

Chapter 8 MATLAB Problems

- 8.1 Consider a barrel of resistors whose values are uniformly distributed from 900 to 1100 ohms. You draw several sets of five resistors and calculate their respective mean and standard deviations m_{R_j} and σ_{R_j} . Demonstrate the validity of the central limit theorem by showing that the resistor mean value of each set converges to a gaussian PDF. How many sets of five will produce a nearly a reasonably good PDF?
- 8.2 Eq. (19) of Sect. 8.4 states that the PDF the sum of random variables converges to a gaussian PDF regardless of the PDFs of the individual components. Demonstrate the validity Eq. (19) by showing that $p_Z(x)$ will converge to a gaussian PDF if the $p_{x_i}(x_i)$ is an exponential PDF.
- 8.3 Simulate the channel for Prob. 8.4-14 and determine how many trials are required such that average simulated BER (P_{be}) is within 1% of the calculated P_{be}
- 8.4 Repeat 8.3, using the channel of Prob. 8.4-15
- 8.5 You have a radar system that is to detect a target. The ambient signal is zero mean gaussian noise with $\sigma = 2$. The target under noiseless conditions has a level of A_c volts. The goal for the system is to have the probability of false alarm $P_{FA} = 10^{-7}$, but target detection probability $P_D = 0.9902$. Write a program to generate a set of curves of threshold point V_T versus $10\log_{10}(A_c^2/\sigma^2) = 0$ to 10 dB. Note the probabilities of false alarm and detections are defined as $P_{FA} = \int_{V_T}^{\infty} p_{X_0}(x)dx = 0.001$ and $P_D = \int_{V_T}^{\infty} p_{X_1}(x)dx$ respectively. Note the traditional **receiver operating curve** (ROC) is a plot of P_D versus P_{FA} .