**IOSR Journal of Engineering (IOSRJEN)** **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 14-18

# Hybrid Index Modeling Model for Memo System with Ml Sub Detector

M. Dayanidhy[1] Dr. V. Jawahar Senthil Kumar[2]
[1]*Assistant professor, Department of ECE, Velammal Institute of Technology, Chennai - 603104, India.*
[2]*Associate professor, Department of ECE, College of Engineering, Anna University, Chennai – 600025, India.*
*Corresponding Author: M. Dayanidhy*

***Abstract:*** *In recent times, we are able to transmit data in high rate with low complexity through Multiple-input multiple-output (MIMO) based spatial modulation(SM). Here, we reduce the MIMO diversity gain by tailoring with SM systems such that it is suitable for efficient low complexity system with tolerable diversity gain. Effects of the spatial modulation are balanced by introducing SM based MIMO systems with index modulation (IM) technique.*
*Since diversity is reduced on transmitting side to balance the quality of service (QoS), we increase the accuracy in detectors by testing various detectors to achieve better performance. The efficiency of MIMO over high order constellations are verified through MATLAB BER simulation and complexity reduction is also proved to be an efficient one.*
***Keywords-*** *MIMO, spatial modulation, index modulation, bit error rate, ML detector etc.*

## I. Introduction

Technology, 4G is the fourth generation of mobile wireless standards. It is a replacement to 3G In and 2G families in general. Speed need for 4G service set the peak download speed at 100 Mbit/s for high movability communication (such as from trains and cars) and 1 Gbit/s for low movability communication (such as pedestrians and stationary users).A 4G system is familiar to provide an exhaustive and secure all-IP based mobile broadband clarification to laptop computer wireless modems, smartphones, and other mobile devices. Effortlessness such as ultra-broadband Internet access, IP transmission, gaming utility, and streamed multimedia may be implementedtocustomers.Pre-4G telecommunication such as mobile WiMAX and first-deliverance 3G Long-term progression (LTE) have been on the market since 2006 and 2009 respectively, and are often stigmatized as 4G. The current chronicle of these technologies did not accomplish the original ITU-R needs of data rates approximately up to 1 Gbit/s for 4G systems. Marketing materials use 4G as a depiction for Mobile-WiMAX and LTE in their current forms. IMT-Advanced docile versions of the above two measures are under progression and called "LTE Advanced" and "Wireless MAN" appropriately. ITU has predetermined that "LTE Advanced" and "Wireless MAN-Advanced" should be admitted the official description of IMT-Advanced. On December 6, 2010, ITU declared that current versions of LTE, WiMax and other derived 3G technologies that do not accomplish "IMT-Advanced" needs could be considered "4G", provided they represent forerunners to IMT-Advanced and "a substantial level of improvement in completion and capacity with respect to the initial third generation systems now utilized. "In all recommendations for 4G, the CDMA spread spectrum radio technology used in 3G systems and IS-95 is dissipated and regained by OFDM and other frequency-domain equalization schemes. This is joined with MIMO
Example: Multiple antennas, dynamic channel allocation and channel-dependent scheduling.

## II. Memo

In point-to-point multiple-input multiple-output (MIMO) systems, a transmitter equipped with multiple antennas communicates with a receiver that has multiple antennas. Most classic pre coding results assume narrowband, slowly fading channels, meaning that the channel for a certain period of time can be described by a single channel matrix which does not change faster. In practice, such channels can be achieved, for example, through OFDM.

### A. System Description

The block diagram of a MIMO-LTE system is shown in Fig1. Basically, the MIMO transmitter has NT parallel transmission paths which are very similar to the single antenna system, each branch performing serial-to-parallel conversion, pilot insertion, N-point IFFT and cyclic extension before the final TX signals are up-converted to RF and transmitted. It is worth noting that the channel encoder and the digital modulation, in some spatial multiplexing systems can also be done per branch, not necessarily implemented jointly over all the NT branches. The receiver first must estimate and correct the possible symbol timing error and frequency offsets, e.g., by using some training symbols in the preamble as standardized in [7]. Subsequently, the CP is removed and N-point FFT is performed per receiver branch. In this thesis, the channel estimation algorithm we proposed is based on single carrier processing that implies MIMO detection has to be done per subcarrier. Therefore, the received signals of subcarrier k are routed to the kth MIMO detector to recover all the NT data signals transmitted on that subcarrier. Next, the transmitted symbol per TX antenna is combined and outputted for the subsequent operations like digital demodulation and decoding. Finally all the input binary data are recovered with certain BER.

