Performance Evaluation of Detection and Combining Techniques for Cooperative Wireless Systems over FSC

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Abstract-In this Study, The issue identified with the transmission protocols and helpful coding is additionally tended to. In the end, note that the transmission protocols and helpful coding are better decision for wireless communication systems. Alongside higher information rate prerequisites, a future age of wireless communication requires progressively dependable transmission joins. Be that as it may, due to multipath blurring, serious shadowing, way misfortune and co-channel obstruction, communication in single-jump wireless systems has confronted some crucial cutoff points. So as to ease the hindrance perpetrated by wireless channels, multiple-input-multiple-output systems have been proposed to misuse assorted variety of the channel. In spite of the fact that MIMO systems can unfurl their immense advantage in cell base stations, they may confront confinements with regards to their sending in mobile handsets.

Keywords - FRC, SNRC, Frequency Selective Channel, DF, MMSE, ML.

I. INTRODUCTION

In this unit, a simple cooperative wireless network with helper in the presence of single eavesdropper is shown in the Fig1.1. Total communication process occurs in two stages. First phase is called broadcasting stage, in which source broadcasts its information to legitimate receiver with power Ps, but because of broadcast nature of transmission medium relay and eavesdropper overhears the source information.

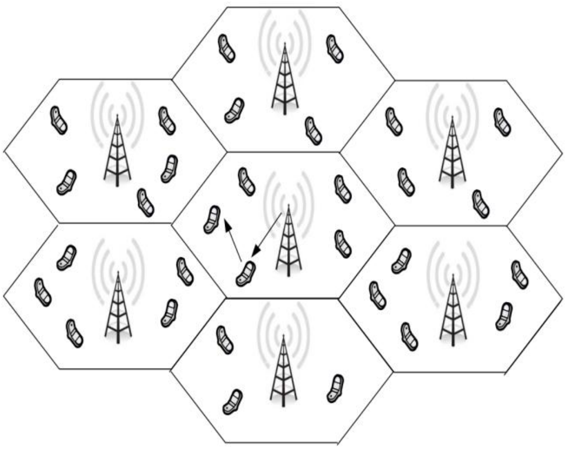

Figure 1.1 Simplified Cooperative Models.

After receiving the information signal from the source, relay uses cooperating relaying schemes to process the signal. Elemental cooperating relaying schemes to transmit the information signal to the destination are Decode and Forward (DF) and Amplify and Forward (AF). In addition to these two relaying schemes, Cooperative jamming is used by the relay, to produce artificial interference to confound the eavesdropper.To combine the benefits of both DF and AF, a new cooperating relaying scheme Hybrid Decode-Amplify-Forward (HDAF) is introduced in this chapter.

In DF relaying, source broadcasts information that is decoded by destination and relay. The relay re-encodes the data and broadcasts this data to the destination. Thus due to the regeneration of the source's information at the relay node, the error propagation from the source-relay node is minimized to the destination. But this also leads to the increase in complexity of the relay node.

In Amplify and Forward (AF) relaying protocol, relay first amplifies the received information signal and then forwards to the destination. But the disadvantage with AF relaying is, it also amplifies the noise signal along with the information signal. Pr is the power transmitted by the relay node, Hr d is the rayleigh channel fading coefficient of helper-destination link, Hr e is the rayleigh channel fading coefficient of helper-eavesdropper, SDF is the re-encoded signal at the best relay and nd, ne are the AWGN noises with zero mean and variance as 1 at destination and eavesdropper respectively.

- Best Relay Selection

This relaying scheme is the best to use when it comes to using minimal network resources. It requires only two channels for transmission. On the other hand, it shows that all the above schemes are using all the network channels in single transmission. The best relay is selected among the number of relays depending on the defined criteria which allows only two channels, i.e., between sender and relay and between relay to destination for communication. The relaying protocol can be AF or DF.

