A Review- Proposed Bidirectional Relaying for Improved Channel Estimation Error and Co-Channel Interference

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***Abstract*— Wireless Communication has gained a lot of interest as future generation requires higher data rates and more suitable transmission with adequate quality of service. Wireless communication suffers from various problems like Co-Channel Interference (CCI) and Channel Estimation Error (CEE). Cooperative communication is an efficient technique to deal with these types of problems by offering significant multiplexing and diversity gains without increasing power and bandwidth. Our proposed two way relaying helps to improve the overall system performance in wireless networks. Cooperative communications also deals with the various problems like fading and shadowing. It is further investigated that proposed two way relaying is spectrally efficient technique which provides a way to surmount half duplexing loss in one way relay channel.**

***Index Terms*—**cooperative communication, Amplify and Forward, two way relaying.

I. INTRODUCTION

Wireless communication system has gained a lot of interest over the last years .The demand for higher data rate is increasing day by day for supporting various services that depends on internet like online games, etc [1]. Cooperative relaying is a diversity achieving technique which provides a reliable communication, high rate of production and large coverage in wireless network. Transmitting data over a wireless communication system suffers from various problems like fading, path loss and shadowing. These problems are compensated by various ways like increasing bandwidth or by increasing power. Or another way to compensate with these problems is to use another efficient approach known cooperative communication [2].

The main objective of cooperative communication is to make non-cooperative and independent users to share their limited resources. Cooperation may be implicit cooperation and explicit cooperation. In implicit cooperation, pre-established framework is not required whereas explicit cooperation, it requires advanced cooperative protocols to be pre-established. Cooperation is also extendable to relaying methods which is used to extend the coverage range in wireless communication system. Cooperative communication proved to be advantageous technique, cooperation referred to as sharing of resources as well as decoding and encoding capability of the network users [3].

Relaying modes are basically of two types half duplexing and full duplexing mode. Half duplexing mode takes more time than full duplexing mode for sharing same information. Generally we prefer half duplexing mode because it is less spectral efficient. Two way relaying is proposed to surmount the spectral loss which occurred in half duplexing mode [3].

Two way relaying has gained lot of interest nowadays due to its advantage of overcoming the half duplex loss in one way relay channel. Two way relaying completes its process in two parts: first part is receive part and second part is transmit part. Multiple Input Multiple Output (MIMO) system improves diversity gain and also helps to improve capacity [4]. As compare to one way relay, two way relaying is spectrally efficient technique to communicate between two users at the same time. Commonly used protocols in relaying technique are Amplify and Forward (AF) and Decode and Forward (DF). DF protocol removes noise from the signal but it needs convoluted non-linear operations. AF protocol is more desirable as compare to DF due to its easier implementation and lower complexity [5].

Amplify and Forward two way relaying, consists of 2 sources and one relay, in first phase two sources simultaneously sends the information to relay and in second phase relay broadcasts the information to the sources [6]. Relay processes the signal by doing amplification and then retransmits that signal, this is referred as analogy network coding. The analogy network coding depends on the observation that collision at the relay is entirely inoffensive and the self interference is removed from the signal which is received at sources and also there is one assumption that sources know their signals which they have transmitted [7].

AF two way relaying, tholes from achievable data rates because of the noise propagation at the relay.

The analogy network coding has been widely used in the AF bidirectional relay network. When relays are multiple, relay selection scheme is used which improves the performance of the system. Just as one way relaying, the performance of relay selection scheme in bidirectional relaying is enthralling due to its higher performance and more throughput [8].

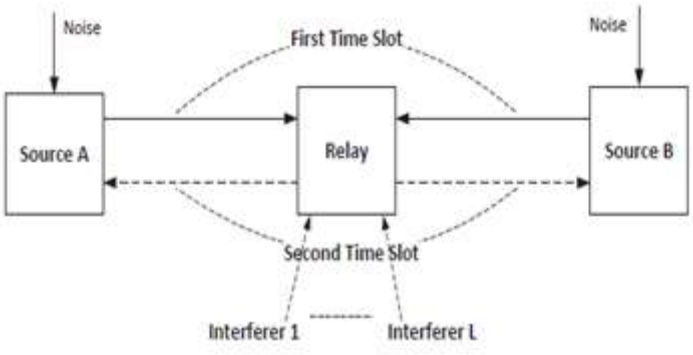

Fig.1.Bidirectinal relaying system with CCI.

