ISSN: 0975-766X
CODEN: IJPTFI
Available Online through *Research Article*
www.ijptonline.com

ENHANCEMENT OF JOINT SOURCE- CHANNEL CODING IN THE ENVIRONMENT OF MULTIPLE ACCESS TECHNIQUES FOR LTE

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Received on 13-02-2016 *Accepted on 20-03-2016*

Abstract

In Multiple Access Channel (MAC) scenario, multiusers simultaneously transmit their information's over the same channel where receiver is responsible for separating the data streams into corresponding users. Basically in MAC system fading is maximum and high energy consumption and also it may leads to unfair distribution among users. For these problems orthogonal CDMA spread code with Joint Source Channel Coding (JSCC) over block-fading Multiple Input Multiple Output (MIMO) is proposed. JSCC is employed to encode the source information at each transmitter prior to be directly input to the MAC access scheme. JSCC performs compression and error correction under a certain bandwidth. A channel access methods are considered to ensure the receiver is able to recover the user information over the noisy communication channel. CDMA technique provides the best performance in terms of distortion and also reduces the unfair rate distributions. Long Term Evolution (LTE) is presented to provide high speed data services.

Keywords: Joint Source Channel Coding, MAC, CDMA, LTE, Energy Consumption.

I. Introduction

MAC is considered as one of the supporting technique for wireless communication. Multiple access schemes is possible using a CDMA, TDMA, FDMA system based spreading codes. In each TDMA and FDMA systems every users at the same time transmit their information's over a similar bandwidth,[1][2] this results in multiple interferences at the receiver aspect. For this problem CDMA scheme based on Orthogonal spreading codes ensure that all users transmit their data over the similar bandwidth without any interference and also achieve a target rate. In MIMO MAC, antenna diversity scheme uses multiple antennas to improve the quality and reliability. The proposed

JSCC provides high transmission rate with minimum complexity. The operation of both source and channel coding are merged into a single step is known as JSCC [5]. JSCC is an alternative method for Separate Source Channel Coding (SSCC), it reduces transmission complexity and delay. It provides both robustness and efficiency and also it reduces the energy consumption. CDMA access scheme is chosen as a MAC technique in our proposed work. Basically CDMA is a spread spectrum technology it spreads the bandwidth of the data uniformly with the same transmitted power [6]. Spreading codes in CDMA can be divided into orthogonal and pseudo noise spreading sequences. The orthogonal concept is one of the most important and essential mechanism in wireless system such as CDMA and WCDMA. MIMO is used within the Long term Evolution (LTE) to provide the better signal performance and higher data rates by the use of radio path reflection. It is used to increase the performance of the system. MIMO add the complexity to system in terms of processing and number of antenna required it enable for high data rate to be achieved along with the improved spectrum efficiency [7]. Rest of the paper will discuss the following topic.

1. System Model
2. JSCC
3. Channel Access Scheme
4. Orthogonal CDMA
5. LTE

II. System Model

Let us consider a scenario where N users transmit independent information simultaneously to a common receiver over a block fading MAC [10]. That is the channel is assumed to remain static during the transmission of a packet of symbols but independently varies from one packet another. We address the general MIMO case where each user is equipped with T_i, i=1…....N, transmit antennas and the centralized receiver with R_i antennas. In this case, the signal at the MIMO MAC receiver is given b

$$X = \sum_{i=0}^{N} \sqrt{\frac{Pi}{Ti}}\ Hi\ Yi + Wi \qquad (1)$$

The above equation is derived for the signal at the MIMO MAC receiver. Where Pi and Yi are the power and Ti are transmitter symbols for i users respectively [10]. Hi is the Ri x Ti complex valued MIMO block fading channel matrix for i users and Wi represents the Gaussian noise at the receiver side. The values of Yi and Hi are assumed to be equal to one to avoid the loss in generality.

III. JSCC

Basically the design of wireless communication system is based on two individual coding such as source and channel coding .Generally the source coding(compression) and the channel coding(Error protection) can be performed separately and serially. This is possible only in the case of long lengths of data. So far the source coding theorem tells us that as long as source symbols are compressed to information bits/source symbol then lossless data compression is possible. The channel coding theorem tells that as long as information bits are transmitted per channel use error free transmission is possible. The operation of both source and channel coding are merged into a single step is known as JSCC [9]. The employment of JSCC in the proposed method mainly concentrates in the region of bandwidth reduction of the transmitted information from the users. It provides high transmission rate with minimum complexity JSCC is an alternative method for Separate Source Channel Coding (SSCC), it reduces transmission complexity and delay. It provides both robustness and efficiency and also it reduces the energy consumption [2].