- Two-way Relaying Protocol

The spectral efficiency of the traditional one-way relaying is constrained due to the half duplex relaying. This loss in spectral efficiency can be mitigated with the help of two-way relaying where the two source nodes are allowed to communicate bi-directionally. Thus, improving the spectral efficiency in comparison to one-way relaying.

- Hybrid decode Amplify forward relaying (HDAF)

In decode and forward relaying, relay can decode the signal impeccably if it near is to the destination and when relay is far away from source, amplify and forward relaying can gives the better result compared to decode and forward. A new hybrid relaying scheme Hybrid Decode Amplify Forward (HDAF) is proposed in order to get the benefits of both DF and AF relaying schemes.

- Relay Selection

The aim of a relay selection procedure is to identify one relay node out of multiple candidates and assign it to a given source-destination pair. The overview here is limited to the selection of a single relay. Selection of multiple relays for virtual MIMO can be found e.g., in. Relay selection should provide efficiently a relay that optimizes required performance characteristics and, therefore, is critical for the performance of cooperative relaying. Most commonly this means a relay minimizing outage probability (in Bit Error Rate (BER) or Packet Error Rate (PER)) at the destination should be preferred.

- Adaptive Relaying

Selective relaying is one form of adaptive relaying. In the DF scenario, it is noted that the transmission reliability is limited not only by the relay-destination node link but also by the link between the source node and the relay node. Selective relaying takes advantage of the SNR information on the relay node to make decision whether to transmit to the destination or not. If the SNR of the received signal at the relay node falls below a certain threshold, the probability of correct decoding at the relay node will be lower, and it is better not to forward the transmission since it will have high probability to cause error in the destination node.

The concept of cooperative communications is to exploit the broadcast nature of wireless networks where the neighbouring nodes overhear the source’s signals and relay the information to the destination. As can be seen from Fig. 1, after receiving the signals resulting from the source, a third-party terminal acting as relays forwards their overhearing information to the destination so as to increase the capacity and/or improve reliability of the direct communication. The end-to-end transmission is clearly divided into two separate stages in the time domain: Broadcasting and relaying phase. In the broadcasting phase, i.e., broadcasting channel as seen from the source's viewpoint, all the receiving terminals including the relays and destination work in the same channel (time or frequency) as opposed to the second stage. In the relaying phase, i.e., multiple access channels as seen from the destination's viewpoint, the transmitting terminals (relay nodes) may operate in different channels to avoid co-channel interference.

II. FREQUENCY SELECTIVE CHANNELS AND PHASE PRECODING

The channel makes frequency selective fading on the got signal, if the channel has a fixed gain and direct phase reaction over the transmission capacity which is littler than transfer speed of transmitted signal.

Under these circumstances, impulse response of channel has multipath defer spread which is more prominent than image time of transmitted signal. This happen, when gotten signal has more than one sort of transmitted waveform which are obscured and postponed in time and from now on got signal is mutilated. Inside the channel, frequency specific fading occurs because of time dissipating of images transmitted and entombs image impedance. From the frequency domain point of view, some frequency parts in the got signal range have greater additions than other. As stand out from level fading channels, frequency specific fading channels are hard in light of the way that each multipath signal must be shown and channel must be assumed to be straight channel. In frequency particular fading, the transmission limit of signal transmitted should be greater than soundness data exchange limit BC of the channel.

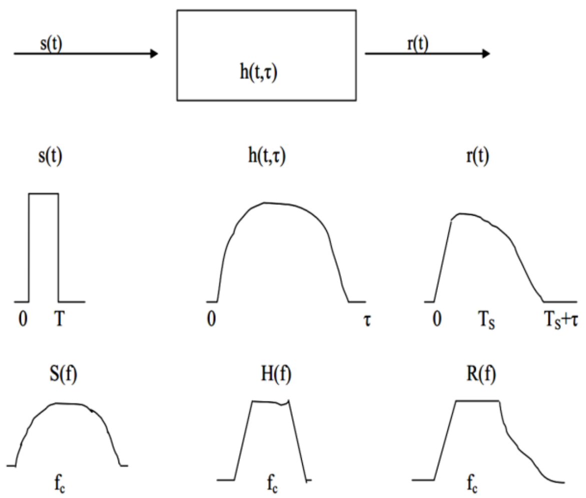

Fig. Frequency Selective Channel.

