Decoding Algorithm of Superposition Modulation in Cooperative Network without SIC

Yu Ho Choi and Seo Weon Heo, , *Member, IEEE*Hongik University, Seoul, Republic of Korea  
seoweon.heo@hongik.ac.kr

Kwi Seob Um and Seo Weon Heo, Member, IEEE  
Hongik University, Seoul, Republic of Korea  
seoweon.heo@hongik.ac.kr

Abstract

In this paper, we propose a new decoding strategy for in cooperative communication method using superposition modulation without SIC. The new decoding scheme can outperform conventional cooperative diversity base on DF by about ‘~~~’dB in the SNR rage of interest.

1. INTRODUCTION

Recently, as IoT is applied to various fields, there is a need for research on high reliability communication systems. Several strategies have been developed to overcome fading channel in wireless communication environments. In the IoT communication system, it is difficult to install a plurality of antennas in order to obtain a diversity effect in a low-cost small device. Therefore, cooperative communication technique obtaining a space diversity effect is a proper alternative.[1] As far as we surveyed, various algorithms have been developed for cooperative communication techniques. There is a method AF, in which a relay node decides whether to receive (Amplify and Forward), or DF (Decode and Forward), a packet of a source node and retransmits the packet of the source node. At this time, a method of lowering the BER by setting an optimal threshold value of the signal noise noise value has also been proposed.[2] - [4] Also, when using multiple relay nodes, a relay node selection algorithm with the best channel state based on signal noise has also been introduced.[5] However, in the

This work was supported partly by the National Research Foundation of Korea (NRF) under the Grants NRF-2016R1D1A1B03930910, by the Korea Electric Power Corporation (Grant number: R18XA02) and by the KIAT grant (MOTIE No. N0001883, HRD program for intelligent semiconductor industry

conventional superposition modulation scheme, SIC decoding can be applied depending on the information bit having a large power ratio. In this paper, a method of independently decoding information of each node is introduced.[6]-[8] This solves the bottleneck of the existing superposition modulation scheme.

1. SYSTEM MODEL

In this paper, we consider a system consisting of one source node (S), one relay node (R), and one destination (D) as shown in Fig.1. All nodes assume a single antenna. The complex channel coefficients between nodes, denoted byand , are random variables having a complex Gaussian distribution with an average of 0 and a variance per dimension of 0.5. Also and  are the complex white Gaussian noises with an average of 0 and a variance per dimension. The information of the source node and the relay node are denoted by  and . For simplicity, we assume channel information all known.

1. DECODING ALGORITHM

1st phase : The source node transmits a packet including its own information. (Relay node) and  (Destination) attempt to decode received signal.

. (1)

. (2)

2nd phase : If decoding fails,  sends a NACK to request retransmission. At this time,  retransmits power by superposing power  on  and  on . The received retransmitted signal and LLR of each node are as follows.

 (3)

. (4)

. (5)

 (6)



Fig.1.Cooperative network phase diagram



Fig.2.Superposition Coding Constellation Point Indexing

1. SIMULATION RESULT

We used log MAP method to generate LLR in Turbo Code(13, 11) with 8 iteration and EGC(Equal Gain Combining).

1. CONCLUSIONS

REFERENCES

[1] J.N. Laneman, D.N.C. Tse, G.W. Wornell, "Cooperative diversity in wireless networks: efficient protocols and outage behavior", IEEE Trans. Inf. Theory, vol. 50, no. 12, pp. 3062-3080, 2004.

[2] F.A. Onat, A. Adinoyi, Y. Fan, H. Yanikomeroglu, J.S. Thompson, I.D. Marsland, "Threshold selection for SNR-based selective digital relaying in cooperative wireless networks", IEEE Trans. Wirel. Commun., vol. 7, no. 11, pp. 4226-4237, 2008.

[3] F. A. Onat, A. Adinoyi, Y. Fan, H. Yanikomeroglu, J. S. Thompson, "Optimum threshold for snr-based selective digital relaying schemes in cooperative wireless networks", Wireless Communications and Networking Conference 2007.WCNC 2007. IEEE, pp. 969-974, 2007.

[4] H. Chen, J. Liu, "Performance analysis of SNR-based hybrid decode-amplify-forward cooperative diversity networks over Rayleigh fading channels", IEEE wireless communications and networking conference, 1–6 2010.

[5] T. T. Duy, H.-Y. Kong, "Performance analysis of hybrid decode-amplify-forward incremental relayingcooperative diversity protocol using SNR-based relay selection", J. Commun. Netw., vol. 14, no. 6, pp. 703-709, Jan. 2012.

[6] Z. Bai, J. Jia, C.-X. Wang, D. Yuan, "Performance analysis of SNR-based incremental hybrid decode-amplify-forward cooperative relaying protocol", IEEE Trans. Commun., vol. 63, no. 6, pp. 2094-2106, Jun. 2015.

[7]  C. Hasan, . Aygl, "An incremental relaying approach for superposition-modulated cooperative transmission", Proc. IEEE WCNC, pp. 1-6, 2009-Apr.

[8] E. Larsson, B. Vojcic, "Cooperative transmit diversity based on superposition modulation", IEEE Commun. Lett., vol. 9, no. 9, pp. 778-780, 2005.