ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

Symbol Error Rate Performance Analysis for Asynchronous Physical Layer Network Coding for 5g Transmissions

R.Nithya, N.Poornima M.E,Ph.D.,

PG Scholar (Communication Systems), Oxford Engineering College, Trichy, India

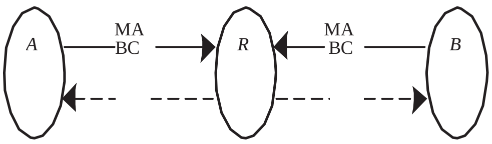
Associate Professor & HOD, Dept of ECE, Oxford Engineering College, Trichy, India

ABSTRACT: Physical-layer network coding (PNC), as a key technology for 5G, supplies a powerful platform through leveraging the broadcast nature of wireless media. However, the symbol error rate (SER) of PNC is not well investigated, which would seriously influence user's quality of experience due to packet loss in wireless environment. Sparse code multiple access (SCMA) is a non-orthogonal code book base multi-access technique proposed to improve the network thoughput. This non-orthogonal multiple-access technique which can improve the spectral efficiency of wireless radio access. With SCMA, different incoming data streams are directly mapped to codewords of different multi-dimensional cookbooks, where each codeword represents a spread transmission layer. Multiple SCMA layers share the same time-frequency resources of OFDMA. On the other hand, the signal spreading feature of SCMA can improve link-adaptation as a result of less colored interference.

KEYWORDS: Asynchonus PNC, SCMA, Spatio Tempoal, Belief propagation, Performance bounds, Ser analysis,5G.

I. INTRODUCTION

Physical layer is fundamental for wireless communications Although a lot of literatures focused on throughput Improvement in PNC, current network design falls in the fairly narrow set of objections, limiting the effectiveness and feasibility of resource demanding applications of 5G networks.



PNC over a bidirectional relay network

The symbol error rate (SER) of PNC is not well investigated, which would seriously influence user's quality. In this paper SER performance is analysed and enhanced better by considering both side of transmission and reception of the communication channel.

Multi-user MIMO (MU-MIMO) is a well-known multiple access technique to share given time-frequency and power resources among multiple users in a downlink wireless access network . The target is to increase the overall downlink throughput through user multiplexing. Multiple beams are formed over an array of antennas at a transmit point (TP) to serve multiple users distributed within a cell. Every MIMO layer is assigned to a user while layers are orthogonally separated in the space domain assuming MIMO beamforming precoders are properly selected according to the channels of target users. At the receive side, every user can simply match itself to its intended layer while other MIMO layers are seemed totally muted with no cross-layer interference, provided the precoders are properly designed. Despite the promising throughput gain and the simplicity of detection at user nodes,MU-MIMO as a closed-loop system suffers from some practical difficulties in terms of channel aging and high overhead to feed back channel state information (CSI) of users to a serving TP. CSI is required to form the best set of precoders for a selected set of paired users. If CSI

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

is not well estimated, cross-layer interference practically limits the potential performance gain of MU-MIMO.

