



## Course project

Using Octave (Not Matlab) simulator, you must develop the following simulations.

### Part I

#### Line coding system

- **Transmitter:**

1. Generate stream of random bits (10,000 bit) (This bit stream should be selected to be random, which means that the type of each bit is randomly selected by the program code to be either '1' or '0').
2. Line code the stream of bits (pulse shape) according to Uni-polar non return to zero (Supply voltages are: +1.2 V and -1.2V).
3. Plot the corresponding Eye diagram.
4. Plot the spectral domains of the pulses (square of the Fourier transform).

- **Receiver:**

5. Design a receiver which consists of a decision device. (The decision device has two inputs: received waveform).
6. Compare the output of the decision level with the generated stream of bits in the transmitter. The comparison is performed by comparing the value of each received bit with the corresponding transmitted bit (step 1) and count number of errors. Then calculate bit error rate (BER) = number of error bits/ Total number of bits.
7. Repeat the previous steps for different line coding (**Polar non return to zero, Uni-polar return to zero, Bipolar return to zero and Manchester coding**)
8. Add noise to the received signal (Hint: use  $n = \sigma * \text{randn}(1, \text{length}(t))$ ), where  $t$  is time vector and  $\sigma$  is the noise rms value).
9. Sweep on the value of **sigma** (10 values ranges from 0 to the maximum supply voltage) and calculate the corresponding BER for each value of **sigma**.
10. Repeat the previous steps for different line coding and plot **BER** versus **sigma** for the different line coding in the **same** figure, where y-axis is in the log scale (Hint: use semilogy).
11. **(Bonus)** For the case of **Bipolar return to zero**, design an error detection circuit. Count the number of detected errors in case of different number of sigma (Use the output of step 8).



## Part II

Using the previous codes, you can implement binary phase shift-keying BPSK transmitter and receiver.

- **Transmitter:**

1. Generate stream of random bits (100 bit) (This bit stream should be selected to be random, which means that the type of each bit is randomly selected by the program code to be either '1' or '0'.)
2. Line code the stream of bits (pulse shape) according to Polar non return to zero (Maximum voltage +1, Minimum voltage -1).
3. Plot the spectral domains.
4. Plot the time domain of the modulated BPSK signal ( $f_c = 1GHz$ ).
5. Plot the spectrum of the modulated BPSK signal.

- **Receiver:**

6. Design a receiver which consists of modulator, integrator (simply LPF) and decision device.
7. Compare the output of decision level with the generated stream of bits in the transmitter. The comparison is performed by comparing the value of each received bit with the corresponding transmitted bit (step 1) and count number of errors. Then calculate bit error rate (BER) = number of error bits/ Total number of bits.

Note:

1. Maximum number of students is 10.
2. Cheating = 0.
3. Deadline : 30/5/2023.