IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 2, February 2021

Impact Factor: 7.488

9940 572 462 6381 907 438 ijircce@gmail.com www.ijircce.com

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

An Efficient Resource Block Algorithm for Power Allocation in Non-Orthogonal Multiple Access System

Divyanshi Singh Parmar[1], Dr. Nikita Shivhare Mitra[2]

Research Scholar, Dept. of ECE., Oriental Institute of Science & Technology, Bhopal, India[1]

Assistant Professor, Dept. of ECE., Oriental Institute of Science & Technology, Bhopal, India[2]

ABSTRACT: Non-orthogonal multiple access (NOMA) is a promising applicant innovation for 5G cell systems. Non-orthogonal multiple access (NOMA) has attracted a lot of attention recently due to its superior spectral efficiency and could play a vital role in improving the capacity of future networks. This paper presents block algorithm for resource allocation in terms of number of user, sum rate and transmission power. Simulation is done in MATLAB software and results shows that proposed resource allocation is better than OFDM and existing NOMA.

KEYWORDS: OMA, NOMA, OFDM, MATLAB, 5G.

I. INTRODUCTION

Conventional mobile communications systems are moving towards faster digital wireless technologies based on advances in semiconductor devices as described below. The first generation (1G) used Frequency Division Multiple Access (FDMA), the second generation (2G) used Time Division Multiple Access (TDMA), the third generation (3G) is using Code Division Multiple Access (CDMA), and the 3.9G and fourth (4G) generations are using Orthogonal Frequency Division Multiple Access (OFDMA) supporting efficient frequency usage and good resistance to fading. The proposals for 5G systems aim to increase spectrum efficiency even further by speeding-up existing technologies, using newly opened frequency bands, and increasing network density, and support for the expected required conditions is being examined. The non-orthogonal multiple-access (NOMA) and higher-order multiple-input and multiple-output (MIMO) technologies described in this work require huge processing power to implement these functions, which will be difficult to achieve using the performance of conventional semiconductor devices. Rapid developments in CPU processing power are expected to be a key element in deployment of 5G services.

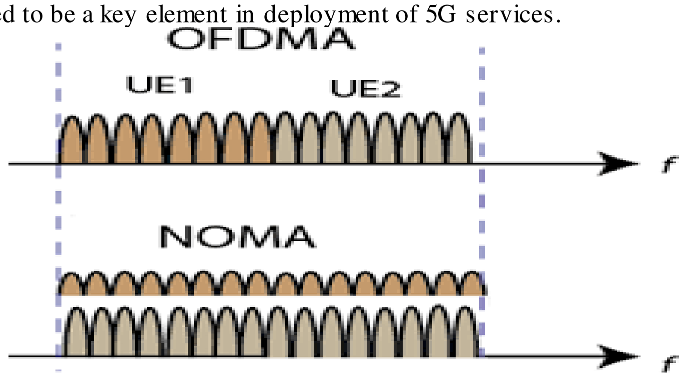

Figure 1: Non orthogonal multiple access

Multiple accesses is a basic function of cellular systems, which are usually divided into two types: orthogonal and non-orthogonal. In orthogonal access systems such as TDMA, FDMA, and OFDMA, signals for different users are orthogonal to each other. On the other hand, in non-orthogonal access systems, such as CDMA, TCMA (Trellis Coded Multiple Access), IDMA (Interleave Division Multiple Access), the cross-correlation of signals for different users is not 0. The commonly used NOMA incorporates the above-described non-orthogonal multiple access but this section discusses a specified NOMA implementation for 5G systems. NOMA under discussion for 5G systems has a new extension of the user multiplex domain to improve the spectrum efficiency. Intentionally introducing non-orthogonality aims to increase the spectrum efficiency further. As a result, technologies such as new encodings and an interference

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

canceller are required to correct the non-orthogonality, which has been considered difficult to implement until now. However, development is pushing forward with the expectation of introduction as key 5G technology following recent remarkable improvements in CPU performance. NOMA can be classified into three different user multiplex domains: NOMA with SIC (Successive Interference Canceler)/SOMA (Semi-orthogonal Multiple Access), SCMA (Sparse Code Multiple Access), and IDMA (Interleave Division Multiple Access).

