

NSCAP @CS.NYCU

Lab6: OFDM Simulation
Instructor: Kate Lin

Source Code

- SISO OFDM:
https://warpproject.org/trac/browser/ResearchApps/PHY/WARPLAB/WARPLab7/M_Code_Examples/wl_example_siso_ofdm_txrx.m
 - Set `USE_WARPLAB_TXRX = 1;`
- Generate frequency-domain channels and noise
 - Call `h_gen(yourID)` to generate the input file `input.mat` (simulated channels and noise vector)
 - Note: we will test your code using a different seed and different SNR configurations. However, your report should be written using the input generated by `h_gen(yourID)`

Tasks (code)

1. Load the channel state information and noise vector from `input.mat`
 - `H(1:32)` is the real-value channel of subcarriers (0:31) while `H(33:64)` is the channels of subcarriers of (-32:-1)
2. Apply the frequency domain channel
 - Just apply $H(i)$ to data point $X(i)$
3. Add the noise vector, `n_vec`, to the time-domain signals
4. Calculate the average SNR(dB) of each data subcarrier (16QAM)
5. Calculate the average SNR(dB) of all the data subcarriers
6. Calculate the bit error rate of each subcarrier (16QAM)
7. Try different modulations and output the throughput of the optimal modulation
 - symbol duration is 4us, no coding scheme

Tasks (report)

1. Output the estimated channels of data subcarriers
2. Plot the power of channel responses of the data subcarriers and output which one experiences the minimum receiving power
 - X-axis: index of subcarrier, y-axis: $|H|^2$
3. Output the average SNR(dB) of each subcarriers (16QAM)
4. Output the average SNR(dB) of all the data subcarrier (16QAM)
5. Output the bit-error rate of each subcarrier (16QAM)
6. Plot the throughput of each modulation
 - X-axis: modulation, y-axis: throughput
7. Plot the constellation diagram of 16QAM and mark the erroneous sample as the green dots

Modifications

- Some modification you may need to do for finishing the lab.
 - remove power scaling (line 235: `tx_vec_air = TX_SCALE .* tx_vec_air ./ max(abs(tx_vec_air));`)
 - scale `raw_rx_dec` by 1/2 (change line 294 to `raw_rx_dec = raw_rx_dec(1:2:end)/2;`)
 - You may have to modify the length of the noise vector when you change the modulation order
 - You may need to modify channel estimation

Submission

- Upload your files to E3
 - Report:
`report_(yourID).pdf`, e.g., `report_111111.pdf`
 - Code: `wl_example_siso_ofdm_txrx_(yourID).m`

Grading Policy

- Deadline – **2022.05.29 23:59** (by Sunday night)
- Grade
 - code correctness - 40%
 - Report - 60%
- Late Policy
 - $(\text{Your score}) * 0.8^D$, where D is the number of days over due
- Cheating Policy
 - Academic integrity: Homework must be your own – cheaters share the score
 - Both the cheaters and the students who aided the cheater equally share the score