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Optimization of Path Selection in MIMO

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Abstract- Multi-hop communication is the best way for improving the coverage area with reduced transmission power.This paper can easily found a path selection based on multi-hop decode and forward (DF) cooperative system. Then it is said to be a simple parallel multi-hop paths based cooperative communication system. Recently, cooperative communication have attracted significant attention to tackle the limitations imposed by multiple-input-multiple-output (MIMO) technology. To eliminate these limitations and increase spectral efficiency, Compress-and-Forward(CF) technique was proposed. In many known examples where compress-and-forward(CF) for relay networks is capacity achieving, it is only trivially so, i.e., it falls back to hashing without quantization.A potentially better strategy is to decode as much as possible and to compress the residual information, i.e., a combination of decode-and-forward (DF) and CF.

Keywords: *Decode-and-Forward(DF),Multiple-Input-Multiple-Output(MIMO), Bit Error Probability(BEP),Best relay selection, Compress-and-Forward,Amplify-and-Forward(AF).*

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1. INTRODUCTION

Multi-hop based cooperative communication system is useful for increasing the transmission range (coverage) of a wireless communication system. Decode-and-Forward (DF) protocol requires digital processing at the relays and avoids error accumulation contrary to the amplify-and-forward (AF) protocol. However, a multi-hop DF cooperative system is highly prone to error propagation due to the presence of multiple erroneous relaying nodes this problem limits the extension of the DF protocol to multi-hop systems. Since the DF protocol looses diversity in the case of erroneous relaying, the performance of DF cooperative system with multiple hops and multiple paths. Protocol in a multi-hop network is severely affected. In order to improve the error and diversity performance of the DF protocol based multi-hop communication system,Compress-and-Forward(CF) technique was proposed.

To the best of the knowledge, the exact error rate of a path selection based multi-hop DF system is not thoroughly analyzed so far in the literature. To be more specific there is no known attempt to derive the exact or very close to exact analytical error rate of the path selection based multi-hop scheme in the literature so far.In this paper, we study the compress-and-forward(CF) selection criterion for the best path selection in a multi-hop DF cooperative system for any kind of wireless fading channels.

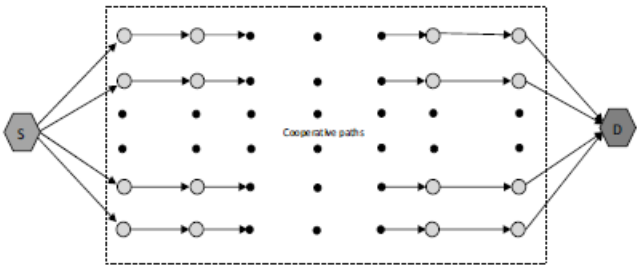

Figure.1. DF cooperative system with multiple hops and multiple paths.

Multi-hop based cooperative communication system is useful for increasing the transmission range (coverage) of a wireless communication system. Decode-and-Forward (DF) protocol requires digital processing at the relays and avoids error accumulation contrary to the amplify-and-forward (AF) protocol. A multi-hop DF cooperative system is highly prone to error propagation due to the presence of multiple erroneous relaying nodes this

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problem limits the extension of the DF protocol to multi-hop systems. However, all aforementioned works over multi-hop relaying consider that there is only a single multi-hop path available between the source and destination. Since the DF protocol looses diversity in the case of erroneous relaying, the performance of DF cooperative system with multiple hops and multiple paths. Protocol in a multi-hop network is severely affected. In order to improve the error and diversity performance of the DF protocol based multi-hop communication system, multiple multi-hop paths can be deployed between the source and destination.

2. METHODOLOGY

2.1 MIMO COMMUNICATIONS

Multiple-Input Multiple-Output (MIMO) systems were introduced in order to enhance the performance of the wireless communications systems to provide robustness, high data rates, and reliability by overcoming the channel fading with the use of multiple antennas. A MIMO system offers redundancy through the multiple independent channels, which are created between the transmitting and the receiving antennas of the system.