II. RELATED WORK

J. Zeng et al., [1] Non-orthogonal multiple access (NOMA) is one promising innovation, which gives high system limit, low latency, and huge network, to address a few difficulties in the fifth-generation remote systems. In this work, it is first uncover that the NOMA methods have developed from single-carrier NOMA (SC-NOMA) into multi-carrier NOMA (MC-NOMA).

Z. Mobini et al.,[2] It is consider downlink non-orthogonal multiple access transmission where an access point communicates with a lot of close and far users by means of a full-duplex multiple radio wire transfer. To manage the between user interference at the close to user and self-interference at the transfer, it is propose ideal and problematic beamforming plans. Also, it is consider two diverse user choice criteria, in particular: 1) random close to user and random far user (RNRF) choice; 2) closest close to user and closest far user (NNNF) choice, and infer the blackout probabilities of the close and far users.

H. Wang et al., [3] proposed NOMA plan beats the current signal arrangement NOMA plan and its orthogonal multiple access (OMA) partner regarding the absolute power utilization. Moreover, the proposed NOMA plan can perform notwithstanding when just the example covariance matrix of sticking interference is accessible.

E. Simon et al.,[4] This work displays a complete presentation examination of a gigantic multiple-input multiple-yield (MIMO) system utilizing non-orthogonal multiple access (NOMA) in both indoor and outside situations, based on down to earth channel estimations. The latter are performed utilizing frequency-space channel sounding investigations led at 3.5 GHz with 18 MHz bandwidth. Multi-user beamforming and NOMA bunching are utilized in the monstrous MIMO system.

M. Moriyama et al.,[5] utilized successive interference cancellation (SIC) for NOMA. it is have likewise explored a get space decent variety (SD) which joins signals in a frequency area to upgrade system unwavering quality. This work demonstrates trial results when 5 users at the same time transmit signals to a BS. it is led two kinds of examinations, utilizing a blurring emulator and in the genuine field. In the blurring emulator test, it is evaluated the impact of recieving wire correlation on SD and investigated appropriate SIR for SIC. it is affirmed that SD was powerful regardless of whether the correlation is 0.8 and that appropriate SIR was around 4 dB when 5 users experienced blurring.

D. Tran et al., [6] In this work, it is consider a multi-input multioutput (MIMO) nonorthogonal multiple access (NOMA) network comprising of one source and two legitimate users (LUs), supposed close and far users as indicated by their separations to the source, and one uninvolved spy, over Nakagami-m blurring channels. In particular, it is investigate the situations where the signals of the far user may or probably won't be effectively decoded at the meddler and the close to user.

W. A. Al-Hussaibi et al., [7] The viability of structured calculations is confirmed through broad examination and numerical simulations contrasted with the reference MU-MIMO and MIMO-NOMA systems. The accomplished outcomes demonstrate a generous increment in availability, up to two-overlap for the accessible number of RFCs, and by and large whole rate limit while satisfying the base users' rates. Plus, significant tradeoffs can be acknowledged between system exhibitions, equipment and computational complexities, and wanted user-fairness regarding serving more users with equivalent/inconsistent rates.

A. Agarwal et al., [8] This investigation examinations the exhibition of a non-orthogonal multiple access-based two-way relaying system. Explanatory articulations are gotten to portray the blackout likelihood and blackout floor of the system for start to finish communication over Rayleigh blurring channels. Furthermore, results are additionally introduced for the subsequent individual user and aggregate ergodic limits.

