WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Implementation of Successive Power Level Detection and Equalization for Noma: A Survey

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ABSTRACT

Generally, Cloud or IoT applications need to share common resources such as bandwidth. With the advent of 5G Communications, the following challenges will be faced:

-Increased number of users

-More bandwidth demand for higher data rate

-Overall limited bandwidth available.

Hence 5G networks would need improved multiple access techniques than their present day counterparts. Non-Orthogonal Multiple access is a technique in which multiple users data is separated in the power domain. The problems addressed by NOMA are low overall bandwidth for multiple users. Thus multi-user detection in time of frequency domain becomes difficult. In the proposed approach NOMA along with successive signal cancellation is proposed. It is expected that the Bit Error Rate will be reduced compared to previous techniques. Multi hop boosting may be required for the purpose.

Keywords :Non-orthogonal multiple access (NOMA), multi-user detection (MUD), multi-hop boosting, successive signal cancellation.

INTRODUCTION

Multiple Access to High Speed Data Transfer

With increased number of users, higher data traffic due to big data technologies and limited bandwidth; it has become mandatory to offer networking services with high Quality of Service, (QoS). Multi-user scenario has become a commonplace. The challenge which networks face is however the detection of all users with equal accuracy. As we can see the high paced networking of communications globally, this can be seen as one of major progress in technical aspect in our civilization to date. It became possible only with the onset and use of the digital communication framework in the world today. The recent era demands a very high speed networking environment to keep pace with the ongoing technical advancements. With increase in noise and many other reasons and causes for distortion of the signal, it remains a challenge to be able to send the signal correctly. The sole aim of the communication system that is digital is to send transmit signal properly and without any distortion with least errors.

Usually an Analog to Digital converter can be used for conversion of the data from analog to signal ,then it can be source encoded for the compression of the digital information to prevent any loss while the signals reception. At the same time the data symbol is gotten from the encoder of the source that is then fed to a channel encoder which then does redundant bit addition to the information for proper communication and also for reliability and to make the transmission efficient and not influenced by the noise disturbances present in the medium. Then this data sequence is supplied to the decoder that helps in yielding and reconstruction of the signal that was originally transmitted. On a whole, in this entire process there is attenuation that is brought in by the channel which can considerably increase errors in signal thereby decreasing the signal to noise ratio.

