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Low Power Allocation Based Error Improvements in wireless 5G

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Abstract: Transmit antenna selection is very common technique to reduce system complexity and power consumption at transmitter side while maintaining nearly the same performance of multiple antennas. In this paper, we introduce a transmit antenna selection (TAS) scheme for non orthogonal multiple access (NOMA) to improve the performance in terms of total sum rate. Therefore different antenna elements added at the base station experiences different fading conditions (A channel is a time varying channel).Experiences different SNR values adding more number of antennas at the base station. Increases the complaxicity as well as the performance with respect to the sum rate Non linear the user experiences the Bit error rate at the receiver simulation results shows that the BER is verified for different antenna error consideration (MIMO).

Key Words: spectral efficiency, massive connectivity, OMA, NOMA, TAS

I. INTRODUCTION

Original analytical investigations from both scholarly community and industry have distinguished a lot of necessities that ought to be met for future 5G [1], [2]. It incorporates 10Gbps associations, 1ms dormancy, 1000× data transfer capacity per unit zone and 90% decrease in vitality use to give some examples. To meet these necessities, a few advances like millimeter wave,massive various info different yield (MIMO), ultra - densification, heterogeneous systems (HetNets), arrange work virtualisation (NFV), programming characterized systems (SDN) and gadget to gadget [3] have been considered. For various access plans, non-symmetrical different access (NOMA) have been viewed as promising possibility for 5G. NOMA appoints a similar recurrence band and availabilities to all clients not at all like customary symmetrical numerous entrance to increment otherworldly effectiveness and information rates. Not with standing, the transmitter assigns distinctive capacity to every client dependent on their channel quality [4]. The client with great channel quality is appointed less power Original analytical investigations from each scholarly network and industry have prominent a variety of requirements that ought to be met for destiny 5G [1], [2]. It contains 10Gbps institutions, 1ms dormancy, 1000× information transfer capacity according to unit area and 90% lower in power use to offer some examples. To meet those requirements, a few advances like millimeter wave,big numerous data unique yield (MIMO), ultra - densification, heterogeneous systems (Het-Nets), set up work virtualization (NFV), programming characterized structures (SDN) and machine to system [3] have been taken into consideration. For numerous get admissions to plans, non-symmetrical distinctive get admission to (NOMA) had been regarded as promising possibility for 5G. NOMA appoints a similar recurrence band and availabilities to all clients on no account like normal symmetrical severa entrance to increment otherworldly effectiveness and information charges. Not with standing, the transmitter assigns exceptional capacity to every client dependent on their channel quality [4]. The client with wonderful channel great is appointed much less strength and deciphers their character information through applying modern obstruction dropping (SIC). In recent years, a few examinations have been accomplished to consolidate NOMA with MIMO. Utilizing severa reception apparatuses for transmission provide multiplexing and respectable range coming approximately big development in the presentation of far flung correspondence frameworks [5], [6]. In [7], The creators have researched ergodic limit amplification problem for and deciphers their man or woman information by way of applying innovative obstruction dropping (SIC). In recent years, a few examinations had been carried out to consolidate NOMA with MIMO. Utilizing severa reception apparatuses for transmission provide multiplexing and first rate range coming approximately considerable development in the presentation of faraway correspondence frameworks [5], [6]. In [7], the creators have researched ergodic limit amplification difficulty for MIMO NOMA framework below absolute transmit control requirement and least price imperative of the feeble purchaser. An ideal energy designation to enlarge total tempo of MIMO-NOMA with layered transmissions considering every customer has a constraint on all out transmission power is tested in [8,18,19,20]. In this paper Section I gives introduction about necessities of 5G and NOMA for future broad band applications. Section II gives basic system model of NOMA and how TAS-NOMA suffers with BER problems we discuss in brief. Section III gives the proposed method based on power allocation.Section IV gives simulation results, which provides the tradeoff between BER and SNR. Section V gives the conclusions

II. BASIC NOMA MODEL AND ANALYSIS

This following section discusses the structure of NOMA with S-IC.