P. Yang et al.,[9] In this work, a novel multi-user multipleinput multiple-yield (MIMO) transmission plot, called non-orthogonal multiple access (NOMA)- supported precoded spatial modulation(PSM) (NOMA-PSM) is proposed for over-burden downlink transmissions. NOMA-PSM usefully amalgamates the idea of list modulation (IM) and NOMA strategies, and therefore it acquires both the benefits of IM with lowcomplexity handset and the upsides of NOMA with high bandwidth proficiency.

C. Xiao et al.,[10] Non-orthogonal multiple access (NOMA) with multiple-input multiple-yield (MIMO) is one of the promising candidates to improve availability, dependability, and latency execution of the developing applications. In this work, it is determine a shut structure upper destined for the postpone target violation likelihood in the downlink MIMO-NOMA, by applying stochastic network analytics to the Mellin changes of administration forms. A key

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

commitment is that it is demonstrate that the endless length Mellin changes coming about because of the non-insignificant interferences of NOMA are Cauchy united and can be asymptotically drawn closer by a limited truncated binomial arrangement in the shut structure.

III. PROPOSED APPROACH

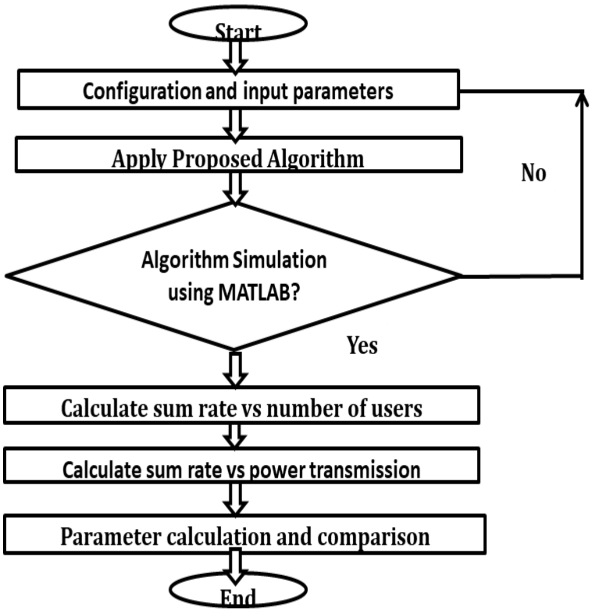

Figure 2: Flow Chart

Figure 2 is showing flow chart of proposed work. In which after applying proposed algorithm calculate sum rate vs power and sum rate vs number of users. The optimization problem is first formulated to maximize the sum rate of the two-user NOMA system, and the solution is then generalized to the multi-user case. In order to guarantee that each user is able to achieve its target data rate, the optimization will include nonlinear constraints of proportional fairness. It is important to point out that by using the proportional fairness constraint, once the minimum rates for all users are satisfied, the remaining resources will also be allocated in a proportional manner. Such approach is important to maintain fairness in distributing the radio resources among these users and to ensure that the weak users have enough power to decode their own data from the received signal while treating the stronger users as noise, and to ensure that the stronger users have enough power to apply SIC and cancel the effect of the weak users and detect their own data.
Without this constraint, the maximum sum rate could simply be achieved by allocating all the bandwidth and power to one user or a few users who have the best channel conditions and not all users will be allowed to transmit. In addition, another important property of this constraint is that it can utilize the potential advantage of NOMA over OMA. The minimum rate requirement is assigned to each user based on the large scale fading factor (the distance based path loss and the Log-normal shadowing factor) experienced by that user in addition to the small scale fading effects. Since path loss and shadowing is more dominant and vary slowly, the proportionality constraint is therefore effectively more long term rather than short term.
Solving the formulated problem in to requires a numerical solution or some iterative algorithm for suboptimal solution. Therefore, we first propose a low complexity sub-optimal approach that allocates the power equally among all the RBs. In other words, the total transmission power in each RB is set to be Using this assumption along with the optimization steps that are depicted in Appendix A, the sub-optimal power for the strong user is found to be

$$P_s^{(L)} = \frac{2|h_s^{(H)}|^2|h_s^{(L)}|^2 P_{RB} + \left(|h_s^{(H)}|^2 + |h_s^{(L)}|^2\right) B_s N_0}{2|h_s^{(H)}|^2|h_s^{(L)}|^2} - \frac{\psi_3\sqrt{B_s N_0}}{2|h_s^{(H)}|^2|h_s^{(L)}|^2\sqrt{\Gamma_1}},$$