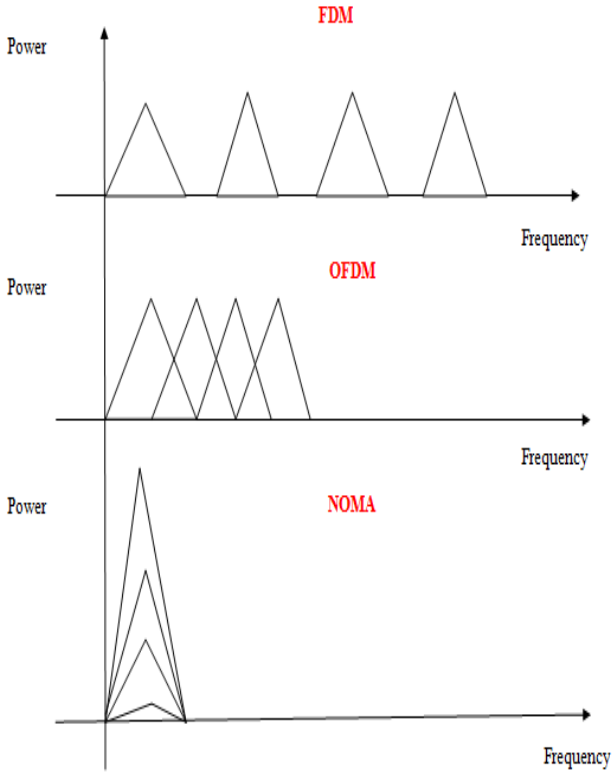


Fig 1.2 Comparison of FDM, OFDM and NOMA

Multipath Propagation

The cellular networks today have high number of users in the same site of location that also entails huge mobility. Hence the there is impact of the far near effect that makes some power systems networks vulnerable wherein it becomes very problematic for detecting the systems with low signal in the impact of high signal systems. This mechanism of a particular signal detection from a domain of multiple signal carriers is referred as Multi-User Detection or MUD. As very evident in today era of multiple access to the wireless networks by multiple devices, this trend is anticipated to increase by manifolds in the coming next decade. As a result, a plethora of devices and systems trying to get access to the wireless systems raises major concerns for access from such great number of devices. For handling such enormous access to the wireless schemes strong methods need to be implemented. Some recent protocols have many loopholes relating to the start of the data transmission. So to get the system for the Massive type communication, all these loopholes need to take care of. MTC devices need to handle these data sporadically to be able to send these huge chunks of data .This huge traffic may lead to sparse aggregation of information rapidly. So there is a need for lot of research for the third generation schemes that need to be carried out globally, and the standardized approach need to be applied for a cumulative beneficial impact for the multipath and multi carrier technologies. These need to dealt with proper schemes and methodology

The multi carrier model of technology has become one of the most sought after schemes in this multi carrier domain of work. Many such schemes for the MC CDMA have been put forth by various sources to handle the work properly.

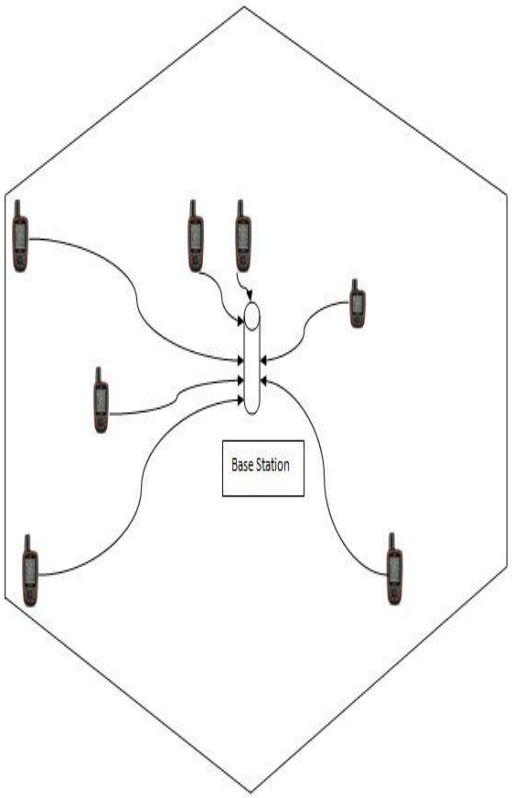


Fig.1.3 Wireless Network with MUD

1.1 PROBLEM DOMAIN

The main problems with NOMA are:

1) BER increases in case signals are not significantly separated in power domain
2) NOMA may suffer from channel noise effects
3) Signal strength may become similar due to fading effects of channel.

1.2 SOLUTION DOMAIN

The sole objective of this proposed work model is to design of an equalizer based on the concept of the decision feedback principle that would aid in negating the adverse effects of the multi path signal transmission leading to the Inter Symbol Interference. It should also support multi user detection in the wireless framework domain. The main goal is to develop the Bit Error Rate scheme as there for the single path systems. This concept entails nullifying the unwanted effects of the all the carbon copies of information from the same transmitter and receiver at multiple intervals. This calls for a decision feedback methodology coupled with successive cancellation algorithm which can nullify the multiple copies of one signal in a successive manner. Another aim of the proposed work is also to put forth the efficacy of the BER performance of the system being greater than the conventional schemes. This can be done using:

1) Multi Hop Boosting
2) Successive signal detection

The proposed system proposes using NOMA for effective bandwidth on utilization Using the successive signal detection mechanism fort multi user detection

The Successive Signal Cancellation works in the following manner:

1. Receive composite signal ‘s’ given by:

s=x1+x2+x3+……..+xn

here,

x1 is the data coming from user 1,

xn is the data coming from user n.

2. Find max(s)

Here max (s) represents strongest user signal in s.

