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Interpretation of AF-DF protocols for FitureMulti Layer-IDMA

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ABSTRACT

In this article, we investigate the bit error rate (BER) performance in a cooperative relay communication system for multilateral IDMA (ML-IDMA) using the maximum ratio combination (MRC) technique.).). We investigate the effect of the number of lines on performance and find the average error rate in bits of the AF relay scheme (Amplify and Forward) using the signal-to-noise ratio (SNR) of the relay connection in closed form. The proposed system for evaluating ML-IDMA performance is provided with a different number of layers and a different number of relays in an ML-IDMA cooperative environment. The simulation results show that the BER performance of a 4-relay IDMA double layer system (K = 2) is approximately 4 dB. In addition, the bandwidth saving is 50%. Ultimately, BER performance deteriorates as the number of layers increases and the proposed system increases bandwidth by approximately 1/K.
Keywords: Amplify-Forward Protocol,, Decode Forward protocol, bit error rate, Multilayer

I. INTRODUCTION

Multi-output Multi-link (MIMO) technology is widely used with its ability to provide great diversity and multiplied amplification. Installing multiple antennas on a mobile station does not bother it, it promotes the use of other wireless communication technologies and these technologies also have a small impact on the device and size. energy. Recently it has been demonstrated that in a collaboration system two or more users communicate with each other to transfer information to a destination. Collaborating users can share their antennas to form a virtual multi-antenna system, allowing one antenna to take advantage of the regional diversity offered by cooperative users. In this way, cooperative communication ensures that the source of one node separates the antennas from the other nodes, creating a kind of virtual MIMO system. Collaborative systems of users using different intraoperative signalling methods are known to improve the capacity and coverage of a cellular system. The physical limitation of the relay node and the complexity of the authorized reporting are two criteria that limit the collaboration system used. Different protocols have been developed and analysed on the diversity of cooperation [1, 2]; Confirm and transmit (AF), decode and transmit (DF), detect and transmit (DtF), evaluate and transmit (EF) and selective DF (S-DF).

In the AF protocol, relay nodes amplify the signals received from the source node and send an amplified version of the signals to the destination. In the Community, the relays send a rating of the received signals to their destination. With DtF, the relays recognize the received signals and send the identified symbols to the destination. In the DF, the transmission nodes decode the data received from the source and recode the signal before sending it to the destination. The S-DF selects only the nodes that can be properly decoded to send signals to the destination [3].

Interleaved Multiple Access (IDMA), considered a special form of multiple division access code (CDMA) in which interlaced index queues are treated as multiple passwords, has been studied in detail as a type of non-orthogonal multicast system. IDMA performance is superior to traditional CDMA in terms of performance and bandwidth efficiency. IDMA shares common interests with CDMA, the diversity of passing out and reducing user interference are two important elements. The preferred turbo-type multi-user detection algorithm (MUD), which can be used in a multi-user system and is essential for high-speed multi-access communication, is a key advantage of IDMA, providing bandwidth efficiency and high transmission speed can combine. date [5]].

The principle of IDMA systems is that the settings at the rag level for the users must be different. In addition, a cheap iterative expression system can be used in IDMA systems. Motivated by the IDMA concept, Superposition Coded Modulation (SCM) breaks down data into different levels, and each level of the user has also developed them [6]. Multilevel IDMA (ML-IDMA) is a special form of web coding system and can be thought of as a general channel coding / modulation system. Based on these predecessors, we propose a joint transfer system based on ML-IDMA based on the above results.[5, 7-9] The authors were familiar with the IDMA collaboration system at the level and without the techniques of the intended combination. In this article, we perform a performance analysis of an independent ML-IDMA collaboration system for equal transmission geometry with different number of layers and maximum ratio combination (MRC) technique. The transfer protocol used in this document is Amplify-and-Forward (AF). The rest of the article is organized as follows: Section 2 covers the ML-IDMA system with the AF protocol; The result of the test is presented in section 3. Conclusions and future work are presented in section 4.

II. Amplify and Forward Protocol based ML-IDMA System

Amplify-and-Forward is a simple collaboration scheme in which relays do not require additional throughput, but can still achieve complete diversity [10]. The only disadvantage of this scheme is that it amplifies the received signal with noise between the user channels. This means that the received signal, also known as the non-regenerative relay protocol, cannot be disturbed.

