NON-SIMULTANEOUS TWO WAY- MIMO RELAYING WITH JOINT PRECODER AND RECEIVER

K. Sravan Kumar, P. Govardhani Anisha

Assistant professor, Mtech student

Dept. of ECE,

JNTUA College of Engineering, Ananthapuramu, India.

ABSTRACT:

The long term evolution (LTE) system employs orthogonal frequency division multiple access (OFDMA) and single carrier frequency division multiple access (SC-FDMA) for the downlink and uplink transmission, respectively. However, in most existing methods the two-way OFDMA resource allocation method is present, all terminals will be assumed under an OFDMA operation, and the allocation scheme is always considered solely under the frequency domain for subcarrier assignment. In this paper, a joint time and frequency resource allocation algorithm for the LTE two-way relaying is proposed, in which the permutation of the sub-frame and the resource block is discussed for augmenting the system capacity. The drawback of any MIMO system is the increased system complexity and the additional cost for enabling multiple transmits and receives radio frequency (RF) chains. By this proposed system we increase network density, network coverage extension, rapid network roll-out, and average weighted sum rate to increase the capacity of the signal

***Key words**: LTE, OFDMA, SC-FDMA.*

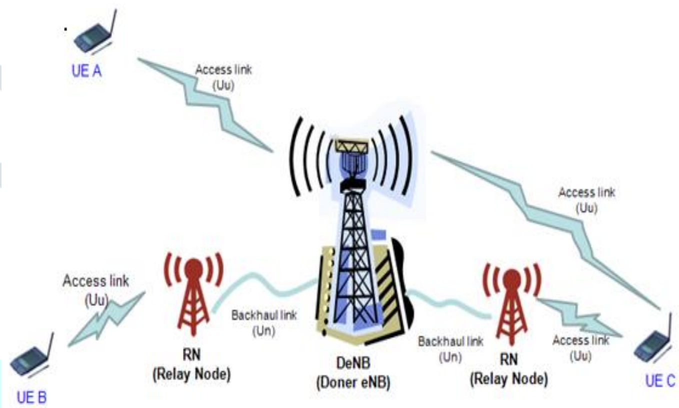
INTRODUCTION:

Relays can bring significant performance gains to wireless networks in a cost-efficient manner; for example, coverage extension, spatial diversity gains, and uniform quality-of service.

In previous papers many improvements have done to gain it so far. Some of the them are BICT [1] A-F mainly based on designing of transmit and receiver matrices on point to point communication, O-MCAF [2] Which mainly concentrate of optimization of A-F multicarrier two hop transmission system on frequency-domain relay processing, [3] Joint source and relay optimization for a non-regenerative MIMO relay concluded that the relay does not decode the packets but performs a multi-dimensional amplify-and-forward function on the baseband signals, [4] on Multi-user MIMO relay system with self interference cancellation concluded that next generation wireless communication systems need to support data rates much greater than 3G systems, MMSE [5] Cell edge multi-user relaying with overhearing concluded that carefully designed protocols can turn overheard interference into useful side information to allow simultaneous transmission of multiple communication are flows and increase the spectral efficiency in interference-limited regime. By exploiting the overhearing link through proper relay precoding and adaptive receiver processing, rate performance will be significantly improve and compared to the conventional transmission which does not utilize overhearing, WI-MAX [6] Framework that will be used to analyze MFT schemes and assess the system-level gains. The framework will be based on cellular wireless users with two-way traffic and it sets the basis for devising composite time-multiplexed MFT schemes, tailored to particular optimization criteria. Those criteria can be formulated by adapting well-known schedulers to incorporate MFT schemes.