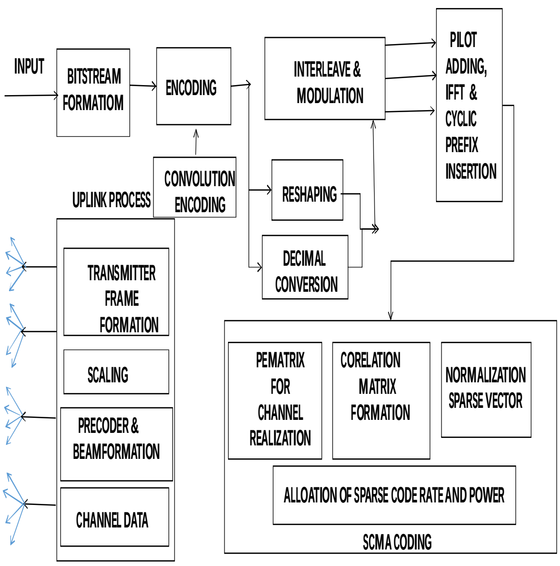
II.SYSTEM MODEL AND DESCRIPTION

A. Downlink SCMA Model
With SCMA, different incoming data streams are directly mapped to codewords of different multi-dimensional cookbooks, where each codeword represents a spread transmission layer.. The sparsity of codewords makes the near-optimal detection feasible.
SCMA is well-matched to user multiplexing as we can allocate code-domain layers to different users without need for CSI knowledge of paired users.
In this paper, multi-user SCMA (MU-SCMA) is proposed to improve a network throughput. With a very limited need for channel knowledge interms of channel quality indicator (CQI), TP simply pairs users together while the transmit downlink power is properly sharedamong multiplexed layers. Compared to MU-MIMO, this system is more robust against channel variations. In addition,the problem of CSI feedback is totally removed for this open-loop multiple-access scheme.
Sparsity of SCMA codewords lets us take advantage of the low complexity message passing algorithm (MPA) detector with ML-like performance. MPA performs well even if the system is overloaded with a large number of layers.

III.BLOCK DIAGAM

TANSMITTER SECTION

The great requirements for dramatic delay reduction and throughput enhancement call a new area of communication systems. It is acknowledged that 5G will bring an army of performance improvement in wireless coverage, spectrum utilization, transmission delay, user experience, and so on.Recently, research on improving spectrum efficiency is now being motivated by novel physical layer techniques, among which physical-layer network coding (PNC) has attracted much interest. PNC's specific strength in improving throughput comes from exploiting the superposition of electro-magnetic waves and the broadcast nature of wireless channelsduring its multiple access (MA) phase and broadcast (BC)phase respectively.



DESCRIPTION
BIT STREAM GENERATION
Input signal is taken as random signal for the process by using function randi

SUB BLOCKS
The generated signal is converted to number of sub blocks.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

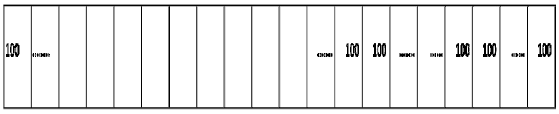
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

MU-Sparsing



From the sub-blocks, we have to encode the Why interleave is done:Interleaving is a technique used to improve the speed of data accessed sequentially into non-sequential sectors.After encoding, the data is passed on to QAM modulation block over the modulation index of 16.Then it is passed on to IFFT block for converting the time domain signal.

IFFT:The IFFT signal is added with Cyclic prefix.

INTERLEAVING

A block interleaver accepts a set of symbols and rearranges them, without repeating or omitting any of the symbols in the set. The number of symbols in each set is fixed for a given interleaver. The interleaver's operation on a set of symbols is independent of its operation on all other sets of symbols.

MODULATION: 16-bit QAM modulation is used.

SCMA CODEBOOK

Inputs to 3d- code book
dictionay
Three inputs are necessary to form 3D sparse coding dictionary

- Data Length
- Number of users
- Number of transmitting antennas used

Modulated output is the input date for dictionary generation which is in complex form.
i.e rand+1i*rand
Code book is in matrics format. Users are in column and transmitting antennas are in rows for the entire data Length.

CHANNEL MATRIX

Multiple data streams can be spatially multiplexed over the transmit antennas and are received by the receiver antennas. Spatially multiplexing increases the capacity of the link, since multiple data streams are transmitted over the same available frequency band. On the other hand, antenna diversity systems (dubbed as MIMO using diversity) merely improve the reliability of the link.

The transmission matrix also called Channel State Information (CSI) determines the suitability of MIMO techniques and influences the capacity to a great extent.
CSI matrix contains elements that are complex and they describe both the amplitude and phase variations of the link.