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This paper, explores how the NOMA with SIC applied for down link. Generally NOMA applicable for down link as well as uplink with respect to BS [8].

A. General Consideration of NOMA

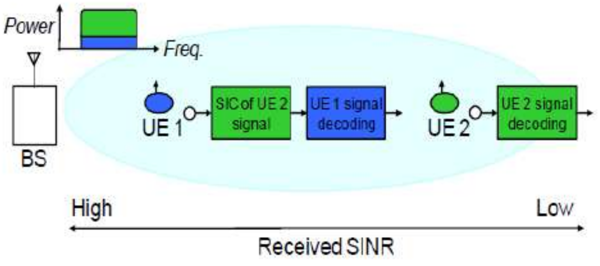

Fig 1: Structure of NOMA for Down Link

Figure1 illustrates thebasic NOMA schemeapplying SIC for UE receivers in the cellular downlink. For simplicity, we assume a two-UE case, a single transmitter, and a single receiver antenna.The overall system transmission bandwidth is assumed tobe 1 Hz. The base station transmitsa signal for UE-i (i = 1, 2), xi, where E[|xi|2] = 1,with transmission power Pi. The sum of Pi is restricted to P at maximum. In the NOMA, x1 and x2 are superposition coded as

$$x = \sqrt{P_1}x_1 + \sqrt{P_2}x_2 \qquad (1)$$

The rx‘d signal at User Equipment -i is represented as

$$y_i = h_i x + w_i \qquad (2)$$

Where h_i is the complex channel coefficient between UE-i and the base station. Term w_i denotes the receiver Gaussian noise including inter-cell interference. The power density of w_i is N (0, 1) .In the NOMA downlink, the SIC process is implemented at the UE receiver.

Therefore, UE-1 can decode x1 without interference from x2. Assuming the error-free detection of x2 at UE-1, the throughput of UE-i, Ri, is represented as

$$R_1 = \log_2\left(1 + \frac{P_1|h_1|^2}{N_{0,1}}\right), \quad R_2 = \log_2\left(1 + \frac{P_2|h_2|^2}{\frac{P_1|h_1|^2}{N_{0,1}} + N_{0,2}}\right) \qquad (3)$$

From (3), it can be seen that power allocation for each UE greatly affects the user throughput performance and thus the modulation and coding scheme (MCS) used for data transmission of each UE. By adjusting the power allocation ratio, P1/P2, the BS can flexibly control the throughput of each UE.

Finally, the sum rate achieved using NOMA by n-th antenna of base station can be expressed as

$$R_{sum}^n = \sum_{m=1}^{M-1} \log\left(1 + \frac{\rho^n |h_m^n|^2 a_m^n}{\rho^n |h_m^n|^2 \tilde{a}_m^n + 1}\right) + \log\left(1 + \rho^n |h_m^n|^2 a_M^n\right) \qquad (4)$$

Subsequently, the aggregate rate for TAS-NOMA can be communicated as

$$R_{sum}^{n^*} = \max_{1 \le n \le N}\left(R_{sum}^n\right) \qquad (5)$$

From equation (5) although, there is linearity between increased num. of antennas with respect to sum rate, but satisfies up to certain value of antennas in number, once it crosses the performance becomes degraded. Secondly the capacity increases with high power at BS along with the increased num of antennas. However this condition fail due to low power at BS.Then errors occur due to this performance decreases.

B. Existing power allocation scheme for NOMA

Different power allocation schemes for users are there for Non-OMA based wireless communication system. In this section, we discussed two popular but simple conventional techniques.

a. Arbitrary Power Allocation Technique

In paper [4,9], the total transmit power P is arbitrarily divided into users. P1 is chosen to be 20% of total power for User1and, P2 is 80% of the total power for the User2.However, it has no explicit mechanism or explanation for choosing these specific powers for users.Therefore, if the no. of users are increased, the choice of power allocation will be complex.

b. Fractional Transmit Power Allocation (FT-PA)

The total transmit power P is fractionally divided into users based on their gain of the channel using fractional-transmit PA [10, 15,18]. Based on the corresponding mobile-users channel gains, the power allocation factors for two users are selected as a1for User 1 and a2 for User 2 where a1<a2.Each user is loaded with power αP followed by superposition of all constellation points. The power allocation factor is calculated using fairness index [11,19,20].The fairness index is optimized to be 0.7 arbitrarily. Therefore we concentrated on formulization of an effective power allocation scheme for NOMA.