In the classic half-duplex mode, the transmission between a source and a destination occupies two time slots, thus the effective system throughput (in bits/channel use) is reduced by a factor of two. Two-way relaying, in this method the two nodes communicate with each other with aid of relay node, in the transmission phase to nodes transmit the data simultaneously through relay, and relay broadcast to the designated nodes. Most research works on the base of relaying, assuming that the transceiver hardware of the relay node is perfect. However, in real time applications, the transceiver hardware of wireless nodes is always affected by impairments; some of them are, IQ imbalance, amplifier amplitude-amplitude non-linearity, and phase noise. Impairments create a fundamental capacity ceiling that cannot be crossed by increasing the transmit power; thus, they have a very significant impact especially in high-rate systems. Since relays are desirable to be low cost equipment, their transceiver hardware would be of lower quality and, hence, more prone to impairments. Without being affected by the importance of impairments for relaying, there are very few relevant works and these only investigate their impact on one-way relaying. In this context we analyzed how transceiver impairments influence the symbol error rate (SER) and outage probability (OP), respectively, in one-way relaying.

I. SYSTEM MODEL:



The existing method is performing two-way MIMO relaying to design joint precoder and receiver. The procedure for the existing method illustrated below

A. Linear Precoder and Receiver Design :

In this section, we jointly design linear precoders (B_u, B_b and W) and linear receivers (D_u and D_b) to 1 cancel the BI experienced by the RUE and diagonalize downlink and uplink MIMO channels. For the proposed BI-cancelling channel Diagonalization (BCID) design, we assume that the relay has global CSI and that it designs the precoder/receiver matrices and distribute them to other nodes. The availability of global CSI at the relay design/distribution of matrices by usually assumed in the literature on basis of joint design. The step of the design is as follows:

BI cancellation Precoder Design:

Our objective is to study and design relay precoders **Z** and **F** to cancel the BI of RUE alone and not that of the BS, as the BS can itself cancel its BI. For this design the steps are as follows:

- Stack the BC phase receive signal of both RUE and BS to form a vector y.
- The composite channel matrices are next expressed in terms of their constituent matrices.
- For cancellation of RUE's BI we assume the conditions such as $G_0 = H_0 = 0$ or $G_u = H_u = 0$.
- To cancel RUE's BI alone, the top-left block of the channel matrix should be zero, this happens when the above condition is exact.
- In this work, we design the precoders according to the condition C1; the design can trivially have been extended for the condition C2.
- Then design precoder matrices Z and F based on the above conditions.

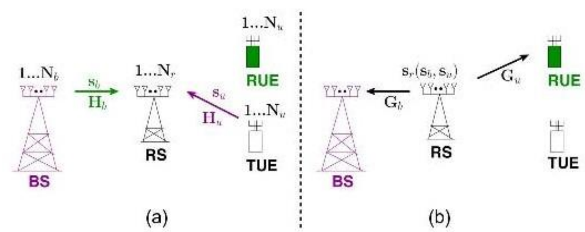


Fig. 1. **Non-Simultaneous TWR protocol**: In the MAC phase, user TUE transmits data meant for the BS while the BS transmits data meant for user RUE. In the BC phase, relay amplifies and forwards the sum-signal received in the MAC phase to both BS and RUE.

Channel Diagonalization design:

For diagonalizing end-to-end downlink (BS→RS→RUE) and uplink (TUE → RS → BS) MIMO channels; we note that the RUE and BS linearly combine their respective signals, $\mathbf{y}_u$ and $\mathbf{y}_b$ in, using receiver matrices D_u and D_b. The matrices are designed to diagonalize the downlink MIMO channel and the diagonal matrix allocates power at the relay to n downlink streams. Next, we perform SVD of channel H and for channel G. Based on this SVD, diagonalize the end-to-end MIMO channels.

Joint Power Allocation via Geometric Programming:

Maximize the WSR, via joint power allocation at the BS, TUE and relay, by casting it as a geometric program (GP). A GP can be efficiently solved using off-the-shelf software packages, maximizing of the WSR are done in two steps:

1) Use a high-SNR approximation to cast WSR maximization as a GP,

2) The WSR obtained is maximized by using an algorithm this maximizes the WSR, by iteratively solving a GP and resulting globally maximal WSR with high probability.

Precoder Design for Multi User Scenario:

In this section, we extend the multi-antenna single TUE/RUE system model to a single-antenna multiple TUEs/RUEs scenario, referred to henceforth as single-user scenario and multiuser scenario, respectively. We will show that, by slightly modifying the single-user precoder design, single-antenna RUEs can receive interference-free signals even in a multi-user scenario. We will also show that the WSR maximization, discussed earlier, can be seamlessly applied herein.

