Proceedings of the 13th INDIACom; INDIACom-2019; IEEE Conference ID: 46181
2019 6th International Conference on "Computing for Sustainable Global Development", 13th - 15th March, 2019
Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA)

Signal Detection Techniques for Spatially Multiplexed MIMO Systems

A. Udawat
Department of ECE, Acropolis Technical Campus
Indore, INDIA
Email Id: amitudawat@gmail.com

S. Katiyal
SOE, DAVV, Indore, INDIA
Email Id: sumant578@yahoo.com

P.C. Sharma
SDBCT, RGPV, Indore, INDIA
Email Id: pc_sharma47@yahoo.com

Abstract—In this article signal estimation techniques for Spatially multiplexed MIMO (SM-MIMO) systems are exploited. MIMO systems with spatial multiplexing can transmit data at high rate than similar systems equipped with antenna diversity techniques. The signal detection using Spatial multiplexing is a difficult task at the receiver side in present scenario of Wireless Communication System. A variety of signal estimation techniques have been discussed, analyzed and compared under different channel conditions. Exploitation of diversity is also taken into consideration and improvement in performance of system is observed. The results have been obtained by plotting the SNR and BER curves for various techniques. In this paper various expressions of BER performance for hard and soft decisions have been presented and comparative analysis for various parameters like quantity of antennas and *SNR* values have been performed for system improvement. Simulation outcomes reveal that the improvement can be enhanced by varying the selected antennas and *SNR* of the system.

Keywords—SM-MIMO; SNR; SVD; SNR; BER.

I. Introduction

The wireless systems equipped with spatially multiplexed MIMO (SMMIMO) antenna systems plays a vital role in delivering superior data rate and increased reliability with space time coding. These are used for variety of applications like 802.11n (modern Wi-Fi Routers), 802.16e (Wi-Max), LTE (4G) etc. The design of detection scheme at the receiver with high throughput and low complexity is a major challenge in SMMIMO systems. In spatial multiplexing (SM) technique multiple transmit antennas transmit separately encoded data signals called streams within the bandwidth of operation [1-3]. At the receiver one can separate the data streams. In addition to it the same channel quality will be experienced by each data stream as would be experienced in case of signal input single output (SISO) stream. This in effect enhances the system capacity and multiplies it equivalent to count of streams. Specifically the MIMO channel reliably supports data streams equal to the smallest of the count of transmit and receive antennas i.e., $min(N_t, N_r)$. The capacity of the wireless channel can be increased by spatial multiplexing gain. In MIMO detection various techniques like Linear detection, Successive Interference Cancellation (SIC) detection, Maximum Likelihood (ML) detection and Sphere decoding methods are popular [4,5]. MIMO detection techniques can be further classified into hard decision and soft decision detection techniques [5]. This paper presents and evaluates the performance of linear signal estimation methods which incorporates the zero forcing (ZF) technique and minimum mean square error (MMSE) technique. The ZF technique of equalization with Successive Interference Cancellation (ZF-SIC) and with Optimal Order is analyzed and simulated for performance improvement. The channel model assumed is flat fading Rayleigh multipath channel with BPSK modulation. The MIMO model under consideration is 2×2 MIMO. The mathematical model of system under analysis is presented along with detection algorithms applied under various BER and different *SNR* values. Simulation results are obtained to validate the improvement in performance of detection techniques.

Section-II presents system model for MIMO antenna configuration and detection algorithms are applied for the same. In Section-III various illustrative simulation results are presented for various detection techniques. The parameters considered are the number of selected antennas and *SNR* values with optimal antenna selected method and sub-optimal method. Finally the paper is concluded in section IV with list of references.

II. MIMO System Model

A. System Model

One can consider a $(N_r \times N_t)$ MIMO communication system using N_t transmit and N_r receive antennas with complex MIMO channel matrix H of dimension $(N_r \times N_t)$ as evident in Figure 1[5,6].

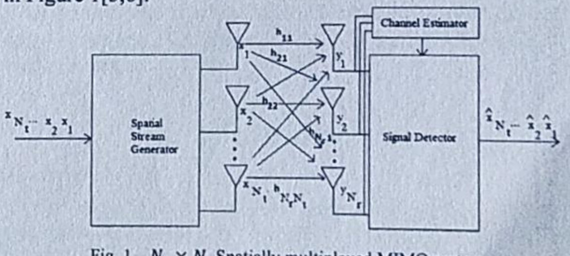

Fig. 1. $N_r \times N_t$ Spatially multiplexed MIMO system

One can represent the spatially multiplexed user data N_t dimensional transmitted symbol vector as