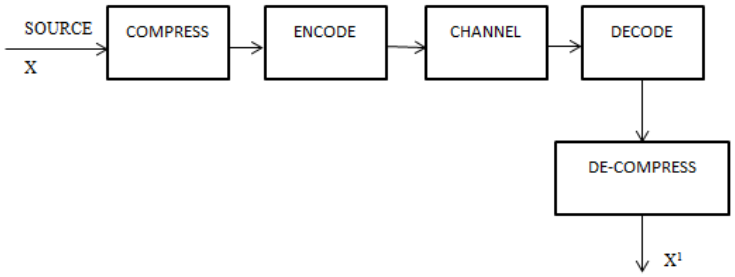

Fig. 1. Block diagram for Joint Source Channel Coding

IV. Channel Access Schemes

A channel access scheme is based on a multiplexing method, which allows several data streams or signals to share the similar communication channel. When sending information over a MAC, the received signal corresponding to each user is affected by the interferences from the other users. An approach to deal with this situation is the utilization of a channel access method for the receiver to be able to separate the information from each user. Orthogonal access schemes have been shown to achieve good performance in the case of fading channel [3]. CDMA guarantees a orthogonal and simultaneous transmission of the user information to the common receiver. Channel state information (CSI) is only available at the receiver.

V. Orthogonal CDMA

In MAC scheme, multiple users can transmit their data with a given constant rate. In multiple accesses it is possible using a CDMA scheme based on Orthogonal CDMA spread codes. For whole CDMA system the orthogonal CDMA

spread code is a major element [4]. The orthogonal CDMA spread codes allows all users simultaneously transmit their data over a same bandwidth without any multiple interference compared to FDMA and TDMA. Each users uses orthogonal CDMA codes to modulate their signal, they don't interfere with each other.

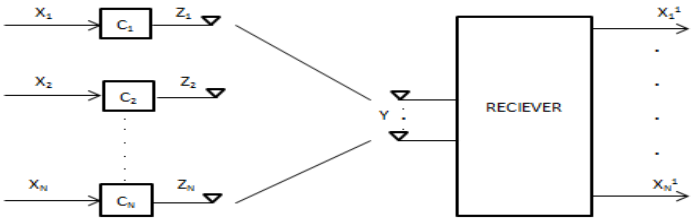

Fig. 2 Block diagram of Orthogonal CDMA access scheme over Block fading MIMO MAC

The figure shows that the orthogonal CDMA scheme for the transmission of symbols over the block fading MIMO MAC. The block fading channel is where the fading process is approximately constant for a number of symbol intervals.

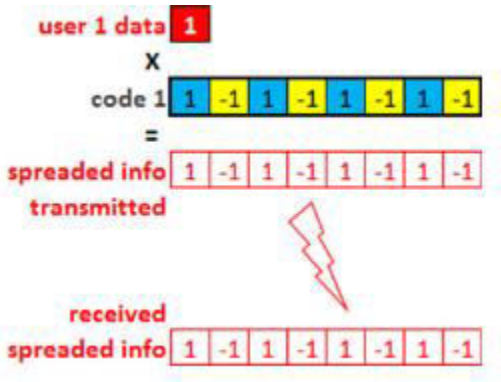

Fig. 3(a)

In figure3 (a), user 1 have some to data for transmission code 1 having unique identity for each user this information is multiplied with user 1 data the result is spreaded in transmitted side finally the receiver receives the spreaded information from the user.

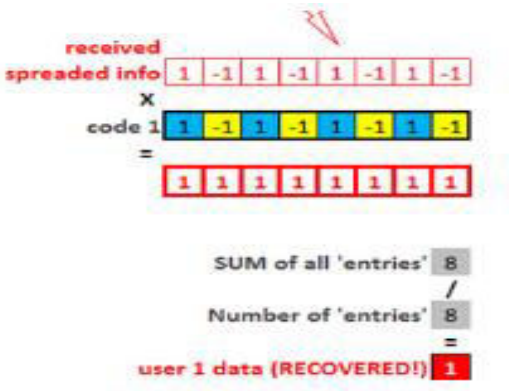

Fig. 3(b)

In above figure3 (b), the received information is multiplied with code 1(identity for each user) then the original information is retrieved. By, this way number of users can achieved the target sequences with constant data rates. This is the basic function of orthogonal spreading sequence.

VI. LTE

LTE is the fastest mobile broad band service and it also the standard for wireless communication high speed data for mobile phones and data terminals .LTE is a wireless broadband technologies developed by 3GPP(Generation partnership project) to supports voice, video and data. The motivation of LTE is need to certify the stability to effectiveness of the 3G system. User demand for higher data Rate and quality of services, [10] low complexity and also avoid unnecessary disintegration technologies for paired and unpaired operation .Generally LTE is used to improve the performance of system and also it provides high data rates.

VII. Result and Discussion

The channel realization is statistically independent to one user to another and one block to another. At each transmitter analog symbols first maps into the channel symbols using a JSCC scheme and then input to be corresponding MAC access scheme. With this a user transmits information in the constant rate and value of this parameter depending on CSNR's.

