Improving the Signal Quality of Multistream Data Transmission in 4G Services

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ABSTRACT

Relaying is one of the key feature in wireless standards that expand the coverage of wireless networks. The ever increasing demand for very high data rate servicesmake use of multicarrier modulation techniques. This project explains about the improvement in bit error rate and elimination of interference. Conjugate Cancellation scheme for transmitter design, Phase Rotated Conjugate Cancellation scheme for receiver design and Equalize and Forward relay provides an efficient method for interference cancellation. In transmitter side only one phase rotation is applied and two phase rotations are applied at the receiver side. With such rotations the mismatch between the transmitter and the receiver can be tracked. The optimal solutions can be obtained by Block least mean square algorithm. Simulation results using the metrics viz. SNR, BER shows the performance of the proposed scheme achieves the interference free transmission and improvement in bit error rate.

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I. INTRODUCTION

Orthogonal frequency-division multiplexing (OFDM) is a method of encoding digital data on multiple carrier frequencies. OFDM has developed into a popular scheme for wideband digital communication, used in applications such as digital television and audio broadcasting, DSL Internet access, wireless networks, and 4G mobile communications. OFDM is a frequency-division multiplexing (FDM) scheme used as a digital multi-carrier modulation method. A large number of closely spaced orthogonal sub-carrier signals are used to carry data[1] on several parallel data streams or channels. Each sub-carrier is modulated with a conventional modulation scheme (such as quadrature amplitude modulation or phase-shift keying) at a low symbol rate, maintaining total data rates similar to conventional single-carrier modulation schemes in the same bandwidth. The primary advantage of OFDM over single-carrier schemes is its ability to cope with severe channel conditions (for example, attenuation of high frequencies in a long copper wire, narrowband interference and frequency-selective fading due to multipath) without complex equalization filters. Channel equalization is simplified because OFDM may be viewed as using many slowly modulated narrowband signals rather than one rapidly modulated wideband signal. The low symbol rate makes the use of a guard interval between symbols affordable, making it possible to eliminate intersymbol interference (ISI) to achieve a diversity gain, i.e. a signal-to-noise ratio improvement.

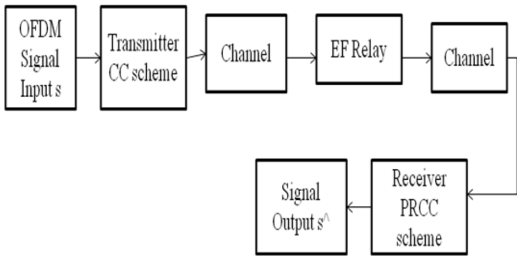

Fig. 1. Block diagram of the system

II. CC AND PRCC SCHEME

The CC and PRCC scheme can achieve good ICI cancellation. We employ two path of rotation at the transmitter and the receiver side. The transmitter comprises a CC schema in which the OFDM signal is passed through one path and the conjugate of the signal is passed through other path. Both the signals are combined and transmitted. The receiver comprises a PRCC schema in which the OFDM signal with artificial phase rotation is passed through one path and the conjugate of the signal is passed through the second path. The two paths are combined to eliminate interference.

III. EQUALIZE AND FORWARD RELAY

Relay communications have attracted increasing research attentions as a cost-effective technique to improve spatial diversity, service coverage, and energy efficiency in wireless networks. However, existing relay schemes (e.g., amplify-and-forward and decode-and-forward (DF) schemes) still face several major challenges, particularly the accumulation of multipath channels effect in AF and long processing latency in DF. To address these issues, we propose a novel equalize-and-forward (EF) relay scheme to enhance the retransmission reliability while maintaining low processing delay at the relay node. In particular, the proposed EF relay estimates and equalizes the channel between source and relay to eliminate the channel accumulation effect without signal regeneration. To further reduce the relay processing time, the channel estimation and equalization in the proposed EF design are performed in parallel. The proposed equalization is realized by presetting the equalizer coefficients with the current channel response that is predicted in parallel using multiple past channel responses.

