EE 6880: Topics in Signal Processing - Space-time Coding and Signal Processing for Wireless Communications

Assignment #3: Due Tuesday, November 5.

In this assignment, you will investigate the bit error rate (BER) performance of several space-time block codes and compare it with BLAST systems in block fading channels, with both independent and correlated fading. (As in Assignment 2, for correlated fading channel, you can use the correlation model you built in Assignment 1.)

- $n_T = n_R = 2$ and transmission rate $R = 2$ bits/s/Hz. This can be achieved either using a BLAST system with BPSK modulation, or using Almouti code $\mathcal{O}_{c,2}$ with QPSK modulation. Compare the BER performance of these two systems under both perfect channel state information and estimated channel state using the channel estimator you wrote in Assignment 2.

- $n_T = 4$, $n_R = 1$ and transmission rate $R = 2$ bits/s/Hz. This can be achieved using the rate-$\frac{1}{2}$ code $\mathcal{G}_{c,4}$ with 16-QAM modulation. Investigate the BER performance of this system under both perfect and estimated channel station information, and compare it with that of the above two systems.

- $n_T = n_R = 3$ and transmission rate $R = 3$ bits/s/Hz. This can be achieved either using a BLAST system with BPSK modulation, or using the rate-$\frac{3}{4}$ code $\mathcal{H}_{c,3}$ with 16-QAM modulation. Compare the BER performance of these two systems under both perfect and estimated channel state information.

- $n_T = 2$, $n_R = 1$ and transmission rate $R = 1$ bit/s/Hz. This can be achieved using the coherent Alamouti code with BPSK, the differential Alamouti code with BPSK, i.e., the equivalent (4,1) cyclic group code $\left\langle \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \right\rangle$, or the (4,1) or (4,3) cyclic group code. Compare the BER performance of these four schemes.