We first concentrate on downlink (BS→RS→RUE−n, ∀n) and design BS and relay precoder.

For the uplink (TUE-n → RS → BS, ∀n), we design a precoder at the relay and a receiver matrix at the BS. Since the effective uplink multi-user channel **U** is upper triangular, the BS can employ successive cancellation to decode Nu receive streams. Then finally the power allocation is also applied to this multiple scenario.

Disadvantages:

The main drawback of any MIMO system is the increased system complexity,

- The additional cost for enabling multiple transmits and receives radio frequency (RF) chains.

Relaying is one of the features that are being proposed for the 4 G LTE advanced systems. The aim of LTE relaying is to enhance both coverage and capacity.

The idea of relays is not new, but LTE relays and LTE relaying is being considered to ensure that the optimum performance is achieved to enable to meet the expectations of the users, while still keeping OPEX within the budgeted bounds.

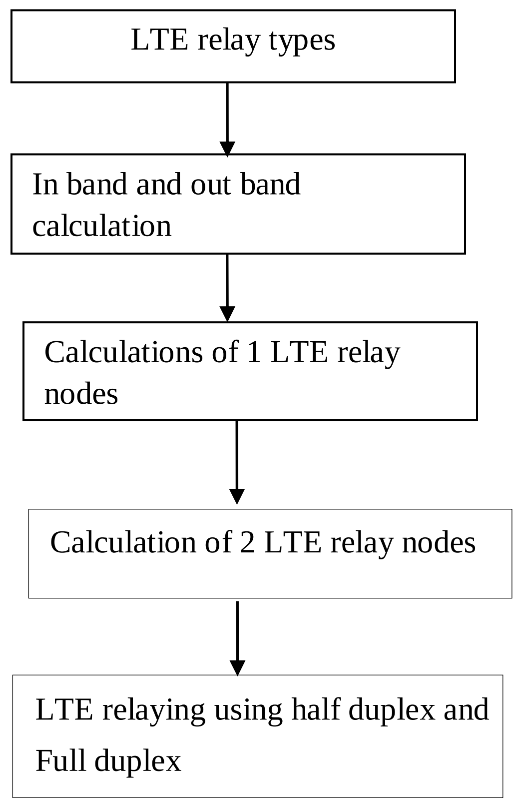
a. LTE RELAY BASICS:

LTE relay receives the data, demodulates and decodes the date apply an error correction, etc, to it and then re-transmitting a new signal. In this way, the signal quality is amplified with an LTE relay, instead of suffering degradation from a reduced signal to noise ratio by using a repeater.

For an LTE relay, the UEs communicate with the relay node, which in turn communicates with a donor eNB.

Relay nodes can optionally support higher layer functionality, for example decode user data from the donor eNB and re-encode the data before transmission to the UE.

The LTE relay is a fixed relay - infrastructure without a wired backhaul connection, that relays messages between the base station (BS) and mobile stations (MSs) through multihop communication.



LTE relaying

The same BICD method is used for the Lte systems to increase the capacity and coverage.

LTE RELAY TYPES:

There are a several different types of Lte relay node that are used. However before defining the relay nodes types, it is necessary to look at the different modes of operation.

One crucial feature or characteristic of an LTE relay node is the carrier frequency it operates on. There are two methods of operation:

- **Inband:**

An LTE relay node is said to be "Inband" if the link between the base station and the relay node are on the same carrier frequency as the link between the LTE relay node and the user equipment, UE, i.e. the BS-RN link and the BS-UE link are on the same carrier frequency.

- **Outband:**

For Outband LTE relay nodes, RNs, the BS-RN link operates of a different carrier frequency to that of the RN-UE link.

For the LTE relay nodes themselves there are two basic types that are proposed, although there are subdivisions within these basic types:

Type 1 LTE relay nodes:

These LTE relays control their cells with their own reorganition, including the transmission of their own synchronized channels and their reference symbols. Type 1 relays appear as if they are a release 8 relay nodes to release 8 user entities, this ensures backwards compatibility. The basic Type 1 LTE relay provides half duplex with Inband transmissions.