IV. PROPOSED SYSTEM MODEL

This scheme has inspired developments on a framework for maximizing Carrier to Interference ratio that is backward compatible with most existing OFDM systems and has potential for performance improvement over the previous schemes.

The input bits are modulated by using any of the modulation techniques and IFFT is performed. This signal is passed through the first path and the conjugate signal is passed through the second path. The signal which adopts conjugate cancellation in it is transmitted to equalize and forward relay where channel estimation is done. Then the signal is passed to the receiver where Phase rotated conjugate cancellation is done in which the the original signal with artificial phase rotation is passed through one path and the conjugate of the signal is passed through the other path. Then the signal undergoes FFT and demodulation is performed to recover the original signal. The advantage is high spectral efficiency, efficient bandwidth usage, immunity to delay spread. For optimal solutions we go for block least mean square algorithm.

V. SIMULATION RESULTS

The performance of the proposed SINR-theory Max Min SINR scheme in terms of BER vs SNR for cooperative communication is shown in fig. 2. As the SNR is increased linearly, the resulting BER is very gradual and appreciable too.

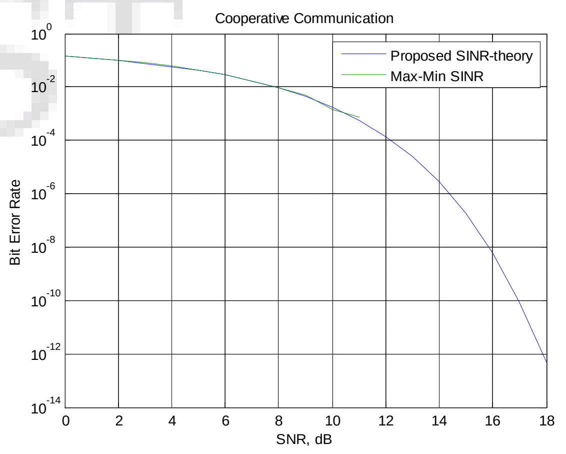

Fig. 2.Proposed SINR theory.

The performance of the proposed Max –Min SINR scheme in terms of BER vs SNR for various number of antennas at the relay. The increasing number of antennas at the relay significantly improves the performance. Increasing the number of antennas at the relay ,allows a better cancellation of inter-antenna interference and hence better performance .The fig. 3. shows the performance of the relays in different transmission. As one can see, for a given SNR, the BER rate is lowest recorded in Proposed Max-Min SINR as compared to other two viz. SINR-MMSE and relays.

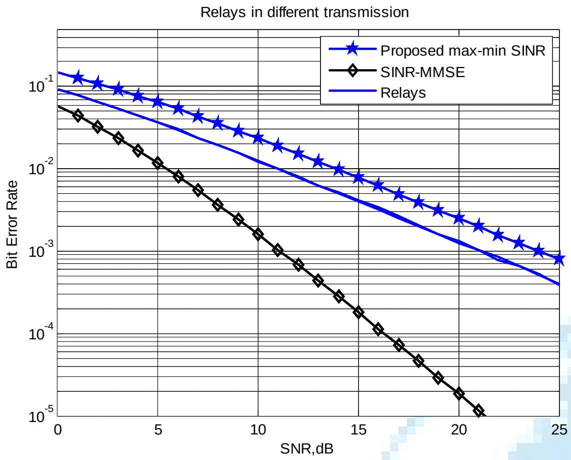

Fig. 3.Relays in different transmission

The performance of the proposed Max -Min SINR scheme in terms of BER vs SNR for different receiver structures are shown in fig. 4.Comparing the performance of various schemes viz. M=2 equalizer, cooperative, M=1 equalizer, Max-Min SINR, is found having superior performance. The performance enhancement appears in the order in which the schemes appear above.

