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Survey on Non Orthogonal Multiple Access for 5G Networks Research Challenges and Future Trend

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***Abstract*:-** *In this paper we will due how non orthogonal multiple access scheme work for the 5G system. In this project we will see the fundamental frequency of the uplink and downlink of the change and its constraint. We further discuss the spectral efficiency and its overall implementation on the network and its relation with every efficiency the above future wireless network as user are encouraged to share their bandwidth resources opportunistically according to the device channel condition and their quality of service requirement the more superior spectral efficiency of these non-orthogonal multiple access (NOMA) has proved to be more efficient in relent year.*

***Keywords*:-** NOMA, efficiency, WSN, 5G.

I. INTRODUCTION

All of the current cellular network implement orthogonal multiple access (OMA) techniques which are generally, TDMA (Time Division Multiple Access) or CDMA. However, when we consider over increasing demand on the 5G networks. These system fails to meet it as the future radio access system work only for the higher data speed with efficiency. NOMA is fundamentally different then the multiple access scheme which provide orthogonal access to the user either in time, frequency, code or space.

In NOMA each user operates in the same frequency band and at the same time which are differentiated by the energy level or called as more of the power level NOMA user superposition coding at the transmitter such that the successive interface cancellation (SIC) receiver can separate both the upload link and the download link channel. Practical implementation of NOMA in cellular network require high computational power to implement real time power allocation and interface cancellation algorithm by 2020. 5G will be made available to find its path for the computational capacity.

II. NOMA FEATURE VIA POWER DOMAIN

- Advance coding and decoding for NOMA
- Various MIMO technique of NOMA
- Security and high speed for NOMA
- Cross level design and optimization
- Connectivity for NOMA
- NOMA via code domain
  - a) Sparse code multiple access (SCAM)
  - b) Multi share user access
  - c) Lattice partition
  - d) Various fitter bank of NOMA
- Other protocol for NOMA includes are as found
  - a) Interline division multiple access
  - b) Massive Internet of Things [IOT]
  - c) Machine learning and uses of Block chin technology

Superposition coding at the transmitter and successive interface cancellation (SIC) at the receiver makes it possible to utilize the same spectrum of all uses. The fig. below show the illustration of these information signal that are superimposed at the transmit.

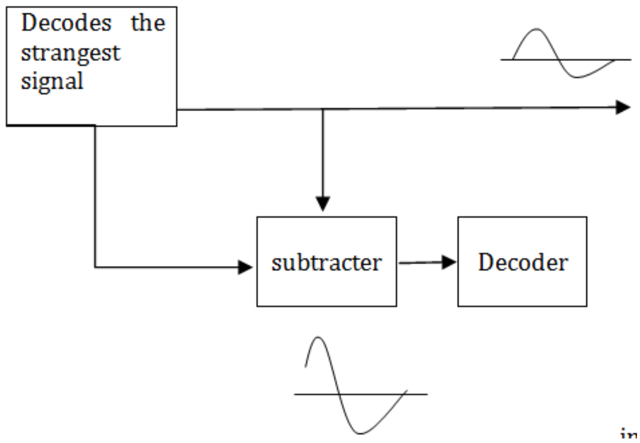

Fig.1 Signal Decoder

The SIC will first decodes the Strangest signal and this signal will be subtracted out from the receiver signal SIC iterates the process until it's found the desired signal.

III. Research methodology

Fifth generation wireless networks face various challenges in order to support large-scale heterogeneous traffic and users, therefore new modulation and multiple access (MA) schemes are being developed to meet the changing demands. As this research space is ever increasing, it becomes more important to analyse the various approaches, therefore in this article we present a comprehensive overview of the most promising modulation and MA schemes for fifth generation networks. We first introduce the different types of modulation that indicate their potential for orthogonal multiple access (OMA) schemes and compare their performance in terms of spectral efficiency, out-of-band leakage, and bit-error rate. We then pay close attention to various types of non-orthogonal multiple access (NOMA) candidates, including power-domain NOMA, code-domain NOMA, and NOMA multiplexing in multiple domains. From this exploration we can identify the opportunities and challenges that will have significant impact on the design of modulation and MA for 5G networks.