3. Detect strongest signal

4. Cancel strongest signal to get s'.

i.e. s'=s-max(s)

5. Repeat the same process for s', s'', s''' and so on till all the signals are detected.

6. Different paths have different gains (g) depending on the distance (d). If distance (d) is more, gain (g) is less.

2.LITERATURE REVIEW

2.1 MOTIVATION

The major motivating factor for this proposed work is the enormous merits and increasing requirements of the modern digital economy. In the domain of the mobile communications and cellular framework, the channels are always vulnerable to multi path disturbances in one way or the other. This causes the inter symbol interference phenomena that badly impacts in the detection of the real signal received amidst other multiple signals. So these give rise to errors that are kind of irreversible. So the only way to mitigate the situation is by the use of Equalizers for a robust communication and signal transmission. It helps in increasing the reliability quotient and also keeps the negative disturbances at bay. So this method and concept forms an effective method for detection of multiple users in Wireless networks domain and also aids in the implementation of MUD reception with decision feedback equalizers. This proves to be of great benefit for overall robust transmission..

2.2 PROMINENT RESEARCH WORK

In the year 2018, X.Wang et al. proposed that Multi-User Detection (MUD) for uplink grant-free Non-orthogonal Multiple Access (NOMA) has received much attention recently. In this paper, the authors consider the scenario in which a Base Station (BS) is equipped with multiple antennas, and propose a Compressive Sensing-based Hard Fusion Algorithm (CSHFA) to realize MUD. More explicitly, they detect the user activity information by a conventional CS algorithm at each antenna, and then amalgamate the detected user activity information to derive an active user set. Finally, the authors can use the obtained active user set to estimate the active users' data. The proposed CS-HFA with low complexity for uplink grant-free Single-Input Multiple- Output Non-Orthogonal Multiple Access (SIMO-NOMA) systems can achieve better BER performance than traditional CS-based MUD in the NOMA system with single antenna at the BS.

In the year 2016, B. Wang at al. proposed a technique based on compressive sensing of the wireless channel or radio between the transmitting and receiving ends. The approach was rather customized for up-link data transmission form several nodes to a common receiving point or node. The approach was based on the dynamic compressive sensing of the radio wherein the channel state information was sensed using compressive sensing. The channel state information using compressive sensing needs to be continually adapted in order to update the channel matrix. It was shown that the system attained low bit error rate but the downside was the low spectral efficiency.

2.3 LIMITATION OF CURRENT SYSTEM

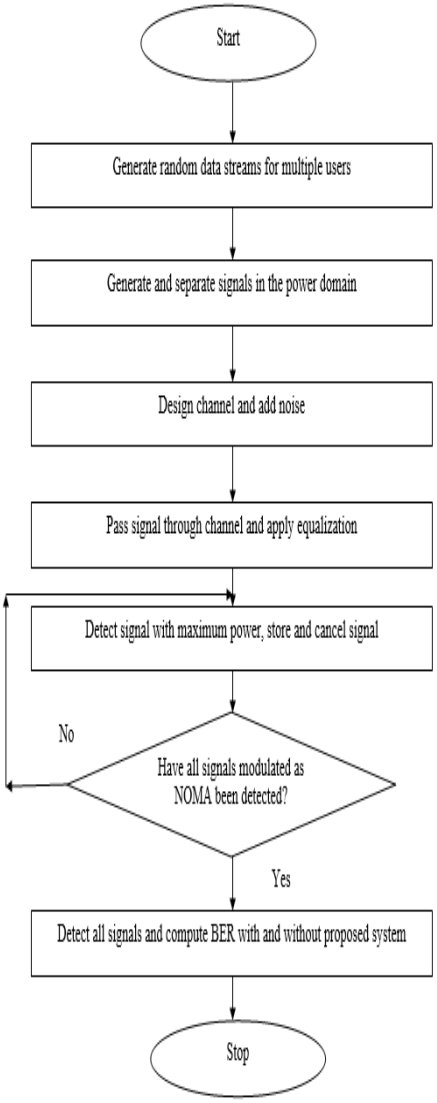
1. Complicated hardware. In comparison to OMA, NOMA introduces more hardware complexity due to SIC implementation. High power symbols must be calculated first with the SIC detector in order to retrieve the users' symbols that send or receive with lesser power symbols. If the number of users is particularly large or fast signal transmission is necessary, the SIC operation, which is repeated numerous times, along with the detection latency, could result in significant energy constraints for battery-powered devices. Because consumer electronics need greater battery life, NOMA adoption, particularly in dense networks, may be inefficient. This issue may limit NOMA's use. To solve this problem, effective user clustering and power allocation are required.