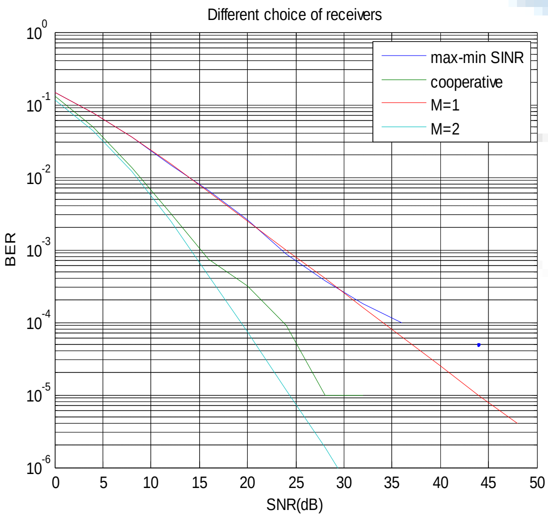

Fig. 4.Different choice of receiver

The distance between the source node and the destination node is shown in the fig. 5. to calculate the source and relay transmit power subjected to a certain quality-of-service. As can be seen the transmit power requirement between two receivers(r = 12.4 and r = 11.6) are replicitily plotted and the one with r = 11.6 is on the low look out for transmit power, with respect to the latter with r = 12.4

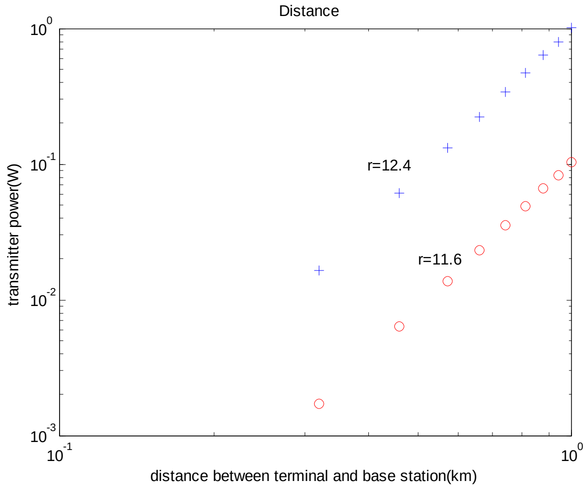

Fig. 5.Distance between source and destination

The performance of the proposed scheme in terms of total power transmitted vs distance is shown in the fig. .6 . As the distance between terminal and base station increases, there is a parabolic increase to the transmit power requirement. The total power consumption increases linearly with increasing required quality-of-service.

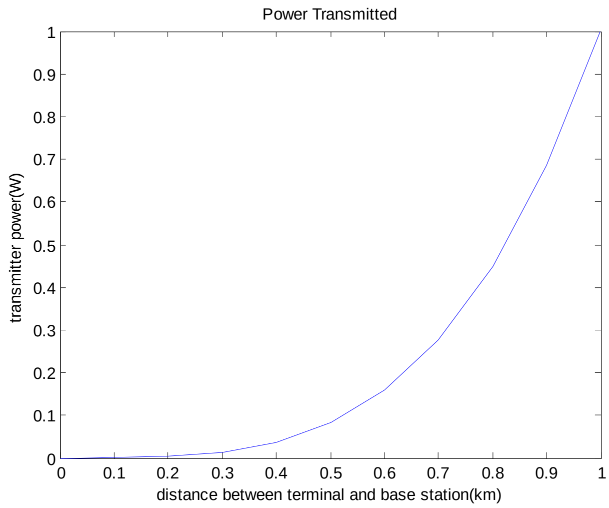

Fig. 6.Source relay transmit power

The table shows the better performance of the proposed system than the existing system with equalizers at the receiver.

Metrics	Receiver with Equalizer	Receiver without Equalizer	Performance
SNR	25	50	Good
Power	2	1	Good

VI. Conclusion

As shown in the simulation results, the joint optimization of the source and relay precoders for fixed receivers in multi–antenna multi–relay networks are studied. The two different criteria, namely the maximization of the worst stream signal-to-interference-plus- noise ratio subject to source and relay power constraints, and the minimization of the joint source and relay powers while ensuring a certain QoS are achieved provided, the sufficient conditions under which convergence to a fixed point is guaranteed. With reference to simulation results, it is clear that the attempts to reduce the complexity are at the expense of the performance and therefore it warrants a suitable trade off between the complexity and the performance. On the contrary, the non-prefixed receivers, have the equalizer jointly designed with the source and relay precoders. The proposed design provides a good performance tradeoff and is suitable for systems where receiver complexity is an issue.

