통신공학 (51437-002)

-Project-

Submit the report including Matlab codes and graphs (Due: 2019. 6. 13).

1. (Central-limit theorem) Generate a standard Gaussian distribution according to the following procedures.

A. Generate *100* uniform random variables (RVs) (hint: use the *rand* function)
B. Calculate the sum of the generated RVs and save it as a new RV.
C. Generate 1000 RVs according to Steps A and B.
D. Calculate the mean and variance of the above RVs (hint: use the *mean* and *var* functions) and compare them with theoretical results.
E. Normalize RVs to make their mean 0 and variance 1.
F. Plot the CDF of the RVs and compare it with the CDF of a standard Gaussian distribution (hint: use the *erfc* function).
G. Use a binomial RVs instead of uniform RVs in Step A (hint: use the *rand* function and the definition of binomial distribution).

2. (AWGN) Generate an addictive white Gaussian noise (AWGN) with variance N0.

A. Generate 1000 Gaussian RVs whose variance is N0/2 (Use the *randn* function).
B. Repeat Step A to generate 1000 Gaussian RVs again.
C. Consider the generated RVs of Steps A and B as in-phase and quadrature components of AWGNs. Draw these AWGN in two-dimensional plane.
D. Calculate its average energy with and compare it with N0.
E. Plot the CDF of the noise energy and compare it with the CDF of the exponential distribution with mean N0.

3. (Error Probability) Plot the bit and symbol error probabilities of BPSK and QPSK under different Eb/N0 (-6dB to 8dB) according to the following procedures.

A. Generate a binary sequence whose 0 and 1 probabilities are equal to 1/2 (hint: use a *rand* function).
B. Given Eb/N0, calculate the corresponding Eb and N0 (Hint: dB scales must be converted into linear scales).
C. Given the bit energy of Eb, generate baseband modulated signals. Use a gray coding.
D. Add AWGN noises with variance N0 (use the codes in Problem 2).
E. Estimate the transmitted bits according to the optimal detection rule.
F. Calculate the error probability by comparing the estimated bits with the transmitted bits.
G. Repeat Steps A to F by changing Eb/N0 and plot BER and SER (hint: use the semilogy function)
H. Compare the results of the theoretical ones (Hint: use the *erfc* function).