III. PROPOSED GPA FOR NOMA WITH DIFFERENT ANTENNA

In NOMA, the power allocation to one user affects the achievable throughput of not only that user but also the throughputof other users due to power-domain multi-user m ultiplexing. Therefore, multi-user transmit power allocation and multi-user schedulingareconnected to each other.For the sake of simplicity, in this paperwe assume a disjoint powera llocationand user scheduling, where the powerallocation for each candidate set of users is conducted first, then the sched ulin metricis calculated.Even in this case, the optimal power allocationremains computationallycomplex because foreach candidate user set all possible combinations of power alloca tions need to be considered. Here, we adopt a suboptimal fractional transmission power allocation (FTPA) similar to the transmission power control used in the LTE uplink [12,18].

In order to reduce complexity of the optimal powerallocation (brute-force search), a low computational complexity algorithm is proposed by exploiting tree-search based transmission power allocation (TTPA) [9,18,19,20]. The key idea of theTTPA algorithm originates from the fact that not all power assignment ratio combinationsneed to bes earched. If the redundant power assignment ratio combinati ons can be effectively identified and discarded, the computa tional complexity can be markedly reduced. In order to inve stigate the performance gain of NOMA, the cell throughput and cell-edge user throughput are evaluated based on the following definitions.

A. *Mathematical Analysis of Proposed Power allocation for different antennas:*

To reduce the complexity of the conventional power allocation problems, we need a low complexity and reliable mathematical analysis is required. Due to the SIC at the receiver some gain mismatches are possible because of this Bit error rate is a major problem, this remark can be overcome by considering different channel types or considering the different antenna arrays. GPA already available for different modulation schemes i.e. 4QAM and BPSK in that they provide tradeoff between SNR vs BER, the calculated value of BER ~0.5 at SNR of 12Db.But in our proposal we want to reduce the error while applying SIC at the receiver for this we consider different channels like AWGN and Rayleigh fading channel

The SC-signal at the BS is

$$x = \sqrt{P_1}x_1 + \sqrt{P_2}x_2 \qquad (6)$$

The received for power allocation calculation at the Receiver for SIC is

$$y_{DL} = h_i x + w_i \qquad (7)$$

Assign power for broadcasting is very crucial in NOMA, we consider an optimal power allocation for MIMO-NOMA with layered transmissions with known instantaneous CSI. Throughout this section, we assume block fading channels where a coded sequence is transmitted within a coherence ti me. While we assume that perfect CSI is available at the BS in this section, we will consider the case that statistical pro perties of the channels are available at the BS and study the power allocation to maximize the average sum rateFor convenience, let

$$\alpha_m = |r_{m,m;1}|^2 \quad and \quad \beta_m = |r_{m,m;2}|^2 \qquad (8)$$

The signl powers are denoted by

$P_m = \mathrm{E}\left[|x_{m;1}|^2\right]$ and $Q_m = \mathrm{E}\left[|x_{m;2}|^2\right]$ we assume that $\mathrm{E}\left[|\bar{n}_{m;k}|^2\right] = N_0 = 1$

In order to be fair to user 2, it is necessary to impose the power constraints separately. To this end, we may have the total transmission power constraints to user 1 and user 2 as follows:

$$\sum_{m=1}^{M} P_m \le \bar{P} \;and\; \sum_{m=1}^{M} Q_m \le \bar{Q} \qquad (9)$$

where and are the maximum transmission powers to user 1 and user 2, respectively.