### B. SM Coding For MIMO

A **spatial modulation** (SM) is a method employed to improve the reliability of data transmission in wireless communication systems using multiple transmit antennas. STCs rely on transmitting multiple, redundant copies of a data stream to the receiver in the hope that at least some of them may survive the physical path between transmission and reception in a good enough state to allow reliable decoding. Space time codes may be split into two main types:

**Space time trellis codes (STTCs) distribute** a trellis code over multiple antennas and multiple time-slots and provide both coding gain and diversity gain.

**Space time block code (STBC)** act on a block of data at once (similarly to block codes) and provide only diversity gain, but are much less complex in implementation terms than STTCs.

## III. Multi-User Mimo

This is the revised version of antenna technology that boosts the communication potentialities of the discrete radio terminal used by radios by introducing multiple independent radios terminals in the network. Then the same band is used between the multiple users for transmission and reception. We have all the achievable cases of 4 bits transmission. When a single antenna is engaged then a constellation signal of 16-Quadrature Amplitude Modulation will be used in which converting bits into symbols. A couple of antennas are deployed wherein each antenna will be assigned to transfer

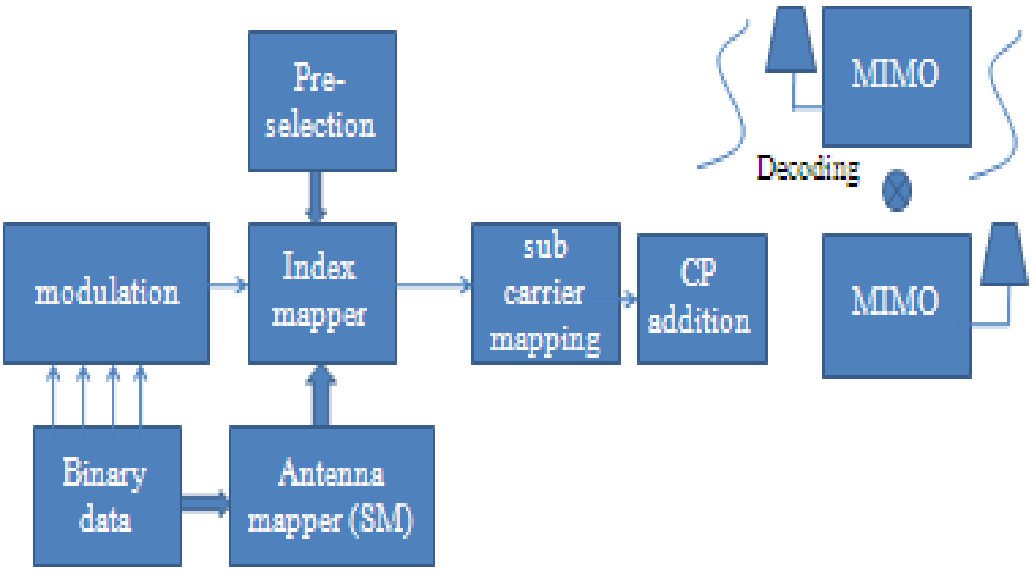


*Fig 1 MIMO Block Diagram*

A low constellation signal namely an 8-Quadrature Amplitude Modulation. The constellation order can be decreased by increasing the number of antennas. Thus, bargaining exists between the constellation signal used and the number of antennas in the network. Supposedly, any constellation signal can be used with any number of antennas. By taking benefit of the patrimonies of SM each user convert into a coded form K source bits using progression collaboration is versed by originally transferring the N1 bits of the first frame and the suggested users to detect and decode what has been initially transferred.

## IV. Performance Results

From Fig 2 with MIMO BER is reduced considerably. When number of antennas increased BER will be reduced considerably. Diversity gain can be increased by increasing antennas. When number of antennas increased BER will be reduced considerably. If we use high end mapping we need to use maximum antennas then only BER will be reduced considerably.

