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A Novel Ergodic Sum Rate- Non Orthogonal Multiple Access for 5G Systems

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Abstract: ***The Choice of antenna transmission is a Scheme ,a channel is chosen from a transmitter and client chooses the proficient channel by watching all the conditions. In this numerous receiving wires are used, out of which one is selected, which is a dull task..This technique is executed in downlink correspondence with numerous response devices with single antenna.ERS (Ergodic Sum rate) Plays a vital part in Non Orthogonal Multiple entrance in 5G.The Capacity can be enhanced betterly by coordinating with Statistical Calculations. In this distinctive kinds of radio wire are utilized and the best mix is chosen. The Efficiency is same as utilized with total of antennas. Our Offered Way accomplishes better Capacity contrasted and different techniques***

Keywords: 5G,NOMA,Ergodic sum rate

I. INTRODUCTION

Today's speed world surely talk about data war, because we come across several wireless and wire line generations , i.e. 1st Generation,2nd Generation,3rd Generation,4th Generation with different multiple accesses schemes such as Frequency division multiple accesses(FDMA) ,Time division multiple accesses(TDMA) , Code division multiple accesses(CDMA) ,Orthogonal frequency division multiple accesses(OFDMA), all these are limited data rate feasibility with increased transmission powers. Different point to point commutation techniques are available.ie SISO, MISO, SIMO and MIMO. The current day technology used in advanced wireless communication is multiple input and multiple output (MIMO) based systems. These systems offer wide services with different data rates. These data rates and services are limited because of the number of antenna elements at the base station side. Therefore adding more number of antenna elements consumes more power and increased complexity.

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Different transmitting and receiving techniques, algorithms are used so far, but those are not up to the mark. Instead of using multiple antennas, multiple frequencies, multiple time slots and same power, better to use single antenna, single timeslot with multiple powers. So we need a different multiple accesses scheme know as Non orthogonal multiple accesses scheme (NOMA).

In order to provide the tradeoff between end users and sum rate, the transmitting antenna selection (TAS) schemes plays major role from the base station side. This scheme automatically reduces the system complexity and power consumption and increases the resultant sum rate. Based on perfect channel state of information, every user in that region knows the information about the far users.TAS automatically provide the best antenna (i.e. in capacity) and minimal interference level. Several multiple accesses schemes are proposed for 5G systems.i.e P-NOMA, C-NOMA.With the same frequency and same time slot with different power levels are signed by TAS-NOMA, where as in case of conventional OMA, same power with different frequencies with different time slot assignments are possible from BS side.Superpostion Coding (SC) at the BS and Successive interference cancellation (SIC) is applied at the receiver to decode the original information signal (ML decoding). The remaining paper arranged as follows. In Section II, previous methods are discussed, In Section III, basic system model was discussed, and In Section IV proposed model and necessary mathematical analysis was discussed, In Section V results are discussed.

II. RELATED WORK

Shahab sanayei et.al proposed an algorithm based on two approaches, norm-based selection and successive selection in which SNR is considered using feedback from the receivers.If the feedback is correlated during acknowledgement it is not accurate for antenna selection .[1]

Yang-seok et.al, proposed a fast antenna selection algorithm based on the correlation and mutual information between the signals at the different antenna elements. The computation of the correlation between the signals is time consuming and requires N^2 computations where N is the number of transmitting antennas. [2]

Ziad qais Al- Abhasi et.al, proposed an algorithm for the maximization of sum rate in the non-orthogonal multiple access using the division of spectrum into sub carrier it is mainly focused on two users, if the users more than two, if the users are more than two, the sum rate gain will be diminishes.[3]

Xin Liu et.al, proposed an algorithm for the antenna selection in multiple input and multi output and non-orthogonal multiple access systems by considering the limited candidate antennas and it is not suitable for the multiple antennas at the base station . [4]

Anish prasad Shrestha et.al, proposed an algorithm for the 5G systems to select a best antenna out of multiple antennas at the base station and they used to investigate each antenna at the user to obtain the maximum sum rate and did not considered PSNR for the transmission of the data through the channel under different conditions .[5]

However, to overcome the problems raised in the existing works, a new approach is proposed. In this proposed work all these conditions are considered for addressing the problems in previous method. TAS-NOMA is existing algorithm but there is no consideration about the PSNR values. So, in this paper, presented work will describe about the increase in capacity of channel and also to reduce the time delay in the evolution of sum rate which is ergodic sum rate .