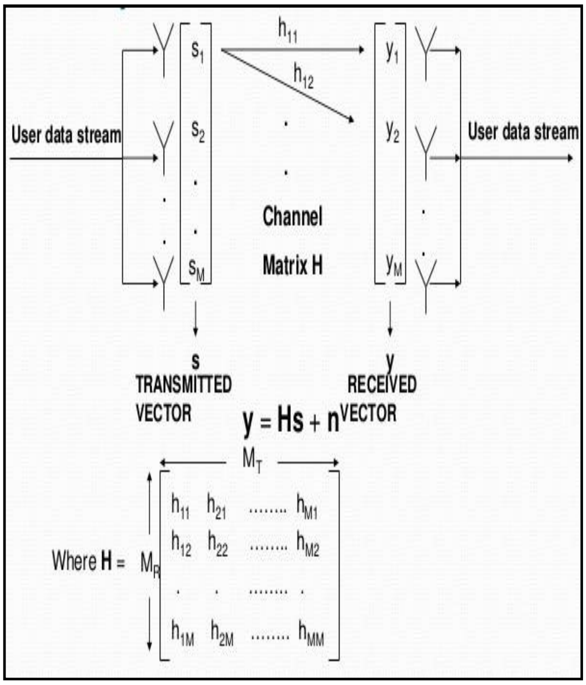
ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017



MIMO CHANNEL

CORRELATION MATRIX

Correlation is a measure of the degree to which two variables vary together, or a measure of the intensity of the association between two variables.

$$\mathbf{y} = \mathbf{Hx}$$

Multiply $\mathbf{H}^{-1}$ on both sides

$$\mathbf{H}^{-1}\mathbf{y} = \mathbf{H}^{-1}\mathbf{Hx}$$

This becomes Identity Matrix

$$\mathbf{H}^{-1}\mathbf{y} = \mathbf{Ix}$$

$$\mathbf{H}^{-1}\mathbf{y} = \mathbf{x}$$

This is the answer that we want to get

The performance of a multiple-input multiple-output (MIMO) is critically dependent on the availability of independent multiple channels. It is well known that channel correlation will downgrade the performance of a MIMO system, especially its capacity. Channel correlation is a measure of similarity or likeliness between the channels. In the extreme case that if the channels are fully correlated, then the MIMO system will have no difference from a single-antenna communication system.

III. RECEIVER SECTION

MUD AND BP-MAP Use transmit diversity (tx diversity) to diminish the effects of fading by transmitting the same information from two different antennas. The data from the second antenna (Open Loop Antenna 2) is encoded differently to distinguish it from the primary antenna (Open Loop Antenna 1). The user equipment (UE) must be able to recognize that the information is coming from two different locations and properly decode the data.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

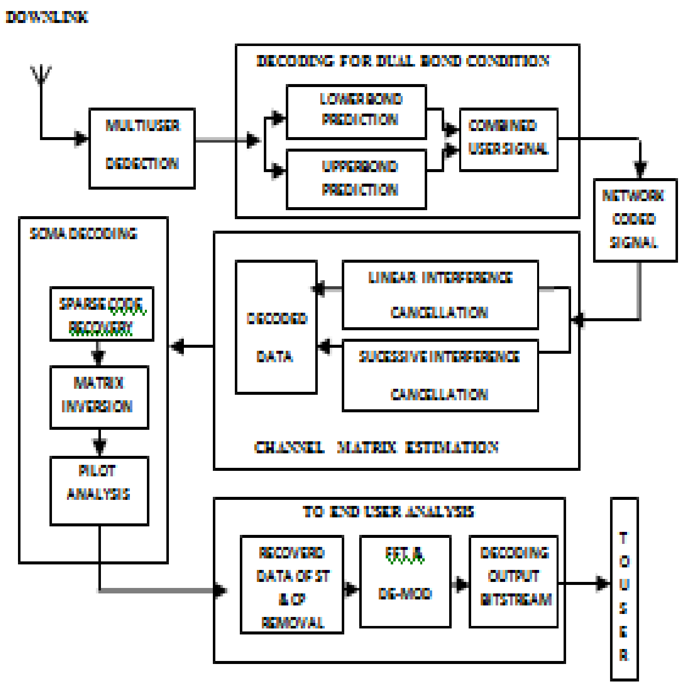
Vol. 6, Issue 5, May 2017

This subsection first reviews the MUD-XOR and BP-MAP methods, and then illustrates the relationship between these two methods.

NETWORK CODING AND DOWNLINK SCMA

Considering trackable relative symbol and phase offsets, we derive an approximate lower bound and an exact upper bound of SER for asynchronous PNC with QPSK, where we consider two candidate decoding and mapping methods.

