

## Next wireless mini-matlab, MIMO/OFDM, Due Wed 4/13

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Posted in group: **wirelessComms\_2016**

Sending this out now in case you want to get a head start. Some of this won't make sense but will after lecture.

MIMO and OFDM form the basis of pretty much every modern wireless standard, so you need to do a bunch of stuff.

Part 1, MIMO:

Model a 2x2 MIMO link, with flat fading gains. You are to 3 different things, Pre-coding, Zero-Forcing and MMSE. Pre-coding has CSIT, where Zero-Forcing and MMSE only CSIR.

Try 3 different flat fading MIMO channels, and add some white Gaussian noise. I'm not interested in a BER plot here. I want you to select a realistic BER target for all 3 schemes, and then try to maximize your data rate for each of the channels you drew. (i.e. you can pick a different QAM for each channel, and for each MIMO method). Which channels can you get the most data through and why? Which method (pre-coding, ZF, or MMSE) works the best?

Be careful using the AWGN function here because remember that each of the individual channels in the MIMO is going to have a different path gain, and thus the SNRs on each path will be different. So if you just use AWGN with the 'measured' flag, you will break the whole frigging thing. Think about why that is true. So either use AWGN and specify the signal power, or just use WGN or RANDN to generate some white Gaussian noise with a fixed power.

Part 2: OFDM

Model the 802.11a OFDM symbol (its in the Goldsmith book). Create 3 different channels, this time single path, but frequency selective. Implement zero-forcing and MMSE equalizer, and as before, see how much data you can get through all 3 channels at some target BER. You can assume perfect CSIR.

Part 3: Put it all together. Take the OFDM symbol and put it through a 2x2 frequency selective MIMO link. You can assume perfect CSIT or CSIR, whichever you want. The magic of OFDM and MIMO is the frequency selective MIMO channel just becomes a bunch of independent flat fading MIMO channels. I uploaded a document, mimo-ofdm.pdf, in that document somewhere explains how this magic all works.

If you do either part 1 or part 2. You get a C. If you do both part 1 and 2, you get a B. If you do all 3 parts, you get an A, and you can consider yourself well prepared for a career in wireless communications.

This is due **Wed 4/13**

-Sam