It is worth mentioning that the superscripts and are included just to distinguish the parameters of the users with the better channel gain from those with weaker channel gains at the selected RB and not over all RBs. It also does not

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

necessarily mean that is higher than, where it could be less than or equal to depending on the final values from the proposed closed form solutions.

IV. SIMULATION RESULTS

Proposed work is simulated using MATLAB environment. Input parameter which is taken to implementation is following.

Table 1: Input Parameters

Sr. No.	Parameter	Value
1	Cell Diameter (D)	300
2	Path loss Exponent (v)	3
3	Noise Power Density (N0)	-174
4	Total Bandwidth (WT)	5
5	No. of RBs (S)	25
6	ıwidth per RB (Bs)	200
7	No. of subcarriers per RB(Nc)	12

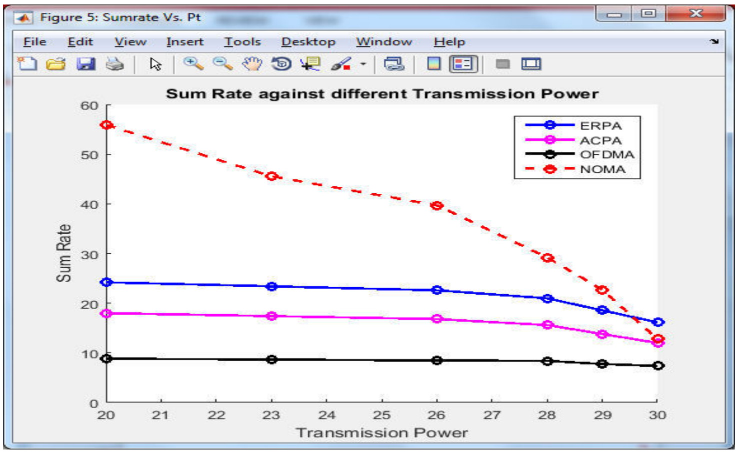

Figure 3: Transmission power vs sum rate

Figure 3 presenting transmission power and sum rate of existing approaches and NOMA. It is clear that NOMA gives significant better performance than previous.

Table 2: Simulation Parameter-I

Sr. No	Approach	Transmission Power	Sum Rate
1	ERPA	30	10
2	ACPA	30	18
3	OFDMA	30	25
4	Proposed NOMA	30	58

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

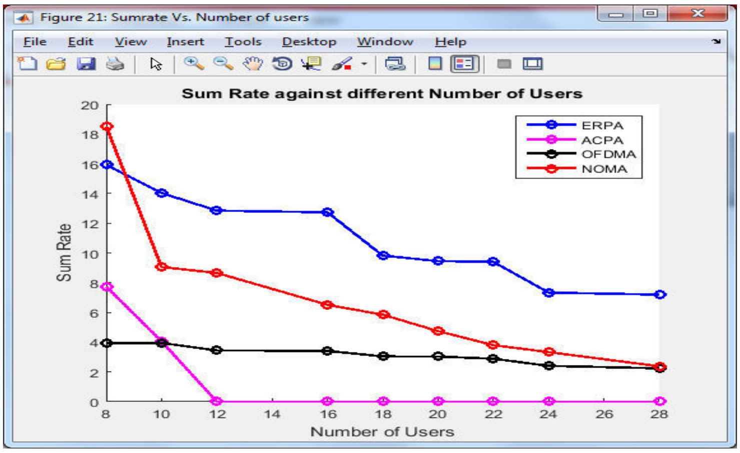

Figure 4: Number of users vs sum rate

Figure 4 presenting number of users and sum rate of existing approaches and NOMA. It is clear that NOMA gives significant better performance than previous.