BLOCK DIAGRAM



In this paper, the lower bound for SER is derived under the BP-MAP decoding method and the upper bound for SER is derived under the MUD-XOR decoding method. As we will discuss later, the lower and upper bounds are correct for cases when performing either MUD-XOR or BP-MAP. 1) The MUD-XOR Method: MUD-XOR exploits MUD technique to estimate individual packets from the superposed signal. The outputs of the correlators when respectively syn- chronized with symbols.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

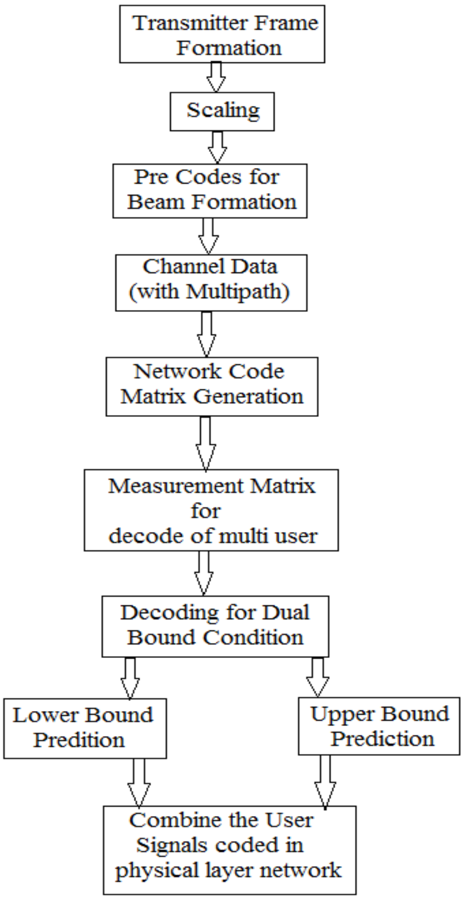
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

PNC CODING



PRECODER: precoding is a technique which exploits transmit diversity by weighting information stream, i.e. the transmitter send the coded information to the receiver in order to the pre-knowledge of the channel. The receiver is a simple detector, such as a matched filter, and does not have to know the channel side information.This technique will reduce the corrupted effect of communication channel.

Channel equalization aims to minimize channel errors, but precoder aims to minimize the error in the receiver output.

SCALING: scaling is performed for normalizing modulation output.

MEASUREMENT MATRIX:

Maximize the detection performance of the network while guaranteeing a certain level of secrecy. security performance of the system can be improved by using optimized measurement.

DECODING FOR DUAL BOND CONDITION

The lower and upper bounds are respectively derived based on BP-MAP.MUD-XOR, and are suitable for either decoding method,Specifically, the lower bound is obtained by assuming that part of the overlapped messages (received by the relay)is known to the relay, and the upper bound is obtained byexpressing the error probability as a sum of upper bounds and eliminating redundant terms.Our simulation results indicate that the lower and upper bounds are relatively tight.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

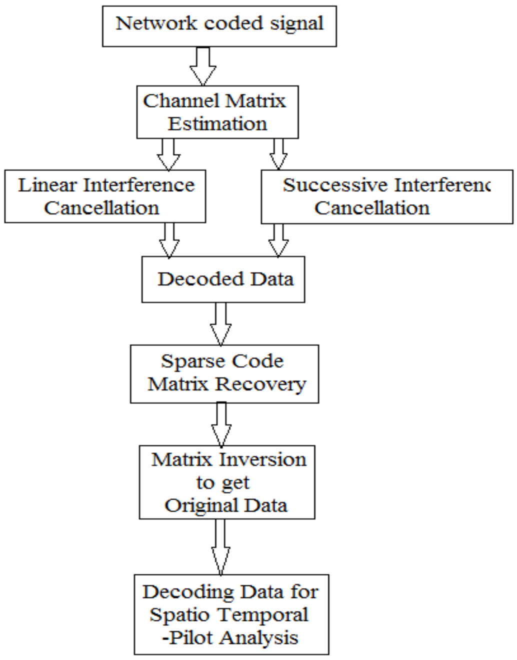
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

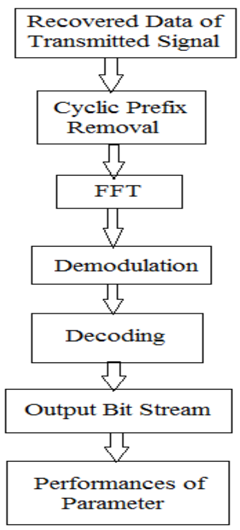
LINEAR SIC AND SPATIO TEMPORAL ANALYSIS



NORMALIZATION: keep the data within limit.