Main problems from which our wireless communication system suffers are Co-Channel Interference (CCI) and Channel Estimation Error (CEE). In most researches these effects are ignored and in most results, there is assumption that in second time slot two sources remove their own signals fortuitously due to assumption of perfect CCI. But in practice, these effects exist due to feedback delay and Channel Estimation Error i.e. CCI must be calculated therefore channel estimation error exists [9]. These problems degrades the system performance.

II. COOPERATIVE COMMUNICATION

Cooperative wireless communication is related to wireless networks where the users or wireless agents may increase their Quality of Service (QOS) with the cooperation [10]. Each wireless agent in a cooperative communication system transmits data and also they behave as cooperating assistant for the other wireless agent in the network [11]. There is interesting tradeoffs in between transmit power and code rates. For power case, we need more power because in cooperation mode each user is transmitting for both sources, but on the other side baseline transmission power is reduced due to diversity. Therefore for power constraint tradeoffs, we expect for the net transmission power reduction, For second case code rate , similar question may arise, in cooperative communication each sends its own bits as well as some other bits of his/her partner [11]. So, some may think that it will cause in the loss of data rates. Spectral efficiency of each user improves because of the cooperation the data rates of the channel can be increased.

As the number of users are increasing, demands for higher data rate is also increasing. The main issues which comes in cooperative communication is path from which data signal passes. For reducing this problem, the diversity technique is preferred in wireless communication system. Diversity is a phenomenon in which the signal which is transmitted travels through various paths which are independent and the possibility that all communication channel is in fade mode is negligible

[12]. There are three basic techniques which provide diversity in wireless communication system are frequency, time and space diversity. Since last decades, wireless communication systems have been grown fortuitously. Need for higher data is increasing for fulfilling the users requirements in order to support their internet requirements like online chatting, video conferencing , online gaming etc and also to support other interactive multimedia applications. But the main problems that communication system faces are path loss, shadowing, and fading. To deal with these problems, MIMO systems are used [13].

In MIMO systems, transmitters and receivers are accoutered with several antennas offers a new degree of freedom in spatial domain to wireless communication system [14]. Now MIMO has become a part of various wireless communication standards for e.g. LTE. However use of MIMO systems in nodes having small size proved to be great challenge. To address this type of challenge, cooperative communication is used for the implementation of the concept of MIMO in a distributed manner. The concept tells that transmitting users will share each other antenna for giving virtual MIMO concept [15].

However, by using multiple antennas which are co-located, it will cause degradation in the QOS due to co-relation among them. Also because of the use of hardware, cost and size limitations, these small handheld devices might not be able to support multiple antennas [16]. These drawbacks are overcome by an approach known as cooperative communication. This type of approach is called virtual MIMO. Virtual MIMO allows single antenna to gather all the benefits of MIMO system.

With the proper utilization of the broadcasting nature, we can improve transmission performance such as throughput and reliability. With the cooperating broadcasting behaviour , we can improve the performance of the wireless system . Cooperative relaying is the efficient technique to deal with the fading, noise hence it enhances the system coverage and capacity.

Basic Relaying Protocols

In cooperative wireless communication, transmitting node transmits its own information as well as relay information on the part of each other. Process of relaying information to destination is called protocol. There are so many protocols which have already discovered, some of the relaying protocols are:

A. Amplify and Forward

Amplify and forward protocol was discovered by the Lane man et al. Here, source sends the information signal to relay node and relay amplifies that signal and forward that amplified signal to the destination.

B. Decode and Forward

It was discovered by Thomas m. cover and abbas a.ei gamal and later explored by many other scientists. In this type of relaying, user sends the data to relay and relay performs some type of decoding and checks whether the signal received is correct or wrong if it is correct then it forwards to the destination otherwise doesn't forward the signal.

C. Compress and Forward

In Compress and Forward type of relaying protocol, decoding of message is done at the transmitter side and a relay performs compression and sends the compressed form of signal to the destination and this technique helps in getting the benefits of the diversity technique.

III. PREVIOUS WORK

In practice, channel state must be estimated and therefore Channel Estimation Error exists. So, it is important to know the performance of AF Two Way Relaying Network (TWRN) in presence of Channel Estimation Error. Moreover, techniques which helps to remove these problems and helps to enhance the system performance are of great interest. This section provides a literature survey in the AF ANC based TWRN.