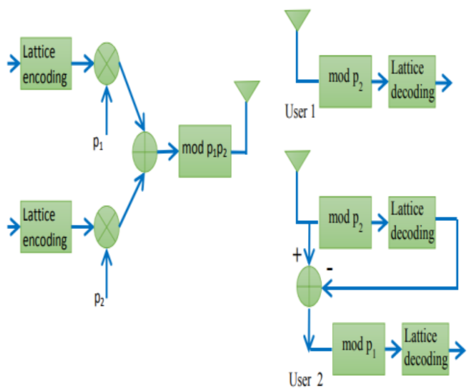

Fig 2 - An example for LPMA downlink transmission with two users

IV. Implementation

In this section, we discuss a number of important implementation challenges which have to be addressed before NOMA can be successfully applied in practical wireless systems. A. Coding and Modulation for NOMA Effective channel coding and modulation schemes are crucial for NOMA, in order to ensure that the achievable rates predicted by theory can be realized in practice. Pulse amplitude modulation (PAM) combined with grey labelling and turbo codes is applied to NOMA. The resulting new NOMA scheme, which does not rely on SIC, is shown to be superior to conventional OMA and NOMA schemes. In addition to turbo codes, other types of channel codes are also applied to NOMA the impact of finite-alphabet inputs on NOMA assisted Z-channels. More importantly, the integration of sophisticated coding and modulation with NOMA has also led to the development of new forms of NOMA, such as Network-Coded Multiple Access (NCMA) and LPMA for illustration purpose, take LPMA as an example. LPMA is based on the property of lattice codes that an integer linear combination of lattice codes is still a lattice code. For a downlink scenario with two users, as shown in Fig., LPMA encodes two users' messages by using lattice coding, such that the transmitted signal is a linear combination 20 of the two encoded messages which are multiplied with a prime number, respectively, i.e., the weak users message is multiplied by a larger prime number, denoted by p1, and the strong users message is multiplied by a smaller one, denoted by p2, p1 > p2. Multiple access interference is removed by using the modulo operation at the receivers as shown in Fig., where the weak user employs a modulo operator with respect to p2 in order to remove the strong users message. We note that the manner in which LPMA removes multiple access interference is very similar to direct-sequence code division multiple access (DS-CDMA). However, LPMA avoids a severe disadvantage of CDMA, namely that the chip rate is much larger than the data rate. As shown in, LPMA can outperform conventional power domain NOMA, particularly when the users' channel conditions are similar.

The application of wireless power transfer to NOMA The motivation for the application of simultaneous wireless information and power transfer (SWIPT), a new member of the energy harvesting, to NOMA can be illustrated with the cooperative NOMA scenario considered in as discussed before, cooperative NOMA can effectively help the user with weak channel conditions, by employing the strong user as a relay. However, in practice, this user may not want to perform relaying, since this will consume its own energy and hence shorten its battery life. With SWIPT, the strong user can harvest energy from the signals sent by the BS, and exploit the harvested energy to power the relay transmission. As a result, the strong user will have more incentive to perform relaying and help the weak user. Following the idea of the transceiver design for cooperative SWIPT-NOMA is investigated. The achievable rate region of wireless power transfer assisted NOMA is characterized the impact of user selection and antenna selection on cooperative SWIPT-NOMA is studied in respectively. Note that SWIPT is not only applicable to cooperative NOMA, but is also useful for other NOMA communication scenarios. For example, in SWIPT is applied for NOMA uplink transmission, where users harvest energy from the BS and then send their information to the BS simultaneously by using the NOMA principle. Resource allocation for this form of uplink SWIPT-NOMA transmission is studied in, where power allocation and the durations for power and information transfer are jointly designed in order to combat the doubly near-far effect. 23 It is noted that most existing SWIPT-NOMA schemes rely on various idealizing assumptions, and the impact of practical constraints, such as hardware impairments, the nonlinear energy harvesting characteristic, circuit energy consumption, etc., on the performance of SWIPT-NOMA has not been investigated yet. B. The combination of NOMA and cognitive radio networks as discussed in Section II, the application of the cognitive radio concept can significantly reduce the complexity of the design of power allocation policies and strictly guarantee the users' QoS requirement. The interplay between the two communication concepts is bi-directional, and the application of NOMA is also important to cognitive radio networks. the NOMA principle is applied to large scale underlay cognitive radio networks, in order to improve the connectivity of secondary networks. Unlike for applications of NOMA in conventional wireless networks, the power of the superimposed signals of cognitive radio NOMA users needs to be constrained in order to avoid excessive interference to the primary receivers. In, NOMA is employed by the secondary transmitter, which supports two functionalities. One is to deliver information to its own receivers, i.e., the secondary receivers, and the other one is to act as a relay helping the primary receivers. The current research results on the combination of NOMA and cognitive radio networks are still very much dependent on the considered network topologies, and more work is needed to gain a fundamental and general understanding of the synergy between these two advanced communication techniques.