Multiuser detection (MUD) based exclusive-or (XOR) network coding (MUD-XOR) and belief propagation (BP) algorithm based maximum a posteriori (MAP) decoding method uppe bound and lower bound ae decoded separately and combined netwok coded symbol is analysed fo inter symbol intetference cancellation. (BP-MAP).

RECEIVE PEFORMANCE ANALYSIS



Since layers are not fully separated in a non-orthogonal multiple access system, a non-linear receiver is required to detect the intended layer of every user. Therefore, further complexity of detection is the cost of the non-orthogonal

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

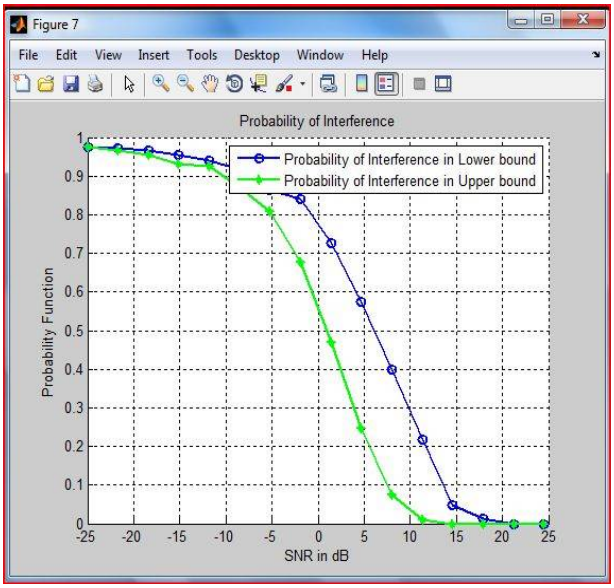
Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

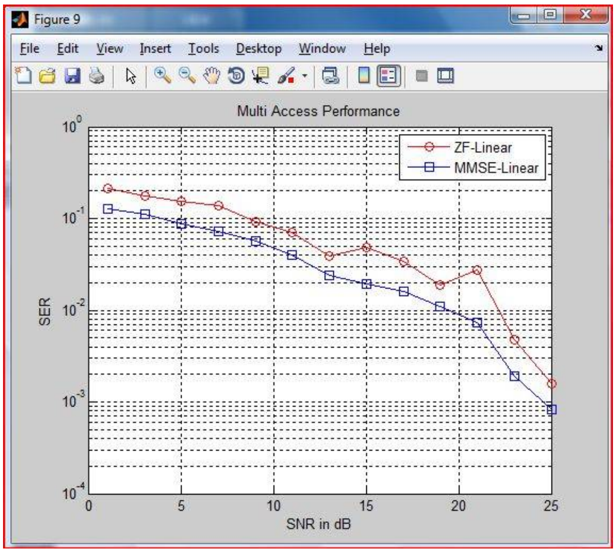
multiple-access especially when a system is heavily overloaded with a large number of multiplexed layers.Sparsity of SCMA codewords lets us take advantage of the low complexity message passing algorithm (MPA) [7] detector with ML-like performance. MPA performs well even if the system is overloaded with a large number of layers.