Type 2 LTE relay nodes:

These LTE relaying nodes do not have their own cell recognition and look just like the main cell. Any user entity in range is not able to distinguish a relay from the main eNB within the cell. Control information can be transmitted from the eNB and user data from the LTE relay.

When considering full duplex systems or half duplex systems for LTE relay nodes, there is a trade-off between performance and the relay node cost. The receiver performance is critical, and also the antenna isolation must be reasonably high to allow the simultaneous transmission and reception when only one channel is used.

Advantages of LTE Relaying:

- Increase network density.
- Network coverage extension.
- Rapid network roll-out.

RESULTS:

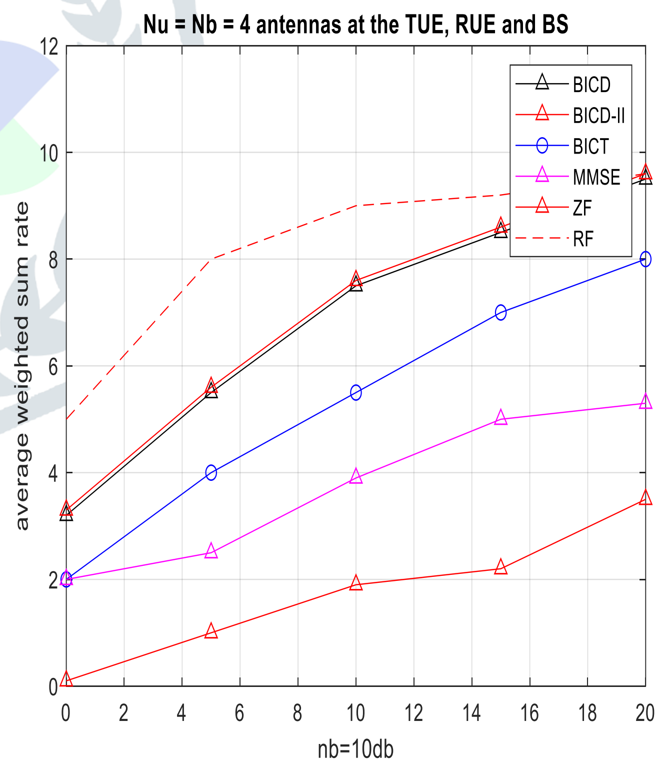


Fig 1: The above fig the nb and nu antennas are same, the average waited sum rate is calculated for different methods, and the average sum rate is more when compared to the proposed method which is on Lte system to the other

methods. Here nb=nu=4 and the value=e obtained for Lte systems is nearly double.

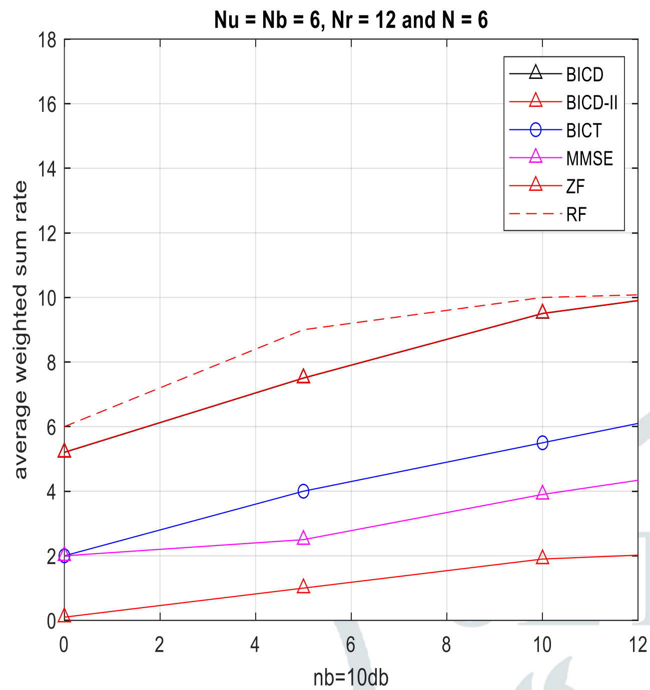


Fig 2:The above fig the nb and nu antennas are same, the relay antennas are different the average waited sum rate are calculated for different methods, the average sum rate is more when compared to the proposed method which is on Lte system to the other methods. Here nb=nu=6, nr=12 and N=6 and the value obtained for Lte system is more