III. Basic System Model of NOMA

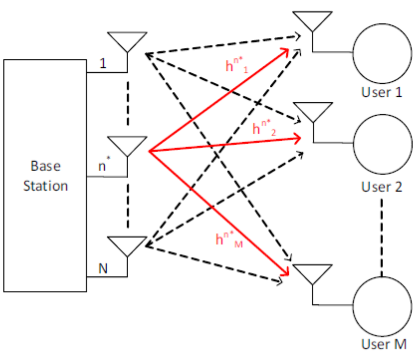

Fig 1: Basic Structure of TAS NOMA

The coded symbols of the M users can be expressed as

$$S^n = \sum_{m=1}^{M} \sqrt{a_m^n P_{tot}}\, s_m \qquad (1)$$

The super position coded signal at the base station is given by

$$y_m^n = h_m^n \sum_{m=1}^{M} \sqrt{a_m^n P_{tot}}\, s_m + n_m^n \qquad (2)$$

The summation rate for TAS-NOMA is given as

$$R_{sum}^{n^*} = \max_{1 \le n \le N} \left(R_{sum}^n \right) \qquad (3)$$

Where n* is index of the efficient antenna that can achieve highest sum rate. But it requires several feedbacks to select best antenna based on perfect channel state of information.Becasue of increased feedback mechanism delay will be increased automatically to reduce this averaged sum rate is used.

IV. Proposed Work

The proposed block diagram for average sum rate is shown in the figure 2

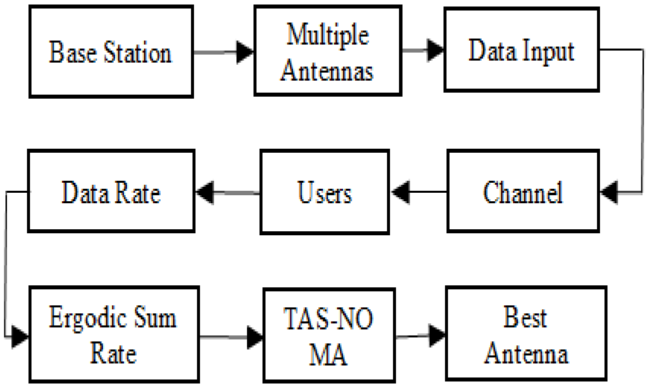

Fig 2: Proposed Method

Different transmitting antennas at the base station experiences different power levels due to the time varying nature of the fading channel, which leads to random SNR values.Healty channel condition decides which user is going to decode first and reaming will be canceled based on SIC.

In this proposal, the sum rate measurement is carried out by a different process and the sum rate achieved by the proposed method is defined as ergodic sum rate. The ergodic sum rate is obtained by calculating the probability density function of channel allocation coefficient (each user assigned a channel) and taking the average of the instantaneous capacity of each channel .The average capacity of the received signal is given by

$$R_{avg}^n = \sum_{n=1}^{N-1} \left\{ \sum_{m=1}^{M-1} \left\{ \begin{array}{l} \int_0^\infty \log\left(1 + \dfrac{x_p^n a_m^n}{x_p^n a_m^n + 1}\right) f\left|h_m^n\right|^2 (x)\, dx + \\ \int_0^\infty \log\left(1 + p^n x a_m^n\right) f\left|h_m^n\right|^2 (x)\, dx \end{array} \right\} \right\} \qquad (4)$$

The averaging algorithm-DL (down link) is summarized as follows

Step 1: Consider **N** number of transmitting antennas
Step 2: Consider M number of mobile users
Step 3: For every NxM feedbacks calculate the channel gain
Step 4: For every NxM feedbacks calculate & apply SIC in the descending order
Step 5: Calculate sum rate for N number of receivers and select the maximum sum rate of the best antenna

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Step 6: Taking averaging of sum rate of all antennas

Step 7: Calculate $R_{sum}^{n\times n^2} = \max_{1\le n\le N}\left(R_{Avg}^{n\times n}\right)$

V. RESULTS AND IMPLEMENTATION

This paper presents simulation results of multiple input single outputs for calculating the ergodic sum rate. In the ergodic sum rate the average of all data rates in the transmitting antenna from the base station. Ergodic capacity can be defined as the maximum average rate under an adaptive transmission strategy averaged over all channel states .