IV. RESULTS

PROBABLITY OF INTERFERENCE



MULTI ACCESS PERFORMANCE



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

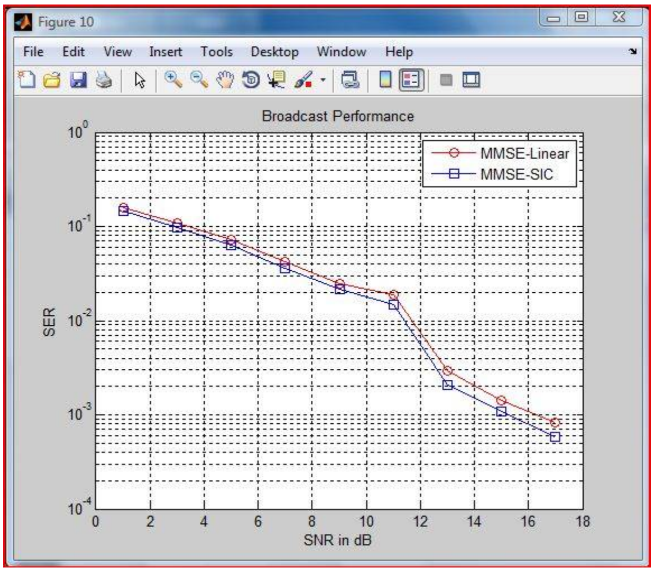
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

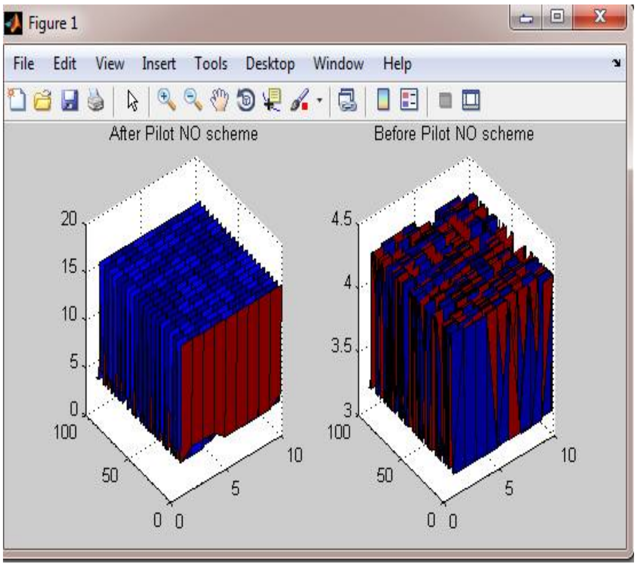
Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

BROADCAST PERFORMANCE



PILOT ADDING



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

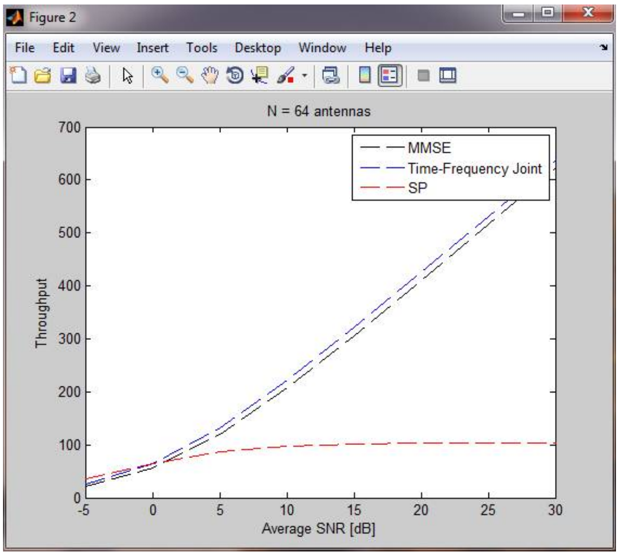
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

SER ANALYSIS FOR SCMA SYSTEM



Finally the SER performance at the receiver is analysed and results are simulated in MATLAB.
MU-SCMA schme to increase the downlink spectral efficiency of 5G wireless cellular networks.Pobablityu of detection in Lowe bound and Upperbound

V. CONCLUSION

SCMA is a non- orthogonal multiple-access scheme provides an advantage for MU-SCMA over other existing multiplexing techniques such as MU-MIMO in which sensitivity to channel aging and high overhead of channel knowledge feedback are the obstacles for their practical implementation in a real network. High data rate and at the same time the robustness to mobility are two major advantages of MU-SCMA. In addition, compared to MU-MIMO schemes which are based on spatial domain precoding, code-domain multiplexing has a substantial advantage in terms of the transmit side computational complexity. Promising performance gain of MU-SCMA makes it attractive for future wireless and moving networks.

