International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-4, April 2019

Spatial Multiplexing in Massive MIMO with QPSK

Ch. Vandana, U.V. Sai Sasank, K. Sai kumar

Abstract: Spatial modulation is a freshly proposed multiple–antenna transmission technique. SM provides data rates are enhanced in comparison to Single Input Single Output (SISO) systems and robust error performance although a extremely low system complexity. This can be done by a effortless coding method which creates a one–to–one mapping among blocks of message (data) bits to be broadcasted and the spatial positions of the transmitter antenna in the number of antennas present in array. The mixed gain of several antenna broadcast strongly depends on spacing between broadcasting antenna and receiver antenna synchronization. Inter channel interference (ICI) can be avoided by an algorithm at the receiver. The fundamental design is to map the information block of digital data bits to two message carriers:

1) From the constellation diagram a symbol is taken.

2) In the given set of transmit antennas an exceptional antenna number of transmitting was chosen. The antenna which is transmitting has lot of information due to this the spectral efficiency was increased.

To retrieve the data block bits a maximum receive ratio combining algorithm is used at the receiver. It handles the base station which has numerous antennas in same time-frequency to provide lot of active users . Among its advantages in very short range areas the likelihood to focus energy of transmitted signal, which provides enormous progress in terms of system capacity.

In this paper, as spatial modulation and massive MIMO are having its own disadvantages we can improve their efficiency by implementing spatial modulation in massive MIMO technology with the assist of QPSK modulation technique.

Index Terms**:** ***QPSK, Massive MIMO, spatial modulation, bit error ratio***

I. INTRODUCTION

In the past years, massive multiple input multiple output has exposed as an evolving technology for wireless communication systems. Featuring up to ten multiple of hundred transmitting and receiving antennas, the opportunity of creating extremely narrow beams for many users is gaining the attraction of engineering & trading. Researchers are concentrating their efforts on promising benefits of this technology to create the future generation of communication systems. The underlying plan is to raise the antennas in count at the base station (BS) by at least two orders of magnitude.

The effects like small fading effects and additive noise caused due to increase in the number of antennas.

As we transmit information or message through all the transmitters at a single instance we face Inter Channel-Interference (ICI) in massive MIMO. So we implement spatial modulation in massive MIMO where only single antenna works at particular time while transmission to reduce ICI caused by massive MIMO. The SM principle is to transmit the information of both the active antenna index and symbol transmitted from this active antenna was illustrated. Even though we use only single antenna at a time, to improve efficiency we also increase the rate of data for faster transmission through the modulation technique (QPSK). Where QPSK broadcasts two bits per symbol while BPSK broadcast one bit per symbol. So, QPSK technique shows high data rate.

Unlike the conventional MIMO systems the selection of antenna depends on the channel states and signal strength received, but in spatial modulation antenna selection depends on arriving data stream of user.

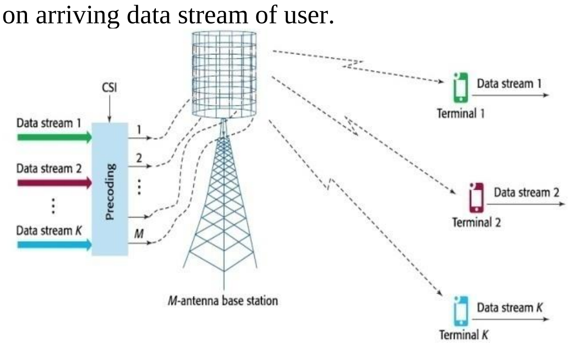

Fig 1: Massive MIMO simple model

.

II. SPATIAL MODULATION

At the transmitter, the binary source will send sequence of bits is further separated into blocks containing log2 of no. of transmitters and log2 of message bits. SM mapper, processes the information block and divides each block into two sub-blocks with log2(Nt) and log2(M) bit. To choose the antenna which is triggered ON for transmission of data whereas remaining transmit antennas are kept silent in the present signaling time interval is done by the bits which are present in first sub-block. Whereas the second sub-block bits are used to opt a symbol in the signal-constellation diagram. The signal is sent from antenna which is active and then goes through a wireless channel.

Manuscript published on 30 April 2019.
***** Correspondence Author (s)
Ch. Vandana, Electronics and communication Engineering, VBIT, Hyderabad, India.
U.V. Sai Sasank, Electronics and communication Engineering, VBIT, Hyderabad, India.
K. Sai Kumar, Electronics and communication Engineering, VBIT, Hyderabad, India.

Due to the dissimilar spatial positions taken by the transmit-antenna in the antenna-array, the dissimilar conditions of propagation are experienced by each antenna, because of emitted signal. Because one transmitting antenna will experience different propagation conditions and that antenna which is transmitting is energetic at any point of time, so only single signal will be received. The other antennas will emit no power.