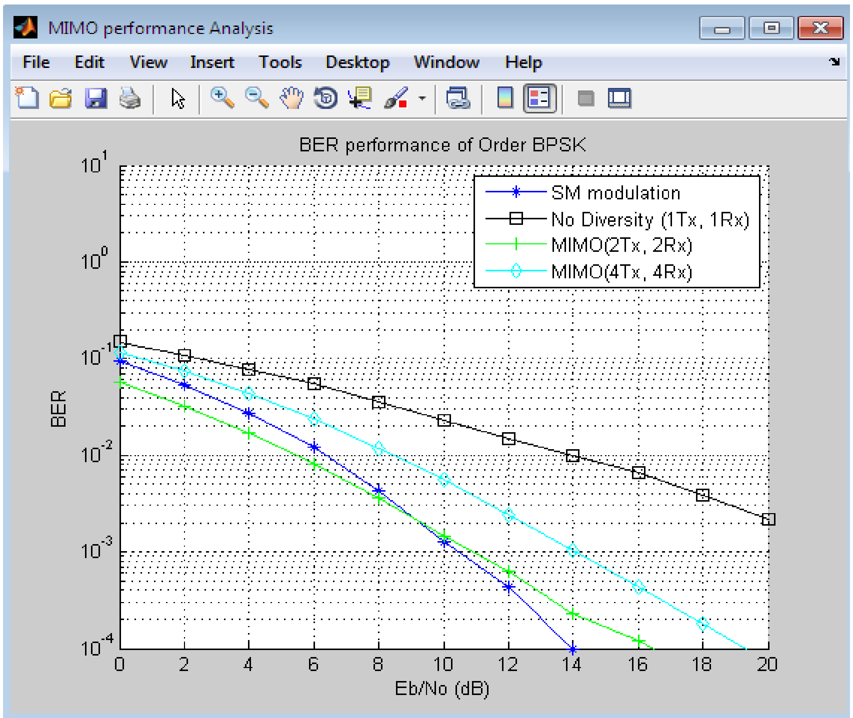


*Fig 2.* **MIMO vs IM modulation**

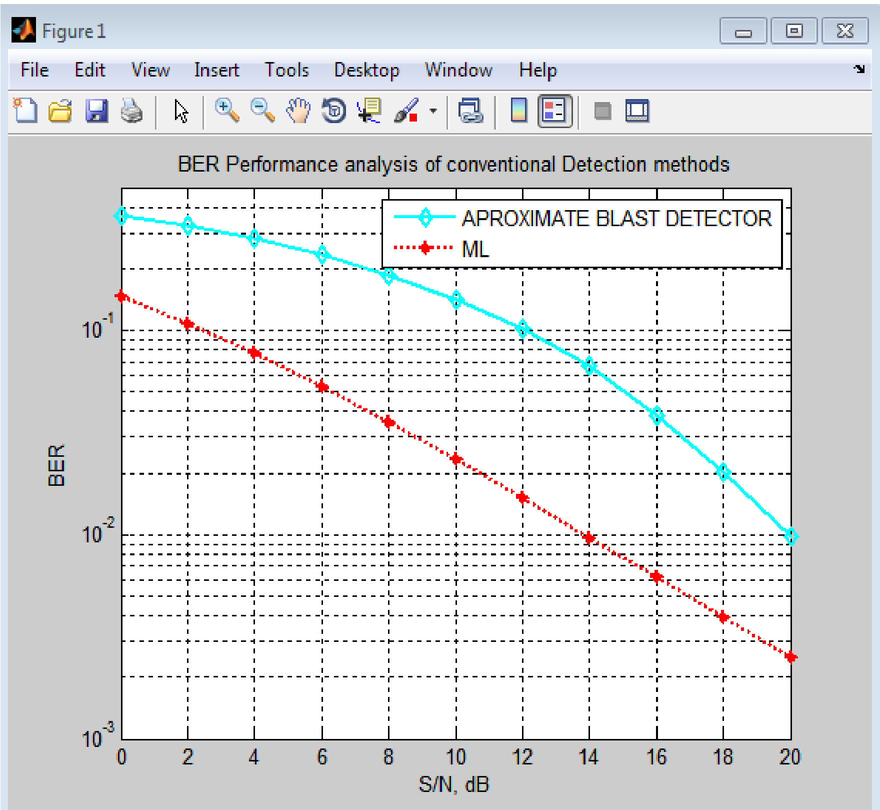

*Fig 3.* **Performance of ML over conventional detectors**

Here compared to conventional signal detector ML based approach will give better BER rate. Error rate is linearly reduced when signal energy increased. But ML will give better results in moderate SNR rate.