In an AF protocol IDMA technique, the source sends a signal to a relay, followed by amplification of the received signal, which is controlled by an amplification factor, and power restrictions. The gain factor has been shown to be inversely related to the received power [11]. We consider the cooperative system of Fig. 1-4. The system consists of a source (S), a relay M and a target (D). The source sends the signal in two phases. First the source sends the signal to the relays, then the relays send the signals to the destination. In our design, the source / user creates a series of input data d = [d (1), d (2).d (N)], which is converted into sequence K layers by a series-parallel converter. Then the data of each layer are distributed, nested and modulated independently of each other. Finally, all data of the K-layers of the transmission are linearly superimposed, after which the source transmits the superimposed signal to the relays.

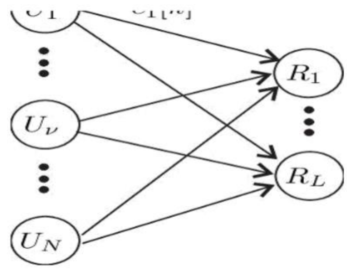

Figure 1. Model of The Ml-Idma Cooperative Multi-Relay System.

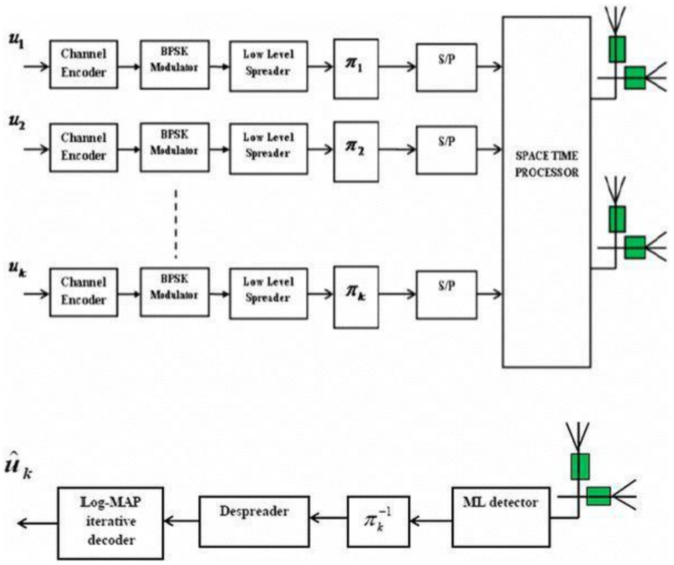

Figure 2. Ml-Idma Transmitter (Source)