2. SIC Implementation Error Propagation On the receiver side, the user with better channel circumstances is assessed first by SIC detection, according to the primary premise of NOMA. As a result, the reception of the main signal is contingent on the accurate assessment of high-power signals. SIC detection can be harmed by channel and hardware defects, which are effective in the receiving process. Due to the presence of carrier frequency offset (CFO), timing offset (TO), and other hardware-related defects, it is difficult for NOMA systems to optimally estimate channel. As a result, in the SIC detection process, erroneous detection and error propagation are likely. More robust solutions are required to overcome this and increase transmission quality. Improving the estimation quality of the indicated impairments, rather than modifying the main detector components, is a more effective way to

produce a practical performance gain.

3. Choosing the Best Pilot Allocation. When many signals are transmitted in an overlapping manner, interference occurs, and error performance begins to deteriorate in NOMA systems when compared to OMA systems. It is an undeniable reality that flawless or near-perfect CSI is required to achieve a successful result. The number of designated pilots and the number of pilot jobs are essential design concerns in the NOMA deployment. As a result, channel parameters should be tracked effectively and precisely in order to allocate a sufficient number of pilots to appropriate places, resulting in good error performance in NOMA systems.

FLOWCHART OF PROPOSED WORK



References

[1] Xiaojuan Zhao, Shouyi Yang, Aihua Zhang, Xiaoyu Li, "A Compressive Sensing Based Multi-user Detection Algorithm for SIMO-NOMA Systems", IEEE 2018

[2] B Wang, L Dai, Y Zhang, T Mir, "Dynamic compressive sensing-based multi-user detection for uplink grant-free NOMA", Vol-20, Issue-11, IEEE 2016

[3] J Choi, J Mo, RW Heath, "Near maximum-likelihood detector and channel estimator for uplink multiuser massive MIMO systems with one-bit ADCs", Vol-64, Issue-5, IEEE Xplore- 2016

[4] Maha Alodeh ; Symeon Chatzinotas ; Björn Ottersten, "Energy-Efficient Symbol-Level Precoding in Multiuser MISO Based on Relaxed Detection Region", Vol-15, Issue-5, IEEE Xplore- 2016

[5] Fabian Monsees ; Matthias Woltering ; Carsten Bockelmann ; Armin Dekorsy, "Compressive Sensing Multi-User Detection for Multicarrier Systems in Sporadic Machine Type Communication", IEEE 2015

[6] Bichai Wang ; Linglong Dai ; Yifei Yuan ; Zhaocheng Wang, "Compressive Sensing Based Multi-User Detection for Uplink Grant-Free Non-Orthogonal Multiple Access", IEEE-Xplore 2015

[7] S Wang, Y Li, J Wang, "Multiuser detection in massive spatial modulation MIMO with low-resolution ADCs", IEEE Transactions on Wireless Communication, Vol-14, Issue-4,available at IEEE Xplore, IEEE 2015

[8] S Narayanan, MJ Chaudhry, A Stavridis, "Multi-user spatial modulation MIMO", Proceedings of Wireless Communications and Networking Conference (WCNC), available at IEEE Xplore, IEEE 2014

[9] P Botsinis, D Alanis, SX Ng, LLCSO Hanzo, "Quantum-Assisted Multi-User Detection for Direct-Sequence Spreading and Slow Subcarrier-Hopping Aided SDMA-OFDM Systems", IEEE 2014

[10] A Mukherjee, SAA Fakoorian, J Huang, "Principles of physical layer security in multiuser wireless networks: A survey", Vol-16, Issue-3, IEEE 2014