Interference Power Reduction Algorithm for Massive MIMO Linear Processing ZF Receiver

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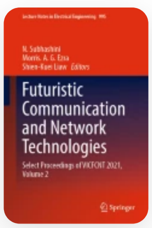

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Abstract

Through large number of antennas, frequency reuse concept enables to suppress interference and to increase the spectral efficiency. To achieve high speed data transmission and to increase capacity, it is very important to focus on spectrum efficiency and to overcome the channel fading in multipath channel environment. Existing traditional modulation techniques such as Multiple-input multiple-output-Orthogonal frequency division multiplexing (MIMO-OFDM) system, combining the OFDM and MIMO technologies can meet the requirements. A group of independently operating terminals transmitting data streams instantaneously to a closely gathered antennas arranged as an array. This antenna array transmits pilot signals to gather the required information. As the Channel State Information (CSI) is imperfect, the antennas transmit pilot signals to acquire the CSI as well as the transmitted power rates from the terminals. To compensate the loss and without reducing the performance levels at the base station end, the power dissipated is maintained reciprocally proportional to the square of the root of the total used antennas. But when CSI is known, the transmitted power is made oppositely symmetrical to the total number of antennas. For Zero forcing (ZF) and Maximum Ratio Combining (MRC) detection, lower capacity bounds are been derived. It is been observed that ZF outperformed MRC. A power scaling method is considered for the analysis of uplink sum rate with imperfect and perfect CSI, the increase in the antenna numbers shows that the sum rate on the uplink side between ZF and MRC reduces and with a constant increase in the number of antennas there won't be any difference between ZF and MRC. In this paper Algorithmic-based Interference Power reduction Linear Processing ZF Receiver is proposed for Massive MIMO also the need of beamforming techniques in Massive MIMO systems in overcoming the technically developed obstacles in the deployment of Massive MIMO system is studied. Simulation is carried out by using Python, the SNR values for Maximal Ratio Combiner (MRC), Zero forcing (ZF) in a 2 * 2 MIMO are also compared. With the proposed receiver performance enhancement of Massive MIMO systems and interference cancelation with and without Power Scaling is been observed.

References

1. Choi S Implementation of a zero-forcing precoding algorithm combined with adaptive beamforming based on WiMAX system. Application Article|Open Access Volume 2013|Article ID 976301|https://doi.org/10.1155/2013/976301

2. Noha Hassan ID (2017) Massive MIMO wireless networks: an overview. Electronics 6(63). https://doi.org/10.3390/electronics6030063. http://www.mdpi.com/journal/electronics

3. Aditya KJ, Vasudevan K, Hanzo L Fellow IEEEUplink Sum-rate and power scaling laws for multi-user massive MIMO-FBMC systems. http://arxiv.org/abs/1901.10239v2

4. Shukla P, Tharani L Comparison of various equalization techniques for MIMO system under different fading channels. In: Proceedings of the 2nd international conference on communication and electronics systems (ICCES 2017) IEEE Xplore Compliant—Part Number:CFP17AWO-ART. ISBN: 978-1-5090-5013-0

Google Scholar

5. Abdulah NF Beamforming techniques for massive MIMO systems in 5G: overview, classification, and trends for future research. Front Inf Technol Electr Eng. www.zju.edu.cn/jzus; engineering.cae.cn; www.springerlink.com ISSN 2095-9184 (print); ISSN 2095-9230 (online)

6. Abd El-Rahma AB, Kawasaki Z (2013) Modified Zero Forcing Decoder for Ill-conditioned Channels. 978-1-4799-0543-0/13/$31.00©2013 IEEE

Google Scholar

7. Ahmed MR (2020) Power scaling and antenna selection techniques for hybrid beamforming in mmWave massive MIMO systems. INTL J Electr Telecommun 66(3):529–535 Manuscript received May 1, 2020: Revised July 2020. https://doi.org/10.24425/ijet.2020.134009

8. Vardhan P (2017) Design, simulation & concept verification of 4 × 4, 8 × 8 MIMO with ZF, MMSE and BF detection schemes. Electr Control Commun Eng 13(1):69–74

Article Google Scholar

9. Kountouris M (2016) Deploying dense networks for maximal energy efficiency: Small cells meet massive MIMO. IEEE J Sel Areas Commun 34(4):832–847

Article Google Scholar

10. Björnson EL, Sanguinetti, Debbah M (2016c) Massive MIMO with imperfect channel covariance information. In: Proceedings Asilomar

Google Scholar

11. Saha A, Ghosh S (2010) OFDM System analysis for reduction of inter symbol interference using the AWGN channel platform. (IJACSA) Int J Adv Comput Sci Appl 1(5)

Google Scholar

12. Sai Krishna KV (2020) Implementation of massive MIMO systems for 512-point FFT processor using VLSI technology. MuktShabd J 9(6) ISSN NO: 2347-3150

Google Scholar

13. Semenova A, Mikhailov V (2019) 5G Base station prototyping: massive MIMO approaches. 978-1-7281-0339-6/19/$31.00 ©2019 IEEE

Google Scholar

14. Marzetta TL (2013) Energy and spectral efficiency of very large multiuser MIMO systems. IEEE Trans Commun 61(4):1436–1449

Article Google Scholar

15. Liang N, Zhang W, Shen C (2015) An uplink interference analysis for massive MIMO systems with MRC and ZF receivers. In: 2015 IEEE Wireless communications and networking conference (WCNC 2015)—Track 1: PHY and Fundamentals

Google Scholar

16. Nguyen HH (2018) Power scaling laws of massive MIMO full-duplex relaying with hardware impairments. IEEE Access 6:40860–40882

Article Google Scholar

17. Poornima A (2018) BER reduction using zf-sic and MMSE-SIC algorithm in LTE-A network. Int J Eng Manufac Sci 8(3) © Research India Publications ISSN 2249–3115. http://www.ripublication.com

18. Qi XF The effect of diversity combining on ISI in massive MIMO. arxiv.org.1811.00534v1

Google Scholar

19. Larsson EG (2013) Uplink performance analysis of multicell MU-SIMO systems with ZF receivers. IEEE Trans Veh Tech 62(9):4471–4483

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20. Guerreiro J A low complexity channel estimation and detection for massive MIMO using SC-FDE. http://dx.doi.org/https://doi.org/10.3390/telecom1010002. http://www.mdpi.com/journal/telecom.

21. Yeoh PL, Evans J (2015) An SNR approximation for distributed massive MIMO with zero forcing, IEEE, pp 1089–7798

Google Scholar

22. Ngo HQ, Ratnarajah T Performance of massive MIMO uplink with zero-forcing receivers under delayed channels. IEEE Trans Vehic Technol. https://doi.org/10.1109/TVT.2016.2594031

23. Hossain MA (2020) Performance analysis of zero forcing and MMSE equalizer on MIMO system in wireless channel. J Network Inf Secur 8(1&2):19–25

Google Scholar

24. Jha RK A survey of 5G network: architecture and emerging technologies special section on recent advances in software defined networking for 5G networks

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