Table 3: Simulation Parameter-II

Sr. No	Approach	No of users	Sum Rate
1	ERPA	28	4
2	ACPA	28	8
3	OFDMA	28	16
4	Proposed NOMA	28	19

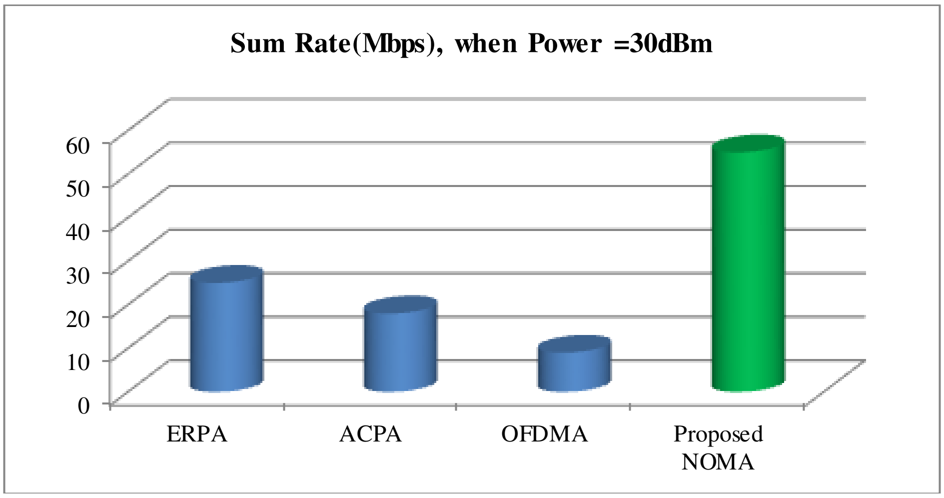

Figure 5: Comparison of sum-rate when power is 30dBm

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

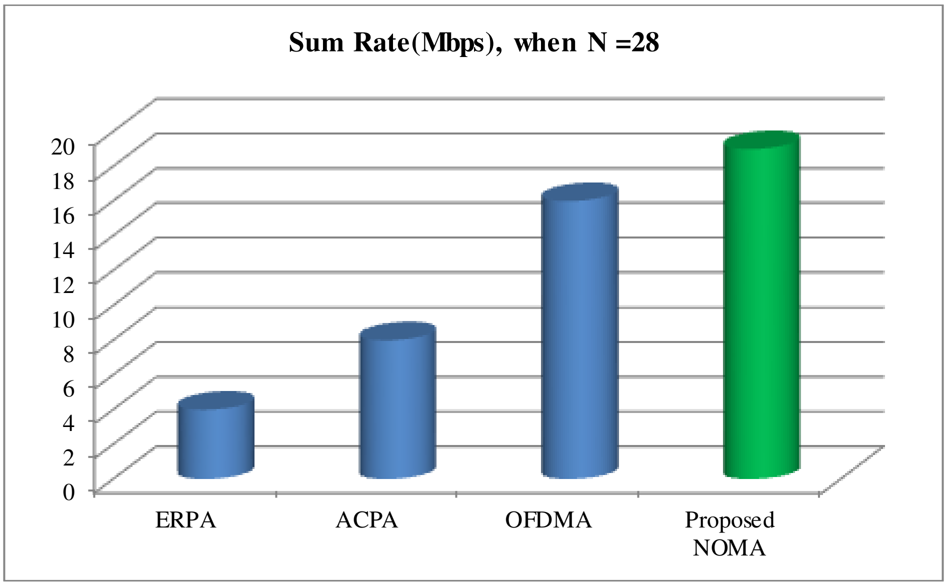

Figure 6: Comparison of sum-rate when user is 28

Figure 5 and 6 are showing comparison of simulated parameter of previous and proposed work. It is clear that proposed method give significance improvement