ACKNOWLEDGEMENT

I render my whole hearted and sincere thanks to my respectable Internal project guide and all professors of oxford Engineering for the nobel endeavor of the completion of work and their guidance and suggestions for completing my project work.

REFERENCES

1.5G:ATechnologyVision,"Huawei TechnologiesCo.,Ltd.Shenzhen,China,WhitepaperNov.2013.[Online]. www.huawei.com/ilink/en/download/HW_314849
2.Mobile and wireless communications Enablers for the Twenty-twenty Information Society (METIS).[Online]. https://www.metis2020.com/
3. 5GNOW. [Online]. http://www.5gnow.eu/
4. D.J. Love, R.W. Heath, V.K.N. Lau, D. Gesbert, and M. Andrews, "An overview of limited feedback in wireless communication systems," IEEE Journal on Selected Areas in Communications, vol. 26, no. 8, pp. 1341- 1365, October 2008.
5. Hosein Nikopour and Hadi Baligh, "Sparse code multiple access," in IEEE 24th PIMRC, 2013, pp. 332-336.4. Mahmoud Taherzadeh, Hosein Nikopour, Alireza Bayesteh, and Hadi Baligh, "SCMA Codebook Design," Submitted to IEEE VTC-fall, Vancouver 2014.
6.Reza Hoshyar, Razieh Razavi, and Mohammed AL-Imari, "LDS-OFDM an efficient multiple access technique," in VTC-spring, 2010, pp. 1-5.
7.Dongning Guo and Chih-Chun Wang, "Multiuser Detection of Sparsely Spread CDMA," IEEE JSAC, vol. 26, no. 3, pp. 421-431
8.J. Hansen, D. Lucani, J. Krigslund, M. Medard, and F. Fitzek, "Net-work coded software defined networking: Enabling 5g transmission and

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 5, May 2017

storage networks," IEEE Commun. Mag., vol. 53, no. 9, pp. 100–107, 2015.
9.X. Liu, P. Wang, Z. Lan, and B. Shao, "Biological characteristic online identification technique over 5g network," IEEE Wireless Commun. Mag., vol. 22, no. 6, pp. 84–90, 2015.
10.K. Lu, S. Fu, Y. Qian, and H.-W. Chen, "SER performance analysis for physical layer network coding over AWGN channels," in Proc. IEEE GLOBECOM, Dec. 2009, pp. 1–6.
11.W. Mao, X. Wang, A. Tang, and H. Qian, "ANC-ERA: Random access for analog network coding in wireless networks," IEEE Trans. Mobile Comput., vol. 15, no. 1, pp. 45–59, 2016.
12. Z. Ning, L. Liu, F. Xia, B. Jedari, I. Lee, and W. Zhang, "Cais: A copy adjustable incentive scheme in community-based socially-aware networking," IEEE Transactions on Vehicular Technology, DOI: 10.1109/TVT.2016.2593051, 2016.
13.J. Wang, K. Lu, J. Wang, and C. Qiao, "Optimal local data exchange in fiber-wireless access network: A joint network coding and device association design," in Proc. IEEE INFOCOM, 2016, pp. 1–9.
14.L. Wan, G. Han, L. Shu, S. Chan, and T. Zhu, "The application of doa estimation approach in patient tracking systems with high patient density," IEEE Transactions on Industrial Informatics,accepted,I:10.1109/TII.2016.2569416, 2016.14.L. Wan, G. Han, L. Shu, S. Chan, and N. Feng, "Pd source diagnosis and localization in industrial high-voltage insulation system via mul-timodal joint sparse representation," IEEE Transactions on Industrial Electronics, vol. 63, no. 4, pp. 2506–2516, 2016.

WEBSITES:

1. ieeexplore.ieee.org/document/7169508/
2. www.matwork.com
3. http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-june-2014.pdf
4. www.androidauthority.com/what-is-5g-705914/
5. www.rcrwireless.com/.../network.../att-outlines-5g-network-architecture-tag4
6. www.recode.net/.../5g-wireless-broadband-spectrum-reality-check-fcc- internet-of-things