TWRN has gained a precious position in wireless communication due to its advantage of surmount half duplexing loss in one way relay channel [17] .There are various researches which has been already done on two way relay network with different schemes for both AF and DF network [18] . Network Coding for TWRN was studied in [19]. Trade-off in Diversity multiplexing for TWRN is considered in [20]. The optimal distributed beam-forming structure is considered in [21]. Asymptotic capacity analysis with multiple antennas for Two Way Relaying Network was studied in [22]. Cognitive spectrum sharing protocols in TWRN was discovered in [23] . Two Way Relaying Network which consists of several relays , there we use relay selection for multiuser diversity and this helps in improving the performance of the system. this type of relay selection in the AF TWRN has been studied [24]. The impact of imperfect CSI on the AF-TWRN performance was studied in [25]. TWRN using MIMO was studied in [26]. Multiple Two Way Relaying Network with other different signalling scheme was investigated in [26]. In the previous researches, the CCI effect on the TWRN is not considered. Moreover, TWRN might operate in a rich Co-Channel interference Environment which is considered to be an important egress in wireless network. Thus, Co-Channel Interference should be taken into consideration in the design and analysis of a TWRN. Authors have recently investigated the AF-TWRN performance in the presence of CCI. Outage probability of the AF-TWRN assumed that the relays affects from an Additive White Gaussian Noise (AWGN) and source nodes suffers from Co-Channel Interference [26]. Authors also assumed that there is no noise at the sources [26]. Performance of the outage probability for an AF-TWRN in which sources are affected by only noise and have interference limited environment [27]. By considering same system structure, AF TWRN performance in a Nakagami-m fading channel was investigated in [27]. We also observed the Co-Channel Interference effect on the AF-TWRN was studied in which nodes which are present in the wireless network are affected by both CCI as well as noise. Moreover, observations which we have concluded are based on the thing that the author has taken outage event as 2 different event and they have not considered the whole system together.

We have observed the amplifying factors are connated to only channel gains of the link. Also, the channel gain of the assumed links are not taken. Moreover, for the AF-TWRN, most of the results assumed that

two sources are capable of removing their own signal in the second time slot. Moreover, this type accuracy in self interference cancellation is based on the accuracy of Co-Channel Interference cancellation. But in reality, it is very difficult to get such an accurate Co-Channel Interference because of presence of the Channel Estimation Error and delayed feedback, it results in the decadence of performance of the system. The AF TWRN with CCI and imperfect Channel State Information (CSI) has not been reported yet in the previous research. So, nowadays researchers are focussing their research on the performance of system with CCI and imperfect CSI for enhancing system performance and for getting accurate results.

IV. TWO WAY RELAYING

Cooperative Relaying is a assuring diversity achieving process ,provides a higher throughput , a reliable communication and also helps in improving capacity for a wireless communication networks in a variety of applications Two Way Relaying Network is a spectrally efficiently protocol which helps to remove the Half Duplexing Loss in One Way Relaying channel. Furthermore, by incorporating the MIMO helps to improve the diversity and spectral efficiency. The general two hop relaying protocols loss suffers from spectral efficiency loss which is overcome by Two Way Relaying Network (TWRN). Two Way

Relaying Network occupies 2 channel uses by establishing bidirectional transmission link in between communication nodes which helps to abate the loss caused by conventional two hop Relaying protocols. In Two Way Relaying Network 2 sources sends information to the relay at the same time in the first time slot and in the second time slot, relay performs broadcasting of the common information to the both sources. . When several relays are present, there relay selection scheme proved to be more beneficial and efficient in Two Way Relaying similar to One Way Relaying. Two Way Relaying network is alluring because of its cost effectiveness and higher performance. Two Way Relaying improves spectral efficiency and provides significant throughput gain.

V. CONCLUSION

Relay networks have acquired a very special attention nowadays. Relay networks provides a benefit for increasing spectral efficiency and for increasing capacity. Two Way Relaying Network as compare to one way relaying is more spectral efficient. In practice, we have to estimate the Channel State Information (CSI) therefore Channel Estimation Error (CEE) exists. So it is important to study the influence of CEE on the performance of the system in AF/DF TWRN. Moreover, the strategies for enhancing the system performance and to deal with the channel uncertainty which results from the channel estimation error are also of practical interest.

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