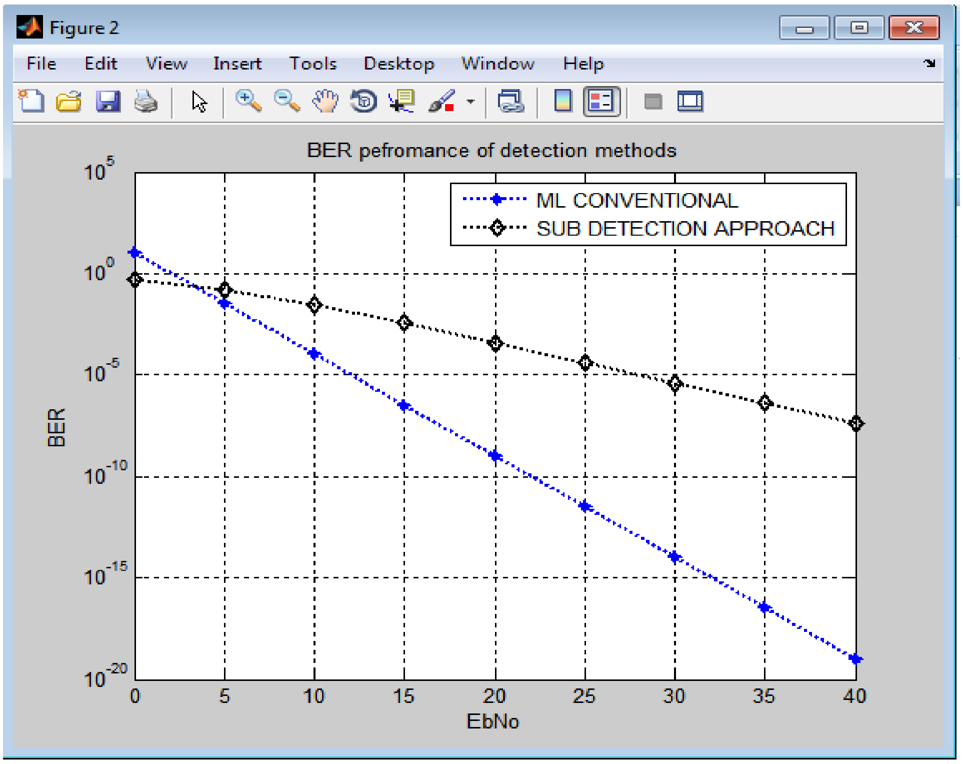


*Fig 4.* **Performance comparison of sub detector ML MIMO**

Complexity of ML detector in practical is much more than the other detectors. To reduce this complex calculation we move on to sub detection approach where the ML detector is arranged in parallel to achieve the sub detector approach. The difference between the ML detector and Sub detector approach is negligible.

## V. Conclusion

The proposed method is based on SM modulation (SM) at the source node (SN) and the information bit stream is divided into different antenna index sets: the antenna index-bits (AI-bits) as well as the amplitude (QAM-modulation) and phase modulation (PSK-modulation)-bits. First, we derive analytical expressions of the elementary Raleigh channel with different assumptions. Then, we apply the obtained expressions to calculate the theoretically achievable rates and compare them with the theoretical values of a simulated transmission. The approximations for the end-to-end SM coded bit error rate (BER) of a general cooperative MIMO scheme with multiple antenna index. Simulation results demonstrate the accuracy of our derivations for different cooperation configurations and conditions

## References


**[1].** CHAO-WANG HUANG, PANG-AN TING, AND CHIA-CHI HUANG "A Novel Message Passing Based MIMO-OFDM Data Detector with a Progressive Parallel ICI Canceller." IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 10, NO. 4, APRIL 2011.

[2]. V. Tarokh, H. Jafarkhani, and A. R. Calderbank, "Space-time block codes from orthogonal designs," IEEE Trans. Inf. Theory, vol. 45, pp. 1456-1467, July 1999.

[3]. H. Jafarkhani, "A quasi-orthogonal space-time block code," IEEE Trans. Commun., vol 49, no. 1, pp. 1-4, Jan. 2001.

[4]. V. Tarokh, A. Naguib, N. Seshadri, and A. R. Calderbank, "Combined array processing and space-time coding," IEEE Trans. Inf. Theory, vol. 45. pp. 1121-1128, May 1999.

[5]. A. F. Naguib, N. Seshadri, and A. R. Calderbank, "Applications of space-time block codes and interference suppression for high capacity and high data rate wireless systems," in Proc. 32nd Asilomar Conf. Signals, Syst. Comput., pp. 1803-1810, 1998

[6]. A. Stamoulis, N. Al-Dhahir and A. R. Calderbank, "Further results on interference cancellation and space-time block codes," in Proc. 35th Asilomar Conf. Signals, Syst. Comput., pp. 257-262, Oct. 2001.

[7]. J. Kazemitabar and H. Jafarkhani, "Multiuser interference cancellation and detection for users with more than two transmit antennas," IEEE Trans. Commun., vol. 56, no. 4, pp. 574-583, Apr. 2008.

[8]. J. Kazemitabar and H. Jafarkhani, "Performance analysis of multiple antenna multi-user detection," in Proc. 2009 Workshop Inf. Theory Applications, Feb. 2009.

[9]. A. Scaglione, P. Stoica, S. Barbarossa, G. Giannakis, and H. Sampath, "Optimal designs for space-time linear precoders and decoders," IEEE Trans. Signal Process., vol. 50, no. 5, pp. 1051-1064, 2002.

[10]. D. Love and R. J. Heath, "Limited feedback unitary precoding for orthogonal space-time block codes," IEEE Trans. Signal Process., vol. 53, no. 1, pp. 64-73, 2005.

[11]. A. Ghaderipoor and C. Tellambura, "Optimal precoder for rate less than one space-time block codes," in Proc. IEEE International Conf. Commun., Glasgow, Scotland, June 2007.