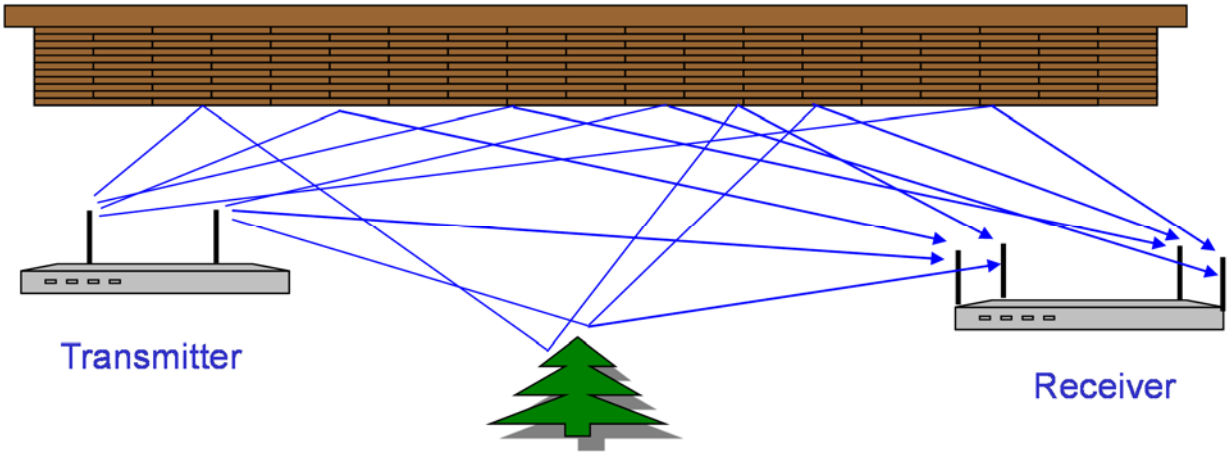
Principles of Wireless Communcations

Lab 2 Part (b)

MIMO Channels

Due 3/4/2015



Overview

You have seen how multiple antennas can be used to support multiple simultaneous users communicating in the same frequency band. Multiple antennas can also be used to increase data rates between pairs of users, if both users have multiple antennas each.

In this assignment, you will implement via simulation, two approaches to data communications using multiple antenna channels. We shall assume that our transmitter has 4 antennas and our receiver also has 4 antennas.

You will consider two different transmission and reception strategies. The first is the case when the transmitter does not know the channels between its antennas and the antennas of the receiver, and the second case, where the transmitter knows the channels between itself and the antennas of the receiver. All channels can be assumed as flat fading with timing synchronized.

The Assignment

1. *Using the MATLAB function (encrypted) MIMOChannel4x4 to simulate a 4x4 channel with additive noise. Design transmit signal vectors that can communicate BPSK data (e.g. using pulses of heights 1 and -1), through the MIMO channel. The transmitter cannot use any channel coefficients that you estimated.*
2. *Repeat the above for the case that the transmitter does know the channel coefficients of the 4x4 channel. You should use appropriate transmit and receive processing to effectively parallelize the*

channels between the transmitter and receiver. You can call the MIMOChannel4x4 function multiple times to do the channel estimation and data transmission separately. Note that you can just "pass" the channel coefficients from the transmitter to the receiver in your code.

3. *Qualitatively, and quantitatively compare the resulting signals in the previous two parts. The quantitative comparison should include an estimate of the signal to noise ratio using both strategies.*

The writeup should include all code, and relevant plots to illustrate that you are able to recover the 4 data signals from the transmitter. You should clearly explain with the aid of equations, all steps you took in recovering the signals.