decreased along with the peak-to- peak amplitude of the *CP*. In our simulations we didn't implement the previous block in order to keep low complexity in system design.

VII. METHODOLOGY

As maximum Imperfect CSI rarely occurs additional simulations had to be conducted with higher amount of information data. This was done in order to verify the innovative performance of the proposed methods through the calculation and plotting for 64 and 128 OFDM carriers. Also μlsr (for 128 carriers) exhibits Imperfect CSI decrease by almost 0.5 dβ and 2.5 db compared to previously mentioned systems.

VIII. TOOLS USED

In terms of various simulations an integrated environment based on 32-bit Windows XP, Windows 7 with supported MATLAB environments.

IX. CONLUSION AND FUTURE SCOPE

In this paper we are in review process of proposed two new techniques for decreasing Imperfect CSI. The primary concern was to accomplish this with no BER deterioration and hence to keep complexity of the system as low as possible. BER curves for μlsr and μlacp which were derived from simulations (in the absence of ADC and DAC) showed clearly not a severe deterioration. μlsr had a slightly better performance (0.5 db) compared to μlacp, but the last exhibited a superior Imperfect CSI performance in terms of probability and maximum Imperfect CSI . Both techniques don't include an expander in receiver's part, for simplicity reasons. This is also a future goal of us, along with the design of a final OFDM system (vast number of subcarriers) introducing precise channel estimation. Reduced, which could result in higher-speed with reference to dynamic scaled data transfer.

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