IV. SIMULATION RESULTS

The simulation results presented using MATLAB R13 to compare the existing algorithm with the proposed GPA algorithm. The BER performance can be analyzed under Additive-White Gaussian-noise(AW-GN).The user by user powers are separately calculated by using equation(7.7)which results the improved BER performance(your proposed method wireless environment and also compare with APA NOMA AND FTPA NOMA).

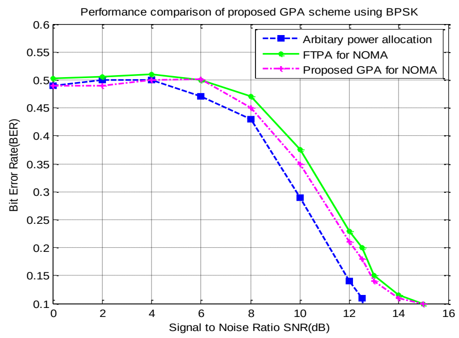

Fig 2: Performance of proposed GPA scheme using BPSK

From figure 2 a graph is drawn between SNR VS BER with BPSK modulation from figure 2 the proposed GPA provides little bit improvement in BER compare to other conventional method undr AWGN Channels.

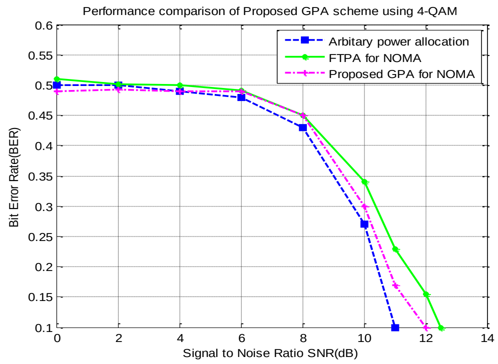

Fig 3: :Performance of proposed GPA scheme using 4-QAM

From figure 3 it provides a trade off between SNR vs BER with 4QAM modulation. Here the proposed GPA method significatly improves BER comparing to other existed convesional method.

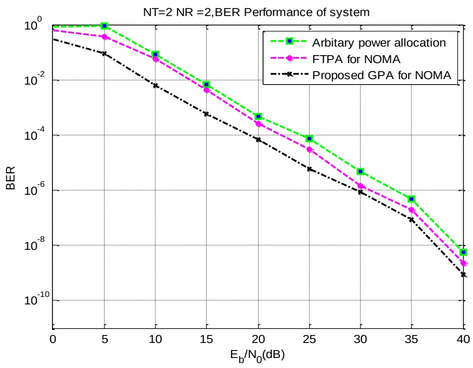

Fig 4: BER Performance of 2X2 (NT X NR)

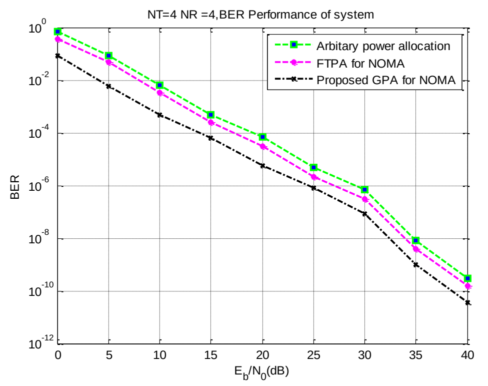

Fig 5: BER Performance of 4X4 (NT X NR)

From fig 4 and 5 Simulation results shows that BER vs curve indicates the improved under Rayleigh fadind channel with no. of Tx'g Antennas and no.of Rx'g antennas from the figure the proposed GPA improves the BER graphically compare to other conventional methods*(wih AWGN and without AWGN.

V. CONCLUSIONS

In our proposal the introduction of successive interference cancellation (SIC) applicable for users superimposed symbol information which allocates low power which leads to poor BER performance. To solve this problem we propose a GPA algorithm which BER and throughput.

The transmit power allocation is the deciding factor of throughput. Because of the super position coding, error propagation is reduced due to more power to strong symbols. Automatically lowering of BER takes place.

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