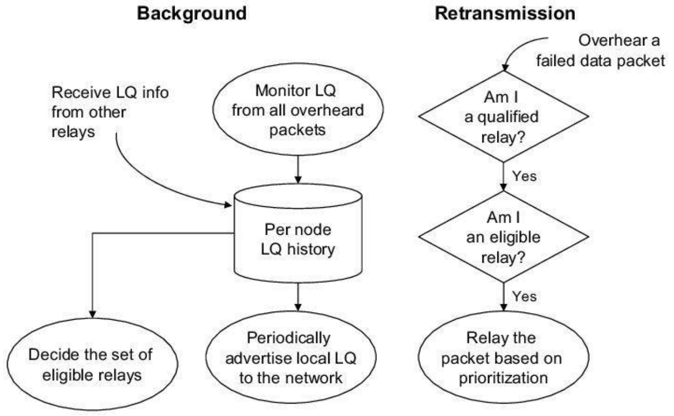

Figure 3. Relay With Gain And Retransmission Protocol

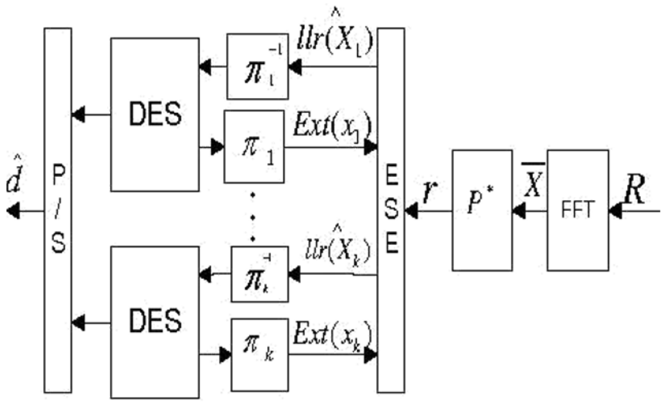

Figure 4. ML-IDMA receiver

For the layer K, the data series dk = [dk (1), dk (2) ..., dk (I)] is distributed first, whereby an offset series sk = [sk (1), sk (2) ... , Sk (J)], then the propagation sequence sk is interleaved by a separate chip interleaver πk to generate a permuted sequence sk. After nesting, the random order sk is modulated into xk = [xk (1), xk (2). . . , xk (J)] by BPSK. Where I = N / K, N is the length of the user data and I is the length of the shift data. After adding K layers, the transmitted signal xs is given by:

$$x_s(j) = \sum_{k=1}^{K} x_k(j) \qquad j=0,\ 1 \ldots,\ J \qquad (1)$$

Assume that each terminal has an antenna. Each relay amplifies the signal received at the destination and retransmits it. The channels between the source and each relay are a quasi-static Rayleigh attenuation channel with white Gaussian additive noise (AWGN). The signal ys, r received at relay a was given by:

$$y_{s,r} = \sqrt{P_t}\, h_{s,r}\, x_s + n_{s,r} \qquad (2)$$

and the received power is given by:

$$E[y_{s,r}^2] = E[(\sqrt{P_t}\, h_{s,r}\, x_s + n_{s,r})^2] \qquad (3a)$$

$$= E[(\sqrt{P_t}\, h_{s,r}\, x_s)^2] + E[n_{s,r}{}^2] \qquad (3b)$$

$$= P_t |h_{s,r}|^2 + N_0 \qquad (3c)$$

where N0=2 2 is the average noise power. The amplification coefficient is given by:

The fading amplitude and noise were considered by amplification coefficient. Some other amplification coefficients were proposed in [12].

$$\beta = \sqrt{\frac{P_t}{P_t\, |h_{s,r}|^2 + N_0}} \qquad (4)$$

$$y_{s,r} = h_{s,r}\, x_s + n_{s,r} \qquad (5)$$

$$\beta = \sqrt{\frac{1}{|h_{s,r}|^2 + N_0}} \qquad (6)$$

Amplification coefficients similar to this paper were also suggested by [10, 11, 13, 14]. This kind of amplification factor considers the channel response of interuser channel and effect of noise when added to the received signal. The signal after amplification is given by:

$$x_r = \beta\, y_{s,r} \qquad (7a)$$

$$x_r = \beta(x_s h_{s,r} + n_{s,r}) \qquad (7b)$$

The relayed signal when received at destination is given by:

$$y_{r,d} = h_{r,d}x_r + n_{r,d} \quad (8a)$$

$$= h_{r,d}\left(\beta\left(x_s h_{s,r} + n_{s,r}\right)\right) + n_{r,d} \quad (8b)$$

The received signal at the destination at the first phase is given by:

$$y_{s,d} = h_{S,d}\, x_s + n_{s,d} \quad (9)$$

The total received signal for Maximum-Ratio Combining (MRC) receiver is given by:

$$r = h^*_{s,d}y_{s,d} + \sum_{m=1}^{M}(h^*_{s,r_m} * h^*_{r_m,d})\, y_{r_m,d} \quad (10)$$

Using a single-path / one relay system, Eq. (10) is:
Where “n” represents the composite noise, h3,6 is the channel coefficient between the source and the destination, h3,0 is the channel coefficient between the source and the relay, h0,6 is the channel coefficient between the relay and the destination and “n” is a sample of an AWGN process with zero mean and variance σ2 per dimension.

We adopted an iterative sub-optimal receiver structure, as illustrated in Fig. 4 which is composed by an elementary signal estimator (ESE) and K de-spreaders (DESs). They are applied to solve inter-layer interference and the spreading constraint separately. The receiver performs the iterative processes to update the extrinsic information between ESE and DESs [15, 16]. For the detection of layer-k, we can rewrite Eq. (11c) as:

$$r(j) = h\, x_k(j) + \xi_k(j), \quad j=1, 2\ldots, J \quad (13)$$

where, ξk(j) , represents the interlayer interference with respect to layer-k. The ESE function is used to calculate the extrinsic log likelihood Ratios (LLR) for estimating the transmitted signal. From the definition of the extrinsic LLR, the output of ESE function can be obtained by:

The mean and variance of xk(j) can be calculated by the feedback from DESs, as follow:

$$E\left(x_k(j)\right) = \tanh\left[\frac{e_{DES}(x_k(j))}{2}\right] \quad (19)$$

$$Var\left(x_k(j)\right) = 1 - \left(E\left(x_k(j)\right)\right)^2 \quad (20)$$

The mean and variance of the interlayer interference can be used to analyze and detect the signal of each layer. Then the updated extrinsic LLR from ESE function was proven to go through the layer-specific de-interleave and gets into the DESs iteratively [17].