V. SIMULATION RESULTS

The Simulation results are shown below Fig.3

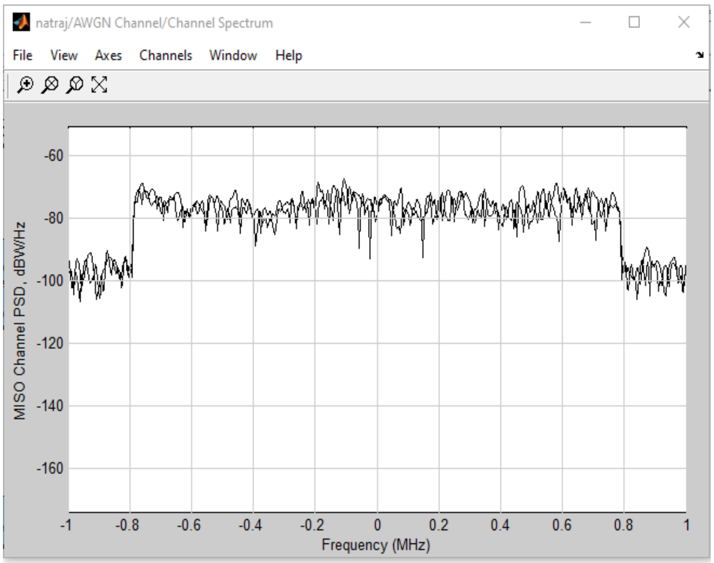

Fig 3 – Simulation Result

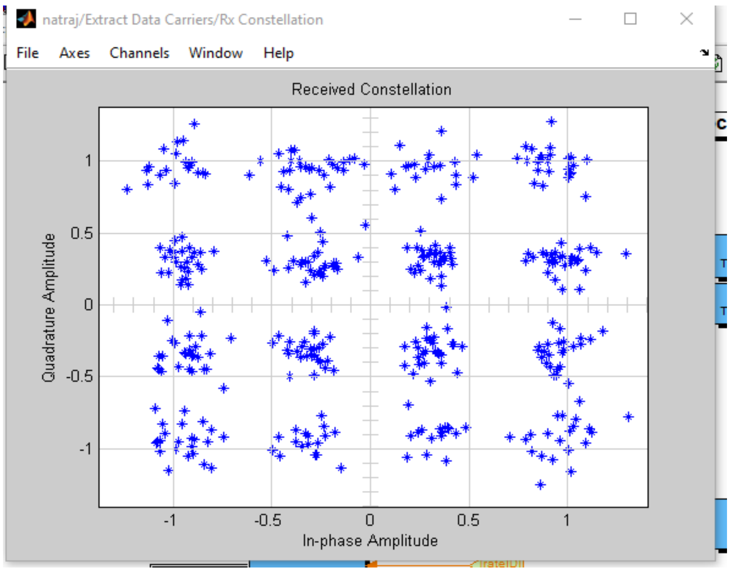

Fig 4 - Simulation Result

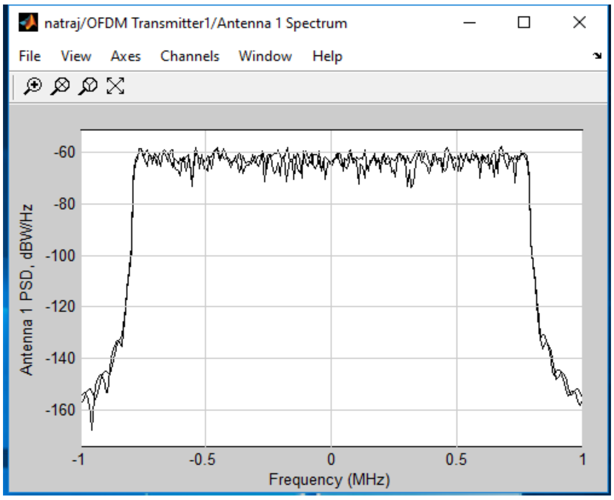

Fig 5- Simulation Result

VI. CONCLUSION

NOMA is an important enabling technology for achieving the 5G key performance requirements, including high system throughput, low latency, and massive connectivity. As shown in this survey, by exploiting the users' heterogeneous channel conditions and QoS requirements, NOMA can utilize the scarce bandwidth resources more efficiently than OMA, and existing studies have already clearly demonstrated the ability of NOMA to improve the system throughput. Since multiple users can be served simultaneously, massive connectivity can be realistically achieved with NOMA, and NOMA networks also reduce the delay since users are no longer forced to wait until an orthogonal resource block becomes available. The recent industrial efforts to include NOMA in 5G, LTE-A, and digital TV standards demonstrate that NOMA will be an integral part of future generation wireless networks, and we hope that this survey and the papers in this special issue will be useful to the readers to gain a better understanding of the benefits and opportunities that NOMA offers as well as its practical application scenarios.

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