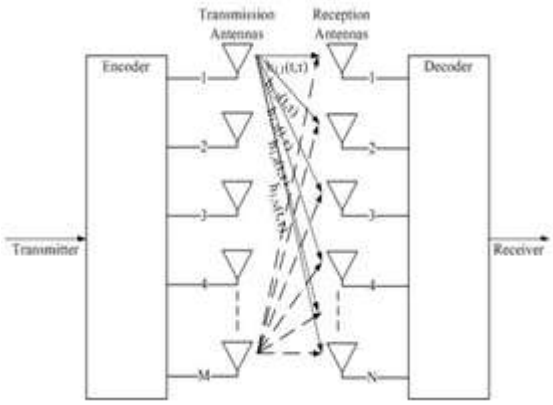

Figure.2. Typical MIMO System with M Transmitting and N Receiving Antennas, which provides an M×N Spatial Diversity Order.

Figure 2, shows a schematic diagram of a typical MIMO system with M transmission antennas and N reception antennas. In such a system a signal can be carried through the M×N different independent channels that exist between the transmitter and the receiver.

2.2 COMPRESS-AND-FORWARD RELAYING PROTOCOLS

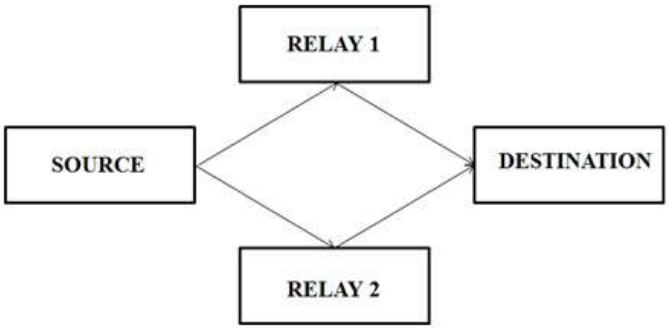

Figure.3. Compress-and-Forward Relaying Protocols in a Diamond RN.

Compress-and-Forward(CF) for relay networks is capacity achieving, it is only trivially so, i.e., it falls back to hashing without quantization.A potentially better strategy is to decode as much as possible and to compress the residual information, i.e., a combination of decode-and-forward (DF) and CF is optimal as shown in above figure 3.

2.3 RELAY SELECTION

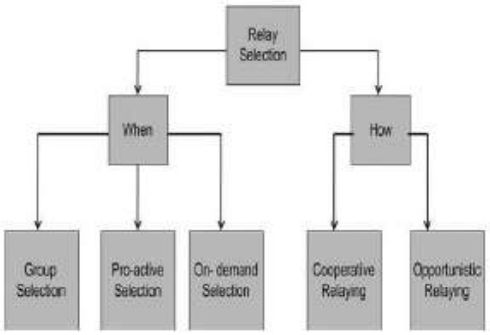

Figure.4. Relay Selection

In cooperative communication, to choose the relay or partner or set of them, is the challenging task. The proper selection of the relay can effectively improve the overall performance of the network in terms of higher data rate/throughput, lower power consumption and better bit

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error rate performance. The relay selection can be classified as follows.

Group selection- In this method, relay selection occurs before transmission. **Proactive selection**- In this method relay selection is performed by the source, the destination, or the relay itself during the transmission time.

On-demand selection- Here relay selection is performed when needed. Depending on the relation between the network entities, relay selection mechanisms can be divided into two categories:

- Opportunistic Relay Selection
- Cooperative Relay Selection

The basic opportunistic relay selection scheme is based on local measurements. They can be further classified as 1.Measurement-based relay selection 2.Performance-based relay selection 3.Threshold-based relay selection.