Frequency selective fading channels are also called as wideband channels as bandwidth of signal is wider than bandwidth of channel impulse response, Where BS is bandwidth of transmitted signal, BC is coherence bandwidth of channel, TS is symbol period and ox is root mean square delay spread.

Phase Precoding

The main difficulty in MIMO channels is the separation of the data streams which are sent in parallel. In the context of the multiple access channels, this task is called multiuser detection.

In this area maker examine precoding or pre-equalization of the transmitted signals for MIMO frameworks. This sort of preparing at the transmitter requires the channel state data (CSI) at the transmitter. Remembering the true objective to have the ability to get CSI at the transmitter, the channel should be settled (non-flexible) or generally relentless completed a sensibly tremendous day and age. In case CSI is open at the transmitter, the transmitted images, either for a lone customer or for different customers, can be incompletely segregated by methods for pre-equalization at the transmitter. In this segment, makers give a compact diagram of precoding plans for single-customer and multiuser frameworks.

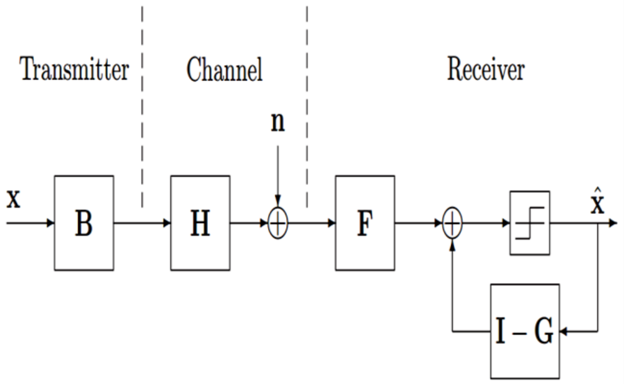

Fig Block Diagram of the Matrix Precoding.

The structure of DFE at the authority is showed up in Figure 3.2. After each image is recognized, it is subtracted from the gotten signal before the accompanying image is perceived. Subsequently error spread may occur in these beneficiaries. For numerous entrance channels, this is equivalent to serial impedance cancelation (SIC). In the downlink channel, dissimilar to in the other two, beneficiaries are cumbersome and consequently it is hard to realize joint preparing methodology, for example, DFE.

III. PROPOSED WORK

The cooperative relay system is made the communication possible with relay based approach which is the operation similar like amplification during transmission to reduce the effect of interferences and noises mixed with the signal during transmission over wireless channel.

But system still needs to be improved to make long distance communication possible with less noise and distortions during transmission. The same thing kept in mind the cooperative relay system is proposed in this work. This is brief here the block diagram of the proposed cooperative relay selection scheme with detect and forward relay mode followed by combining technique Fixed Ratio Combining (FRC) and Signal to Noise Ratio Combining(SNRC). To reduce the effects of errors detection algorithms are applied which are maximum likelihood (ML), minimum mean square error (MMSE) and without detection. Where data is randomly generated to achieve the all the possibility of noise encounters. The channel considered here Gaussian channel which is the most near to practical channel behavior. After applying combining techniques at the receiver signal is then detected by the detection algorithms and then finally get the data at the output.

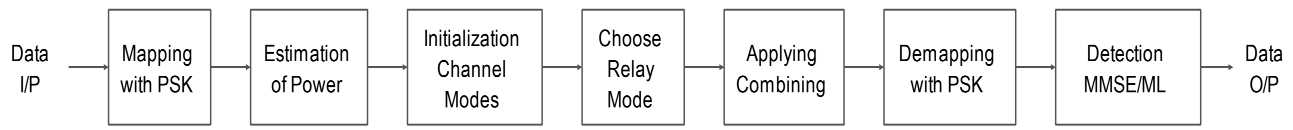

Fig Block Diagram of Proposed Methodology.