The signal is detected by the receiver which is radiated from the transmitter. Impulse responses of channel (Nt Nr) needed to be expected by bank on the number of Tx's and Rx's antennas. At the receiver the detector of ML is used as stated in the ML principle, the Euclidean distance is calculated by receiver, (M Nt Nr) between the Rx signal and the wireless channel will modulate the group of probable signals and chooses the nearest one. The original bit stream can be recovered in a way that the block which is transmitted can decode all the bits.

ICI which is present at the receiver input for BPSK and QPSK transmissions can be avoided by alternative approach. The approach is to make the block of 'Nt' symbols is compressed into a single symbol prior to transmission, where the number of transmit antennas are indicated as 'Nt'. The algorithm which maintains the information which maps this single symbol to one and only one of the Nt antennas. The receiver task is twofold: Firstly the single symbol which is to be transmitted should be estimated. By mixing information and by carrying out the inverse encoding operation, the receiver is able to retrieve the entire block of 'Nt' symbols. Thereby, multiplexing gain is achieved, but ICI in the MIMO transmission is completely avoided.

Constellation point in the complex in two dimensional is represented by individual symbol which is referred as modulation of signal (signal modulation). This paper consists a fresh way is planned in which this two dimensioned plane is extended to third dimension which is named as spatial dimension. The paper contains an inventive algorithm of number detection to find transmit antenna called iterative maximum ratio combining is presented. The main theme of i-MRC is that only one antenna transmits at a time.

III. QPSK

Quadriphase shift keying is a four phase modulation scheme. The message is in binary format which contains 0's and 1's is expressed by four dissimilar phase states in the carrier signal. The phase shifting is occurred for every 90∘, i.e θ=0∘ for binary 00, θ=90∘ for binary 10, θ=180∘ for binary 01 and θ=270∘ for binary 11. It doesn't specifically matter where exactly the constellation points are situated. And a figure which contains constellation points at real axis, at 0∘ and 180∘ whereas unreal (imaginary) axis for 90∘ and 270∘. Because of this reason, it holds the maximum level of noise or alteration prior to the demodulator takes a false decision. That makes it the robust of all the PSKs. It is, able to modulate at a data rate of 2 bits/symbol with the help of four phases and so it is suitable for large data-rate applications. The constellation figure shows the signal as a two dimensional xy-plane scattered diagram in the complex planes at a symbol sampling instants. Both the BPSK and QPSK are the DSBSC modulation schemes but it differs in the sending of information where the QSPK sends 2 bits of binary information.

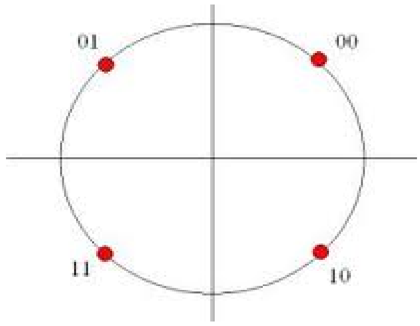

Fig 2: QPSK constellation

IV. SM IN MASSIVE MIMO

Reduce the active antenna's elements in numerical figure with the purpose of amplify the efficiency of energy and diminishing the circuit power which is utilized at the transmitter. Given the implementation and size constrains raises the number of passive elements in order to rise the both spectral efficiency by diminishing the transmit power intake. The passive elements don't need any extra power to work.

At present in spatial modulation we can alter the two dimensioned constellation into third constellation where the new dimension is called as spatial constellation. Some of the bits are mapped to the Tx's which is provided by the third dimension antenna array. So for Nt =4 we have four achievable combinations which can be plotted on spatial constellation. Only single antenna is active at one particular time, which can attain energy efficiency and we could transmit more than 2 bits for M=4 to reach the spectral efficiency. In SM-MIMO information which is carried by symbols is modulated onto two units which has information 1) PSK/QAM symbol 2) A single active transmit antenna via an information drive an antenna switching mechanism R=$\log_2(M) + \log_2(Nt)$.

The encoding mechanism of SM-MIMO is shown for Nt=4 by considering two generic channels are used, where the spatial diagram of constellation concept is also is introduced. In the implementation the rate of MIMO setup is Rsm=$\log_2(M) + \log_2(Nt)$ =4 bits per channel used, for

this reason the encoder processes the information bits in the block of 4 bits each. The activated Tx may change every channel use according to the input information bits. Thus, Tx switching is an effective way of mapping the information bits to Tx indices and of raising the transmission rate. It is worth mentioning here that the idea of raising the rate of wireless communications using TA switching has been alluded in pioneering MIMO papers under the concept of ''spatial cycling using one transmitter at a time.''