3. RESULT AND DISCUSSION

In this paper,we obtained the performance improvement by increasing the SNR with reduced BER.We are also improved the coverage area with reduced transmission power.All the limitations imposed by MIMO technology were eliminated.And the spectral efficiency is increased with compress-and-forward(CF) technique.

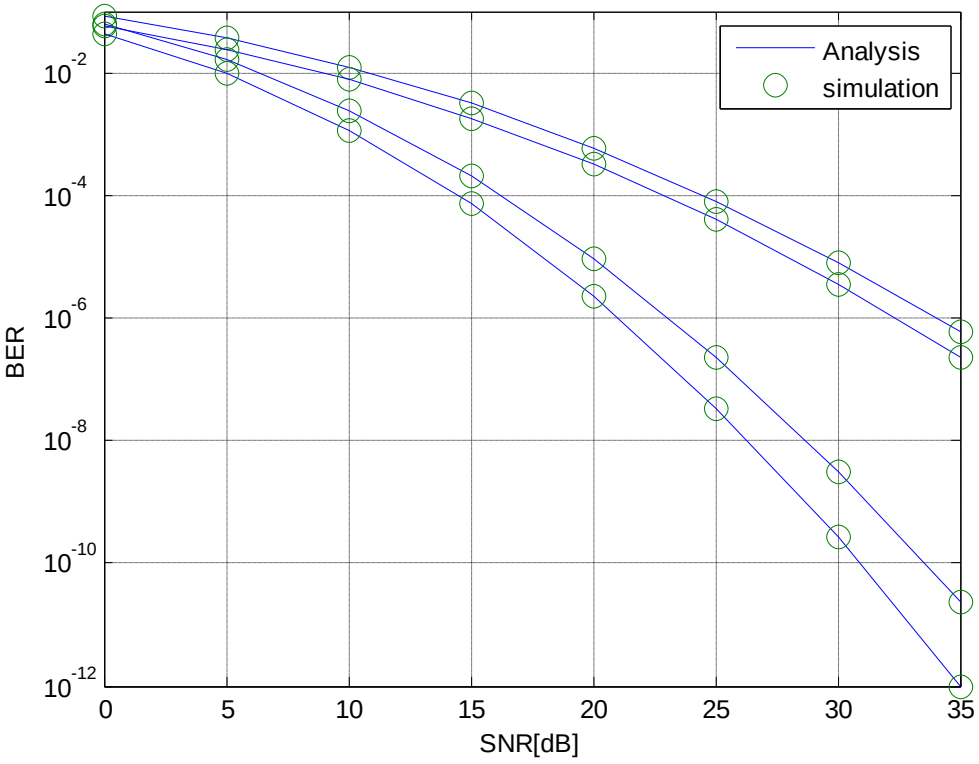

Figure.5. Analytical and simulated error performance.

Fig. 5, shows that the analytical and simulated BER versus SNR performance of the best path selection based multi-hop DF scheme. It can be seen from Fig. 5, that the simulation results follow the analytical values satisfactorily; matching of the analytical and simulation results is good. Moreover, the max-min criterion based path selection scheme works well in the multi-hop DF system and a significant SNR gain can be achieved by increasing the number of paths as can be seen from Fig. 5.