The number of antennas at the transmitter and number of users on ergodic sum rate presentation with respect to total power available at the base station. In this non orthogonal multiple access system, power allocation is essential phase of transmitting antenna selection it means the capacity of NOMA system and fairness of allocation to be enhanced from all users.

This algorithm gives a morecapacity compared to previous results and more number of users efficiently utilizescapacity using the proposed method. The user necessary to send the feedback from the base station antennas in NOMA the partial CSI is available at the transmitter. It is well known that the capacity of a wireless channel with transmit side CSI is generally higher than without it. The capacity generated by the transmitter knowledge of the channel. When the transmitter is fully aware of the channel coefficients, the maximum capacity available in the channel .

Figure 3 plots the ergodic sum rate as a function of total transmission power available at the base station for different values of N. the figure clearly demonstrates that TAS can achieve a larger ergodic sum rate than single antenna system at base station. The sum rate efficiency can be improved by using instantaneous capacity when compared to previous method. Although increasing the number of transmitting antennas N and cheek the sum rate. And also noticed that the ergodic sum rate increases with the increase in total power available at the base station.

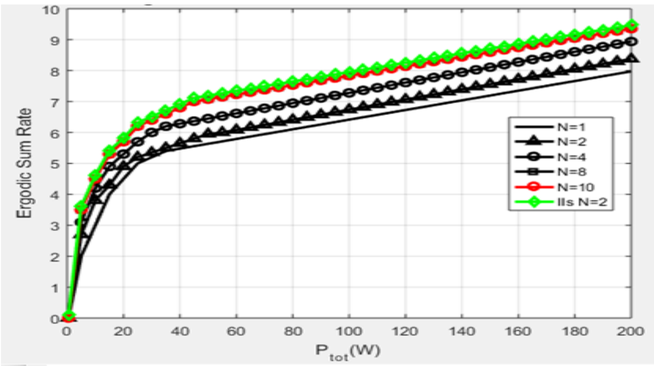

Figure 3: ergodic sum rate vs P_{tot} various values of N=2

Figure 4 represents the ergodic sum rate as a function of total transmission power available at the base station for different values of M in this figure can observe that ergodic sum rate increases with the number of users. Still it's precise only when total power available base station is relatively high. When total power is relatively low increase in the number of users increase conditioned each total power available at transmitter is low increase in number of users and decrease in the ergodic sum rate. The ergodic sum rate increases when the number of antennas at base station and number of users increases conditioned each total power available at the transmitter is high enough .