V. CONCLUSION

Thus the Resource Block was allocated using the NOMA algorithm of RBs allocation and classification algorithm. Due to this algorithm the power consumption gets reduced and the sum rate against the Transmission Power was increased. Two sub-optimal power allocation methods have been proposed to allocate the transmission power to each user in a two-user scenario. In addition, to optimize the sum rate for a large number of users, the proposed techniques are extended to a multi-user scenario by the vertical pairing concept. Simulation results show that NOMA provides better performance than OFDMA. In future this process will be extended to analysis of real time value with reduction of Signal to Noise Ratio with the Resource Block algorithm and Classification algorithm.

REFERENCES

1. P. J. Zeng et al., "Investigation on Evolving Single-Carrier NOMA Into Multi-Carrier NOMA in 5G," in IEEE Access, vol. 6, pp. 48268-48288, 2018.
2. Z. Mobini, M. Mohammadi, B. K. Chalise, H. A. Suraweera and Z. Ding, "Beamforming Design and Performance Analysis of Full-Duplex Cooperative NOMA Systems," in IEEE Transactions on Wireless Communications.
3. H. Wang, Y. Fu, R. Song, Z. Shi and X. Sun, "Power Minimization Precoding in Uplink Multi-Antenna NOMA Systems With Jamming," in IEEE Transactions on Green Communications and Networking.
4. E. Simon, J. Farah and P. Laly, "Performance Evaluation of Massive MIMO with Beamforming and Non Orthogonal Multiple Access based on Practical Channel Measurements," in IEEE Antennas and Wireless Propagation Letters.
5. M. Moriyama, K. Takizawa, M. Oodo, H. Tezuka and F. Kojima, "Experimental Evaluation of UL-NOMA System Employing Correlated Receive Diversity," 2019 International Conference on Computing, Networking and Communications (ICNC), Honolulu, HI, USA, 2019, pp. 894-899.
6. D. Tran, H. Tran, D. Ha and G. Kaddoum, "Secure Transmit Antenna Selection Protocol for MIMO NOMA Networks Over Nakagami-m Channels," in IEEE Systems Journal.
7. W. A. Al-Hussaibi and F. H. Ali, "Efficient User Clustering, Receive Antenna Selection, and Power Allocation Algorithms for Massive MIMO-NOMA Systems," in IEEE Access, vol. 7, pp. 31865-31882, 2019.
8. A. Agarwal and A. K. Jagannatham, "Performance analysis for non-orthogonal multiple access (NOMA)-based two-way relay communication," in IET Communications, vol. 13, no. 4, pp. 363-370, 5 3 2019.
9. P. Yang, Y. Xiao, M. Xiao and Z. Ma, "NOMA Aided Precoded Spatial Modulation for Downlink MIMO Transmissions," in IEEE Journal of Selected Topics in Signal Processing.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 2, February 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0902037 |

10. C. Xiao et al., "Downlink MIMO-NOMA for Ultra-Reliable Low-Latency Communications," in IEEE Journal on Selected Areas in Communications, vol. 37, no. 4, pp. 780-794, April 2019.
11. J. Dai, K. Niu and J. Lin, "Iterative Gaussian-Approximated Message Passing Receiver for MIMO-SCMA System," in IEEE Journal of Selected Topics in Signal Processing.
12. M. R. G. Aghdam, R. Abdolee, F. A. Azhiri and B. M. Tazehkand, "Random User Pairing in Massive-MIMO-NOMA Transmission Systems Based on mmWave," 2018 IEEE 88th Vehicular Technology Conference (VTC-Fall), Chicago, IL, USA, 2018, pp. 1-6.