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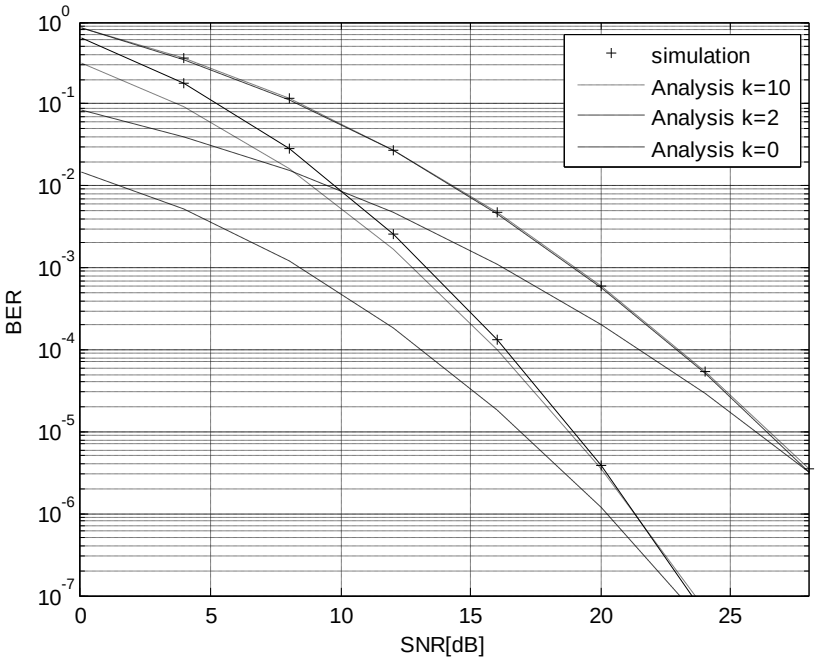

Figure.6. Simulated and analytical BER versus SNR performance of best path selection scheme.

The analytical and simulated BER performance of the considered scheme with independent and non-identically distributed (i.n.i.d.) hops is shown in Fig. 6. Further, it can be seen from Fig. 6 that max-min criterion based path selection works well for i.n.i.d. hops; it avoids loss in diversity due to presence of multiple relays in a cooperative path and enables the DF protocol to achieve better diversity order by adding more cooperative paths in the system.

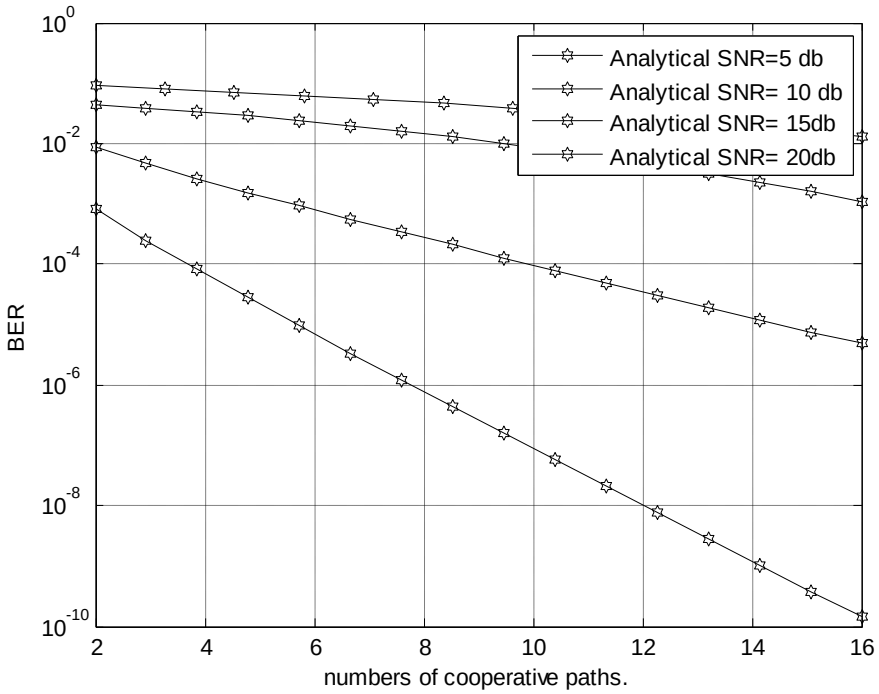

Figure.7. Analytical and simulated BER of best path selection scheme for different numbers of cooperative paths.