The proposed system is explained using the block diagram in the Fig. 3.1, and this system is simulated in the simulation environment and the simulation steps are shown in the Fig. 3.2 with the help of flow chart. In the simulation step first the simulation environment need to be created with the help of variables, followed by the initialization of the channel coefficient initialization which are Detect and Forward relay selection schemes. The data is generated randomly to achieve all the possibilities with the system integration. Then the proposed methodology is applied i.e. combining techniques followed by linear (MMSE) and non-linear (ML) detection techniques to get the optimum results. Last step is to compare and display all the possible relay selection results with different techniques and modes.

After receiving the information signal from the source, relay uses cooperating relaying schemes to process the signal. Elemental cooperating relaying schemes to transmit the information signal to the destination are Decode and Forward (DF) and Amplify and Forward (AF). In addition to these two relaying schemes, combing Cooperative is used by the relay, to produce artificial interference to confound the eavesdropper. To combine the benefits of both DF and AF.

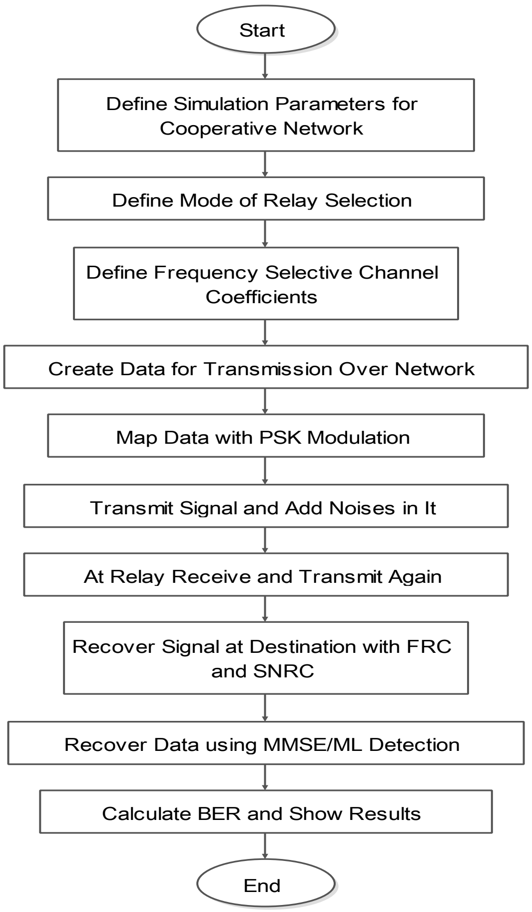

Figure 3.2 Flow Chart of Proposed Methodology.

An incorrectly detected symbol at the relay station will have a fifty percent probability of also being incorrectly detected at the destination. This stands in contrast with the equal ration combing in a system using AAF. Instead of detecting the symbol at the relay, it is amplified and transmitted to the sender.

IV. SIMULATION RESULTS

In this section the simulation results of the proposed system utilizing different cooperative modes and Various Relay Selection Modes and the optimum BER is achieved using minimum mean square error(MMSE) and maximum likelihood (ML) detection. Also a combination of different combining methods and diversity protocols are analyzed to illustrate their potential benefits. The detected signals at the receiver side from various cooperative modes are than combined using Fixed Ratio Combining (FRC) and Signal to Noise Ratio Combining (SNRC) and outcomes are given in below figures.

The simulation of proposed algorithm has completed in Matlab and simulated in Matlab Simulink. The simulation waveforms of proposed algorithm has visualized on Matlab Scope. In Figure 4.1 BER Vs SNR Curves using Relay Selection and without Detection has shown. In Figure 4.2 BER Vs SNR Curves using Relay Selection and MMSE Detection curve has shown. BER Vs SNR Curves using Relay Selection and ML Detection has shown in Figure. 4.3.

