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A Comparative Study of Adaptive Modulation and Joint Temporal Spatial Power Allocation for STTC and OSTBC MIMO Systems with Imperfect CSI

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Abstract

In this paper comparison of space time trellis coded (sttc) and orthogonal space time block coded (ostbc) MIMO systems with imperfect channel state information is done. It is proposed a novel adaptive transmission scheme for space-time coded multiple-input multiple-output beam forming systems with imperfect channel state information at the transmitter, of which the signal constellation, total transmit power (temporal power), and power allocation among Eigen beams (spatial power) are jointly adapted to maximize the average spectral efficiency, subject to a target bit-error-rate and an average power constraint.. By introducing a new variable, called as effective signal-to-noise-to-modulation ratio (ESNMR), it is derived a rate-selection policy by partitioning the range of the ESNMR with an optimal set of thresholds. Graphical results demonstrate that the sttc adaptive transmission scheme yields a significant performance gain over ostbc adaptation systems.

Keywords: *Adaptive modulation, orthogonal space-time block coding (OSTBC), multiple-input multiple-output (MIMO), beam forming, imperfect CSI, power allocation.*

1. Introduction

In this paper, we develop optimal AM schemes for STTC &OSTBC MIMO systems with joint spatiotemporal power allocation under imperfect CSI. The constellation size, total transmit power and spatial power allocation parameters are jointly optimized to maximize the average spectral efficiency (ASE), subject to a target BER and an average power constraint. The initial formulation seems to be complicated. However, by introducing a new variable, called as effective signal-to-noise-to-modulation ratio (ESNMR), we can modify the original problem as an inner-outer optimization problem resulting in an efficient solution. Employing this variable, we can derive a rate-selection policy by partitioning the range of the ESNMR with optimal thresholds. A closed form temporal power control policy and a simple spatial power allocation algorithm are also obtained. The complexity of the proposed variable-rate and variable-power adaptation algorithm is reduced to one-dimensional root-finding of a monotonic function.

In this paper we are comparing the performance of adaptive modulation and joint temporal spatial allocation for STTC and OSTBC MIMO systems with imperfect CSI. Comparison is done with respect to BER, ASE and throughput.

2. System description

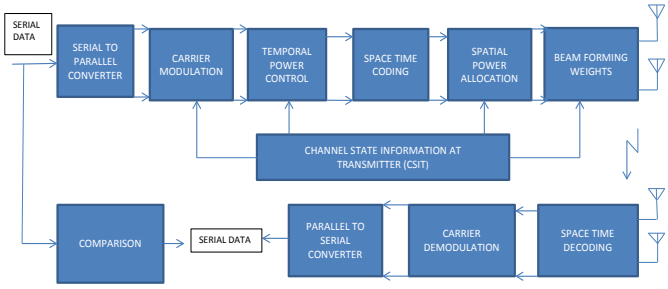

Fig. 1 System diagram.

A wireless multi-antenna communication system with N_t transmit antennas and N_r receive antennas is considered. Serial data converted to parallel. Adaptive modulation i.e. QAM/PSK is used.STTC (Space-Time-Trellis-Coding) and STBC (Space Time Block Code) is used. Both temporal and spatial power allocation is considered. Beam-Forming weights are computed. Space-Time decoding is performed at the receiver (corresponding to whether trellis coding or block coding is used at the transmitter). Carrier demodulation is performed. Parallel data is converted to serial data. Serial data at the input and output of the system is compared for plotting different graphs

3. Results

Result shows the comparison between space time trellis coded (sttc) and orthogonal space time block coded (ostbc) MIMO systems with imperfect channel state information. Here three graphs are shown, i.e. SNR vs.BER, SNR vs. ASE, SNR vs. Throughput. It can be seen that sttc system is better than ostbc system

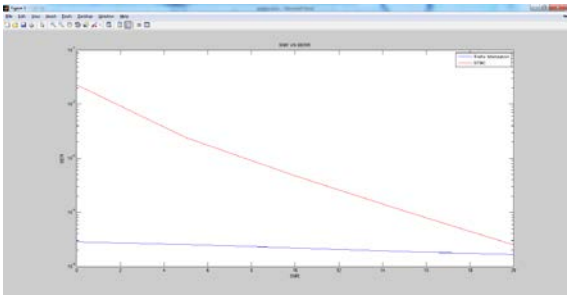

Fig. 2 SNR vs. BER

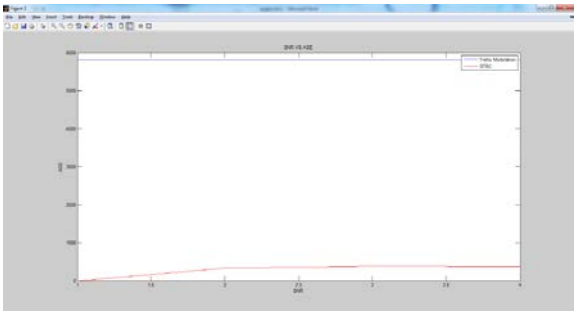

Fig. 3 SNR vs. ASE

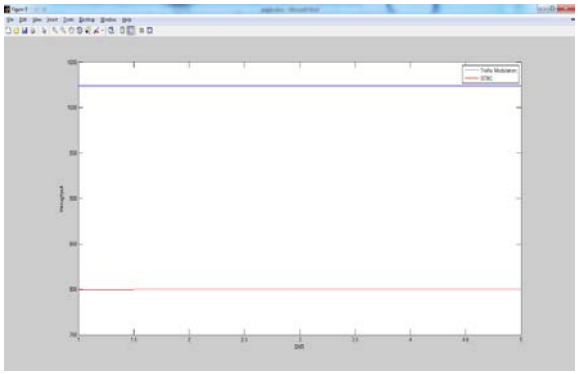

Fig. 4 SNR vs. Throughput

4. Conclusions

Adaptive Modulation and Joint Temporal Spatial Power Allocation is proposed for STTC & STBC MIMO Systems with Imperfect CSI.The proposed transmitter is expected to adjust the signal constellation, temporal power, and spatial power allocation to maximize the ASE subject to a target BER and an average power constraint. We compare the performance of adaptive modulation and joint temporal spatial allocation for STTC and OSTBC MIMO systems with imperfect CSI. Comparison is done with respect to BER, ASE and throughput and performance of STTC system is found to be better.

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