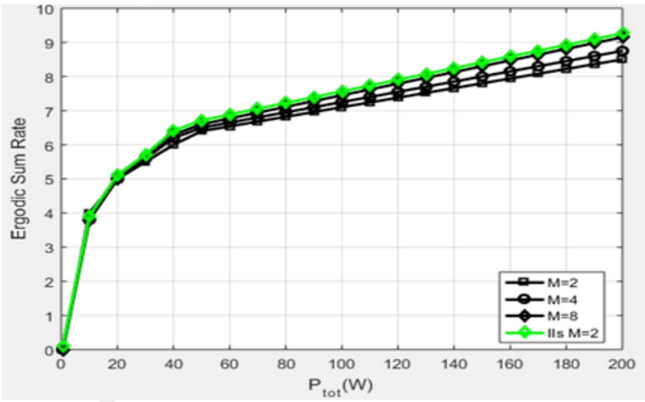

Figure 4: ergodic sum rate vs P_{tot} various values of M=2

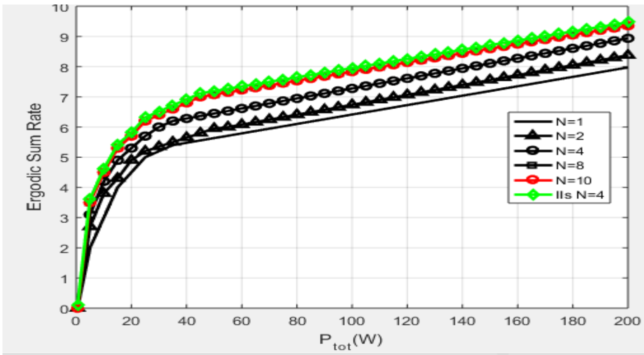

Figure 5: ergodic sum rate vs P_{tot} various values of N=4

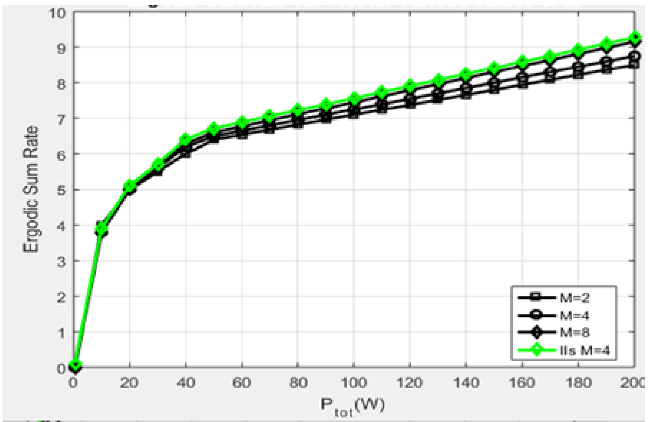

Figure 6: ergodic sum rate vs ptot various values of M=4

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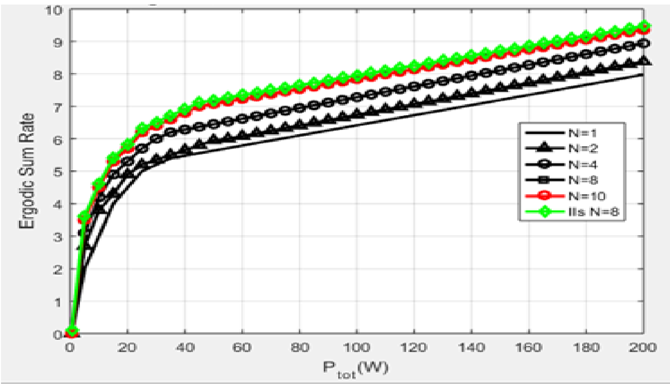

Figure 7: ergodic sum rate vs P_{tot} various values of N=8

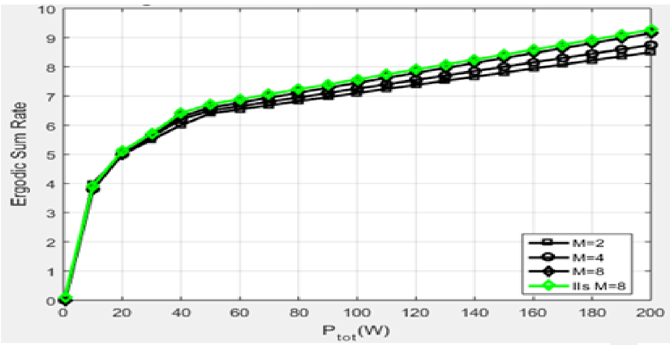

Figure 8: ergodic sum rate vs P_{tot} various values of M=8

VI. CONCLUSION

The channel capacity increases in TAS-NOMA scheme by considering the ergodic sum rate and delay is reduced and considering the ‘n’ number of receiving antennas for ‘n’ number of transmitting antennas to measure the average of the instantaneous capacity at each receiving antenna and the best antenna is selected based upon the maximum ergodic sum rate and the capacity also increased. In future, this work can be extended for massive mimo systems to increase the channel capacity.

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