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Improvement of Symbol Error Rate Performance in Spatial Multiplexing Systems Using Transmit Antenna Selection

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Abstract—In this paper, we consider $M_t \times M$ system ($M_t > M$), where M_t and M are the numbers of antennas at the transmitter and receiver, respectively. We select M out of M_t transmit antennas using two different antenna selection schemes. In scheme 1, we select the subset of M antennas out of total $\binom{M_t}{M}$ subsets. In the selected subset, the minimum SNR is maximum compared to minimum SNR of all the remaining subsets. In scheme 2, M_t available transmit antennas are divided into M_{tg} disjoint groups of successive antennas, where $M_{tg} = M_t / N$. It means that there are N antennas in each group, where $N \le M$. Further both M_t and M are divisible by N and the total possible combinations of available groups are given as $\binom{M_{tg}}{C}$, where $C \in \{1, \ldots, M_t / N\}$.

Then we select the subset of M antennas out of total $\binom{M_{tg}}{C}$ subsets. In the selected subset, the minimum SNR is maximum compared to minimum SNR of all the remaining subsets. In this scheme, N and C are chosen to meet the requirements of M selected antennas for transmission. After antenna selection, the resulting system will be $M \times M$. We use Minimum Mean Square Error (MMSE) Vertical Bell Laboratories Layered Space Time (VBLAST) detection at the receiver for both the antenna selection schemes. We present MIMO Symbol Error Rate (SER) versus MIMO Symbol SNR using simulations for M-QAM constellations with Rayleigh fading channels. We have compared the performance of the considered systems with prevailing high complexity schemes ML and MMSE Improved VBLAST. The considered scheme 1 with MMSE VBLAST outperforms the prevailing schemes while scheme 2 with MMSE VBLAST provides similar performance in a wide range of SNR compared to prevailing schemes. However, the number of feedback bits used in scheme 2 is less as compared to scheme 1. There is a tradeoff between the SER performance and the number of required feedback bits. As N decreases, scheme 2 performance starts moving towards the performance of scheme 1. Both the systems provide the diversity gain in the fading channel.

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1. INTRODUCTION

Wireless communication has created revolution changes in the human life, in particular due to mobile communications. The mobile communication over wireless channel gives rise to a number of challenges because of several factors such as channel fading, the limitation of power resources, especially on mobile terminals, the limited availability of the Radio Frequency (RF) spectrum, etc.

One of the available technologies to overcome the challenges and fulfill the demands is exemplified by a multiple input multiple output (MIMO) system, i.e. the use of multiple antennas at both the transmitter and the receiver. The benefits of MIMO systems are realizable when the channel state information (CSI) is available at both the transmitter (i.e. CSIT) and at the receiver (i.e. CSIR). There are two approaches to get CSIT [1]. First approach is through the channel reciprocity and the other one is through the feedback to the transmitter via a dedicated channel. To reduce the prerequisites of numerous RF chains without sacrificing

ADDITIONAL INFORMATION

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