

MATLAB Assignment-2

*Matched filtering and effect of noise on constellation**March 2025*

The objective of this assignment is to implement matched filtering and see the effect of noise on received constellation.

1. Generate a 600-bit bit sequence $b[n] \in \{0, 1\}$ for $n = 1, \dots, 600$.
2. Modulate it using QPSK modulation scheme.
3. Pulse shape the above modulated symbol streams using the square root RC (SRRC) pulse. You could either use inbuilt MATLAB command or implement it yourself (check wikipedia) You will have to do this as follows
 - (a) Generate samples of SRRC pulse such that it has 12 samples/symbol. You should truncate this pulse such that it only extends to 6 symbols on both sides of the main symbol.
 - (b) Separately up-sample the QPSK symbol stream by a factor of 12 i.e., insert 11 zeros between every symbol. This ensures that the symbol stream and the SRRC pulse are sampled at the same rate.
 - (c) Convolve the symbol stream and the SRRC pulse. This is transmit pulse shaping.
 - (d) Add complex AWGN noise to above pulse-shaped transmit stream. MATLAB generate complex AWGN noise such that each of its component has unit variance. Change the variance such that you observe SNR of 10 dB.
 - (e) Convolve the noisy symbol stream again with SRRC pulse. This is receive matched filtering.
 - (f) Downsample the received stream such that it has only one sample per symbol. You need to decide the start of downsampling process such that you pick the cleanest sample per symbol. You can decide this start by visually looking at the constellation point obtained after downsampling. You can fix this starting point for plotting constellations for different SNR values in the next question.
 - (g) Plot the noisy receive constellation. You see the effect of noise by changing the aforementioned SNR. Write the code such that it generates received constellations plot for 6 dB, 8 dB and 10 dB.
4. You should structure your code as follows.
 - Write a file main.m and within that write separate MATLAB functions for the following
 - (a) QPSK modulation.
 - (b) Generating SRRC pulse shape.
 - (c) Transmit pulse shaping.
 - (d) Receive matched filtering and down sampling.

- Sequentially call these functions in `main.m`, which should do the aforementioned tasks. Any other tasks not mentioned above should be included in `main.m`

Please follow these Coding instructions:

- Properly comment your code.
- Code should execute and generate the desired output.
- Your submission should be self-contained (should include all the files required for running it).
- Avoid hard-coding the values of the variables for specific configurations. Code should be generic.

Please follow these submission instructions.

- Deadline is Mar. 9th, 11:59 pm.
- All codes should be in one `.zip/.rar` folder, and submit one zip file.
- Name your code as `rollno.zip`. and upload your properly commented in drive link below.
<https://tinyurl.com/d4wjyvcp>
- Please do not mail your file to us.

Please also read this carefully.

- Each one of you have to individually do all the reading and MATLAB assignments. You can discuss with your friends but you will have to completely write your own code.
- Copying also means sharing your code with some else for them to copy. We will not differentiate between two acts, and both such cases will be awarded zero. Our decision will be final.