References

[1] O. Mu˜ noz-Medina, J. Vidal, and A. Agust´ın, "Linear transceiver design in nonregenerative relays with channel state information," IEEE Trans. Signal Process., vol. 55, no. 6, pp. 2593–2604, Jun. 2007.

[2] X. Tang and Y. Hua, "Optimal design of non-regenerative MIMO wireless relays,"IEEE Trans. Wireless Commun., vol. 6, no. 4, pp. 1398–1407, Apr. 2007.

[3] W. Guan and H. Luo, "Joint MMSE transceiver design in nonregenerative MIMO relay systems,"IEEE Commun. Lett., vol. 12, no. 7, pp.517–519, Jul. 2008.

[4] A. S. Behbahani, R. Merched, and A. M. Eltawil, "Optimizations of a MIMO relay network,"IEEE Trans. Signal Process., vol. 56, no. 10, pp. 5062–5073, Oct. 2008.

[5] Y. Rong, X. Tang, and Y. Hua, "A unified framework for optimizing linear non-regenerative multicarrier MIMO relay communication systems," IEEE Trans. Signal Process., vol. 57, no. 12, pp. 4837–4851, Dec. 2009.

[6] Y. Rong and Y. Hua, "Optimality of diagonalization of multi-hop MIMOrelays," IEEE Trans. Wireless Commun., vol. 8, no. 12, pp. 6068–6077, Dec. 2009.

[7] V. Havary-Nassab, S. Shahbazpanahi, and A. Grami, "Joint receivetransmit beamforming for multi-antenna relaying schemes," IEEE Trans. Signal Process., vol. 58, no. 9, pp. 4966–4972, Sep. 2010.

[8] Y. Rong, "Optimal linear non-regenerative multi-hop MIMO relays with MMSE-DFE receiver at the destination,"IEEE Trans. Wireless Commun., vol. 9, no. 7, pp. 2268–2279, Jul. 2010.

[9] J. Mohammadi, F. Gao, and Y. Rong, "Design of amplify and forward MIMO relay networks with QoS constraint," inProc. 2010 IEEE GlobalCommunications Conference.

[10] Y. Fu, L. Yang, W.-P. Zhu, and C. Liu, "Optimum linear design of twohop MIMO relay networks with QoS requirements," IEEE Trans. Signal Process., vol. 59, no. 5, pp. 2257–2269, May 2011.

[11] C.-B. Chae, T. Tang, R. W. H. Jr., and S. Cho, "MIMO relaying with linear processing for multiuser transmission in fixed relay networks," IEEE Trans. Signal Process., vol. 56, no. 2, pp. 727–738, Feb. 2008.[19] Y. Yu and Y. Hua, "Power allocation for a MIMO relay system with multiple-antenna users,"IEEE Trans. Signal Process., vol. 58, no. 5, pp. 2823–2835, May 2010.

[12] L. Sanguinetti, A. A. D'Amico, and Y. Rong, "A tutorial on the optimization of amplify-and-forward MIMO relay systems,"IEEE J.Sel. Areas Commun., vol. 30, no. 8, pp. 1331–1346, Sep. 2012.

[13] J. Wang and D. P. Palomar, "Robust MMSE precoding in MIMO channels with pre-fixed receivers,"IEEE Trans. Signal Process.,vol.58,no. 11, pp. 5802–5818, Nov. 2010.

[14] S. Boyd and L. Vandenberghe, Convex Optimization. University Press,2004.

[15] D. P. Palomar and Y. C. Eldar,Convex Optimization in Signal Processing and Communications. Cambridge University Press, 2009