V RESULT MIMO vs. MASSIVE MIMO

Here in this project we use QPSK technique as the modulation scheme where spatial modulation is the transmission technology.

The result is plotted BER (Bit error rate) performance of spatial modulation against SNR (Signal to Noise Ratio).

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication (BEIESP)

International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-4, April 2019

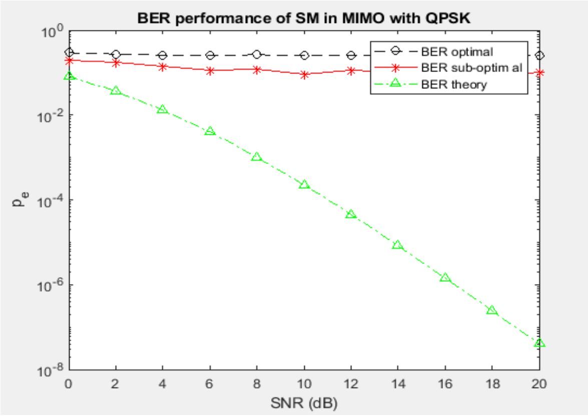

Fig 3: BER performance of SM in MIMO with QPSK

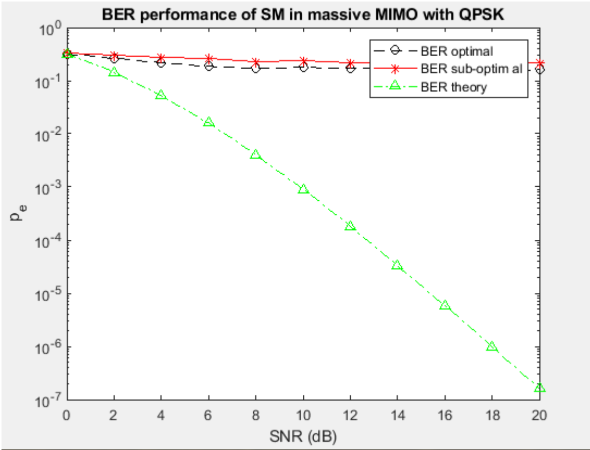

Fig 4: BER performance of SM in massive MIMO with QPSK

CONCLUSION

This paper describes the conception of SM scheme for massive multiuser MIMO system. In this scheme, the index of receiving active antenna of each user is used to communicate extra information in addition to the transmitted symbols. Simulated results displays about major increase in the system throughput are achieved as the number of available receiving antennas per user is increased. BER performances of other methods have also studied. Our results displays that for the sub channel selection method, its performance degrades with increase in number of users serviced by the BS Tx or the number of antennas which are received per user.

REFERENCES

1. E. Telatar, "Capacity of Multi-Antenna Gaussian Channels," European Transaction Telecommunication, vol. 10, no. 6, pp. 558-595, November/December 1999.
2. W. K. Wai and R. S. C. Chi-Y. Tsui, "A Low Complexity Architecture of the V-BLAST System," IEEE Wireless Communications and Networking Conference, (WCNC), vol. 1, pp. 310-314, September 2000.
3. S. Catreux, P. F. Driessen, and L. J. Greenstein, "Simulation Results for an Interference-Limited Multiple-Input Multiple-Output Cellular System," IEEE Communications Letters, vol. 4, no. 11, pp. 334-336, November 2000.
4. H. Haas, E. Costa, and E. Schulz, "Increasing Spectral Efficiency by Data Multiplexing Using Antenna Arrays," Proceedings of the International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 2002), vol. 2, pp. 610-613, September 15 - September 18 2002.
5. M. Chiani, M. Z. Win, and A. Zanella, "On the Capacity of Spatially Correlated MIMO Rayleigh-Fading Channels," IEEE Transactions on Information Theory, vol. 49, no. 10, pp. 2363-2371, October 2003.
6. RAED MESLEH, HARALD HAAS, CHANG WOOK AHN, SANGBOH YUN "SPATIAL MODULATION - A NEW LOW COMPLEXITY SPECTRAL EFFICIENCY ENHANCING TECHNIQUE" FIRST INTERNATIONAL CONFERENCE ON COMMUNICATIONS AND NETWORKING IN CHINA 2006.
7. https://www.hindawi.com/journals/ijap/2014/563273/

AUTHORS PROFILE

Ch. Vandana studying in Vignana Bharathi Institute Of Technology pursuing Bachelor Of Technology.

U.V. Sai Sasank pursuing Bachelor Of Technology in Vignana Bharathi Institute Of Technology.

K. Sai Kumar pursuing Bachelor Of Technology in Vignana Bharathi Institute Of Technology.