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In Fig. 7, shows the analytical and simulated BER of the path selection scheme for number of cooperative paths J = 2, 3, . . . , 16, each path containing N = 3 i.n.i.d hops. It can be seen from Fig. 7,that increasing the number of cooperative paths does not improve the performance of the best path selection scheme significantly at SNRs of 5 dB and 10 dB. However, at higher SNRs (15 dB and 20 dB),there is significant improvement in the performance of the path selection scheme with increasing number of paths between the source and the destination.

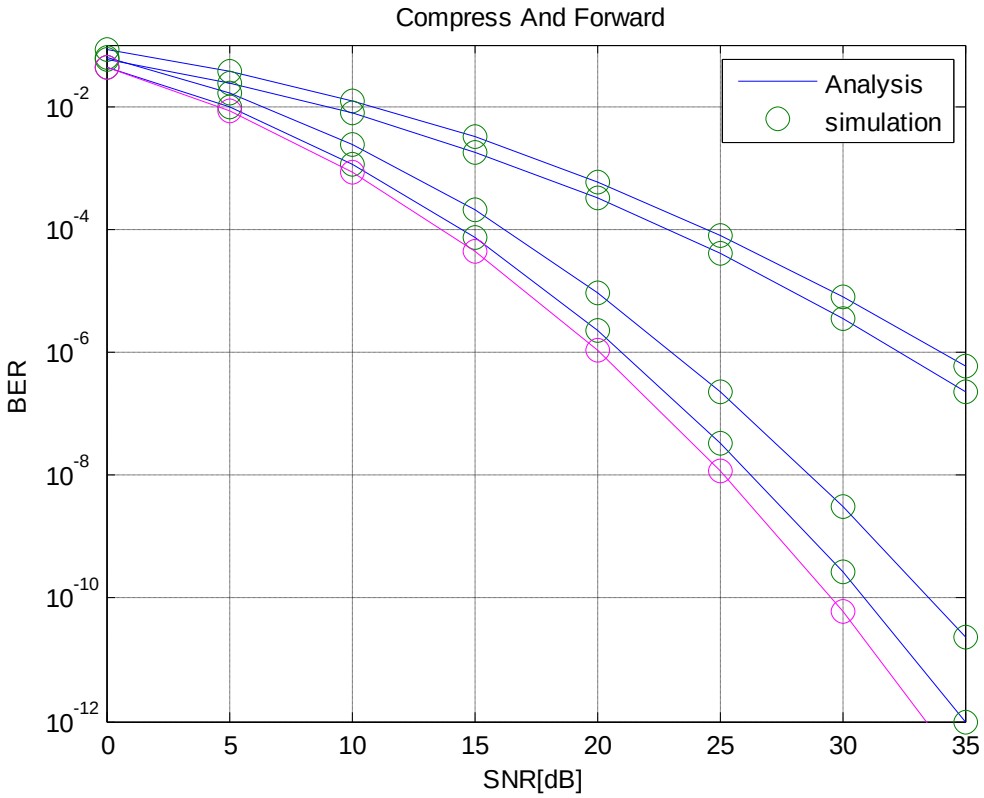

Figure.8. Analytical and simulated error performance of compress-and -forward scheme.

Analytical and simulated error performance of compress-and –forward scheme is as shown in figure 8,Moreover, the compress-and-forward technique based path selection scheme works well in the multi-hop DF system and a significant SNR gain can be achieved by increasing the number of paths as can be seen from Fig. 8.When compared to best path selection scheme,Compress-and-Forward technique achieves more throughput with further more reduction in BER.

4. CONCLUSION

This paper presents that by using multiple antennas, MIMO wireless technology is able to considerably increase the capacity of a given channel.By increasing the number of receive and transmit antennas it is possible to linearly increase the throughput of the channel with every pair of antennas added to the system. This makes MIMO wireless technology one of the most important wireless techniques to be employed in recent years.This study also defines the performance improvement by increasing the SNR with reduced BER, and the coverage area is improved by compress-and-forward technique.Some limitations imposed by MIMO technology were addressed in this paper and the spectral efficiency is increased .

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