Simulation Analysis:

In this article, we analyze the performance of a one-time ML-IDMA cooperative scheme for uniform users transfer the geometry with a different number of layers and one MRC technology. The relay protocol used is Amplify And Forward (AF), which has been implemented for the system using the binary phase shift key (BPSK). MATLAB is used to simulate the results obtained. In this article, that's it provided that all stations are arranged on the edges of one Square with a length of one. This means all channels will have the same power loss and therefore the same average Signal to noise ratio (SNR).

To simulate the ML-IDMA cooperative, we have it Suppose the channel is a Rayleigh fading channel. equidistant relay geometry, BPSK signalling is used, Frame length (N) = 512, propagation length (SP) = 32, Number of relays (R) = 1 ..., 4, number of layers (K) = 2, 4 and number of iterations (it) = 3. shows a deterioration of BER Performance by increasing the number of services. In the case since without relay, K = 2 and Eb / N0 = 15 dB, BER The power was 1.9 * 10-4, while K was increased to 4, BER performance deteriorated to 6.6 * 10-3 Decrease BER performance by increasing The number of layers is due to an increase in the signal Amplitude that causes signal distortion. For single relays (R = 1) for the improvement in two layers (K = 2) The BER power is 1.67 dB compared to without

Relay System. Even in the case of four layers (K = 4) and BER improvement was found at Eb / NO = 20 dB approx. 2.6 * 10-3 compared to without relay system Increasing the number of relays at R = 4 to K = 2 by 4 dB compared to no relay system, shows that R = 4 is approximately larger than the case of R = 1. 3.5 dB BER at 10-4. We can conclude that the cooperative environment in

$$r = (h^*_{s,r} * h^*_{r,d})\, y_{r,d} \qquad (11a)$$

$$r = (h^*_{s,r} * h^*_{r,d}) h_{r,d} x_r + (h^*_{s,r} * h^*_{r,d}) n_{r,d} \qquad (11b)$$

Where $h = (h^*_{s,r} * h^*_{r,d}) h_{r,d}$ and $n = (h^*_{s,r} * h^*_{r,d}) n_{r,d}$

$$r = h \sum_{k=1}^{K} x_k(j) + n(j) \qquad (11c)$$

which two signals were sent out of various relationships outperforms systems without a relay environment. We may find that additional relays affect performance in the collaborative environment. The analysis showed that there are multiple processes with a lower error rate (BER) in the collaborative environment. 8 shows that the diffusion performance (SP) can be significantly increased. By increasing the SP, we could benefit more by spreading the spectral signal, which improves efficiency as the signal increases.

III. CONCLUSION

This article presents a communication scheme based on ML-IDMA technology to collaborate with a common source, destination, and several relays. The proposed system is based on the rag detection algorithm. The data reaches the destination via two different paths, a direct path from the source to the destination and a transmission path applied to the AF protocol and redirected to the data that eventually reaches the MRC connector. The proposed system was predicted to evaluate the performance of the ML-IDMA technique with a different number of layers using the MRC (Maximum Ratio Combination) technique in the collaborative environment. The simulation results showed that the result decreased due to an increase in the number of layers, while the bandwidth (BW) was saved by (1 / K). The simulation also showed that the cooperative environment, which contains two different related signals, works better than the unrealistic system. If additional webcasts are installed, performance in the collaborative environment improves. This improvement means that the application of different trajectory forces in a collaborative environment results in a lower error curve (BER) in Eb / N0 than the BER curve. We also found that performing in a collaborative environment better examines two or more iterations at each level. Future work will be undertaken to examine the performance of the ML-IDMA, OFDM ML-IDMA or OFDM ML-IDMA encryption collaboration schemes.

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