3.1 Normal Mode (UN CODED MODE)

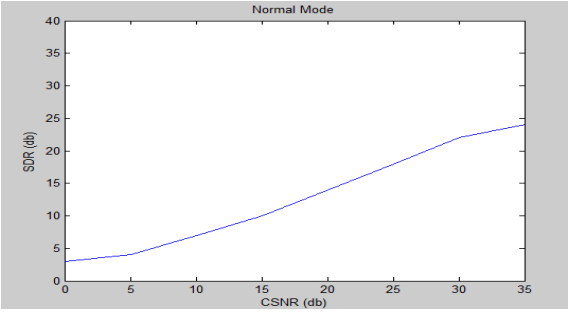

Fig 4.1 (a) Uncoded mode

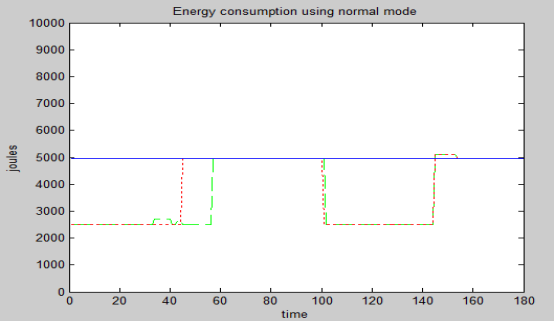

Fig 4.1 (b) Energy Consumption

The above fig 4.1(a) shows the performance in terms of SDR&CSNR for the uncoded mode. For the uncoded mode energy consumption is high. Fig 4.1 (b) clearly displays the energy consumption of normal mode

3.2 Coded Mode

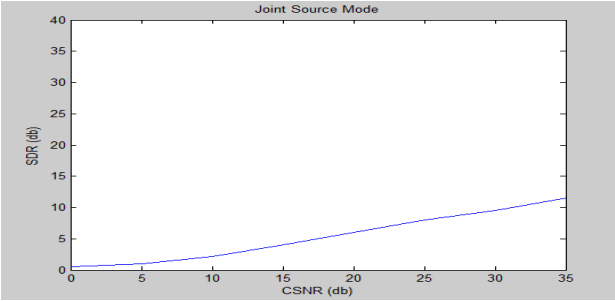

Fig 5.1 (a) coded mode

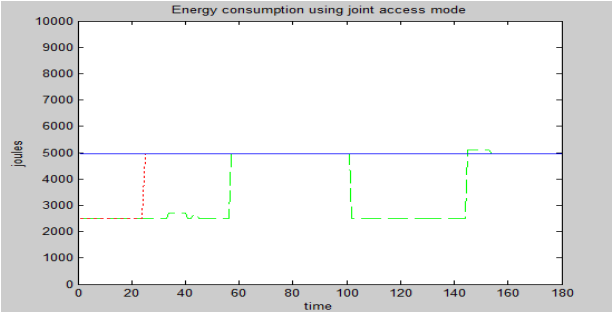

Fig 5.1 (b) Energy Consumption

It displays the system performance in terms of SDR&CSNR for the coded mode symbols. The behaviour of CDMA scheme is quit satisfy by considering that is does not utilize CSI at the transmitter and lower complexity of the orthogonal codes. For coded mode the compression of data is clearly displays in the fig 5.1(a). In this optimization will be less when to others. The good performance provided by the CDMA system without parameter optimization is motivated by the graceful performance with JSCC scheme.

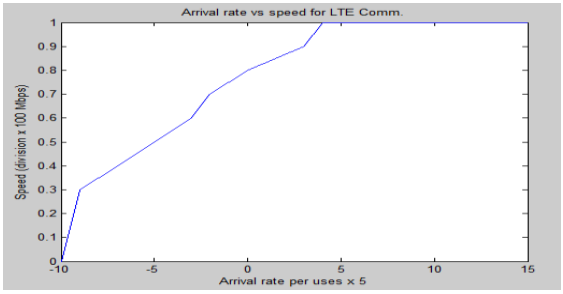

Fig 6.1 (a) LTE

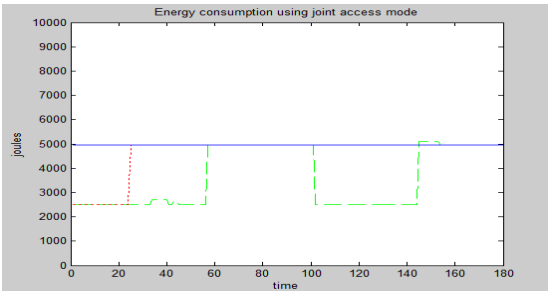

Fig 6.2 (b) Energy consuption

Figure 6.1 (a) and (b) describes about the performance of orthogonal CDMA spread codes for LTE. In this case, the required energy consumption for the transmission of information is same at even at high data rate compared to low data rate of transmission of information.

VIII. Conclusion

In this paper, we have proposed a distributed architecture called enhancement of JSCC in the environment of MAC for LTE [1]. Where CDMA is applied even in the channel is unknown at the transmitter because it makes the use of orthogonal spreading codes to ensure the separation of user information's at the receiver. CDMA is especially suitable for MAC system the simulation output shows that energy consumption reduced significantly, and LTE provides the high data rate at the receiver side. The Orthogonal CDMA access method provides the best result in terms of energy consumption under a compression mode.

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