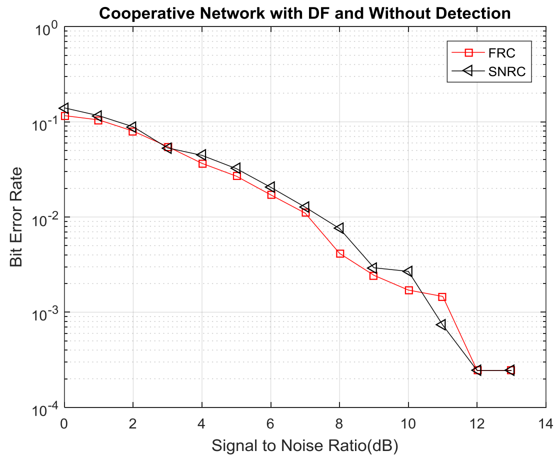

Figure 4.1 BER Vs SNR Curves using Relay Selection and without Detection

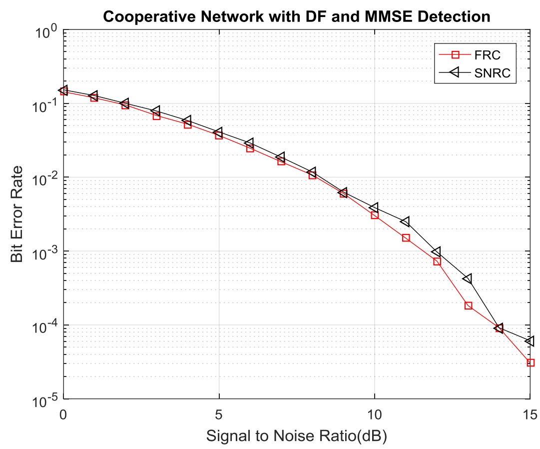

Figure 4.2 BER Vs SNR Curves using Relay Selection and MMSE Detection

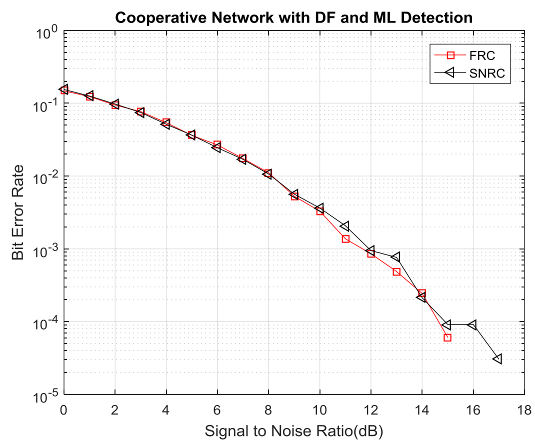

Figure 4.3 BER Vs SNR Curves using Relay Selection and ML Detection

From the above simulation results of proposed system with Coherent-MRC and MRC with relay selection schemes and MMSE and ML detection technique, and it can be seen that the cooperative relay communication system outperform with C-MRC with DF cooperative mode with

No Collaboration Threshold Harmonic(SNR) and MRC with DF cooperative mode with Collaboration threshold Max (min (SNR)) relay mode.

V. CONCLUSION

Recently, due to the increasing interest for the new wireless services, the demand for radio spectrum has increased dramatically. But, in the current spectrum management policy, it is very difficult to find a spectrum for a new wireless service because most of the spectrum has already been allocated. Therefore, there is a spectrum scarcity in particular spectrum bands. On the contrary, a large portion of the assigned spectrum is used sporadically, leading to under-utilization of a significant amount of spectrum. In the typical spectrum usage for a range of frequencies, certain portions of the spectrum are heavily used, some are partially used and others are sparsely used. In this paper the survey of cooperative system based on Adaptive hybrid relay techniques.

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