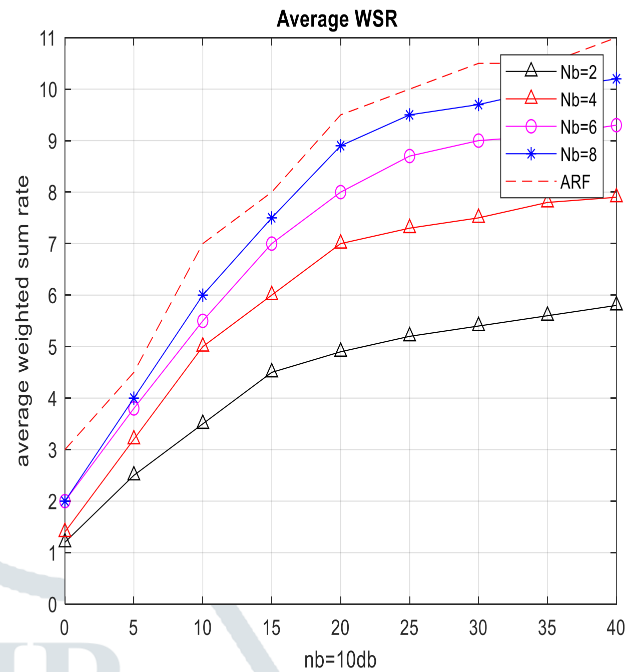


Fig 3: In the above figure the WSR is calculated for different methods such as BICD, BICT, MMSE, Zf, the present method is based on Lte systems, the average sum rate is more when compared to the other methods

Conclusion:

This paper presented an overview of relay technology now being standardized for the LTE-Advanced system. The capacity performance for different channel conditions and permutation scenarios are discussed. The simulation results will demonstrate that the proposed scheme possesses the maximal capacity.

REFERENCES:-

[1] L. Sanguinetti, A. D'Amico, and Y. Rong, "A tutorial on the optimization of amplify-and-forward MIMO relay systems," IEEE J. Sel. Areas Commun., vol. 30, no. 8, pp. 1331–1346, Sep. 2012.

[2] W. Zhang, U. Mitra, and M. Chiang, "Optimization of amplify-and forward multicarrier

two-hop transmission," IEEE Trans. Commun., vol. 59, no. 5, pp. 1434–1445, May 2011.

[3] Z. Fang, Y. Hua, and J. Koshy, "Joint source and relay optimization for a non-regenerative MIMO relay," in Proc. IEEE Workshop Sensor Array Multichannel Process., Waltham, WA, USA, Jul. 2006, pp. 239–243.

[4] R. Zhang, Y.-C. Liang, C. C. Chai, and S. Cui, "Optimal beam forming for two-way multi-antenna relay channel with analogue network coding," IEEE J. Sel. Areas Commun., vol. 27, no. 5, pp. 699–712, Jun. 2009.

[5] T. Yang, X. Yuan, L. Ping, I. Collings, and J. Yuan, "A new physical layer network coding scheme with eigen-direction alignment precoding for MIMO two-way relaying," IEEE Trans. Commun., vol. 61, no. 3, pp. 973–986, Mar. 2013.

[6] Y. Yang, H. Hu, J. Xu, and G. Mao, "Relay technologies for WiMAX and LTE-advanced mobile systems," IEEE Commun. Mag., vol. 47, no. 10, pp. 100–105, Oct. 2009.

[7] J. Gao, S. Vorobyov, H. Jiang, J. Zhang, and M. Haardt, "Sum-rate maximization with minimum power consumption for MIMO DF two-way relaying: Part I—Relay optimization," IEEE Trans. Signal Process., vol. 61, no. 14, pp. 3563–3577, Jul. 2013.