Computer Simulation of Communication Systems—Homework 1

Due date: 3/2

1. Given a signal $x(t) = \text{sinc}^2(t/T)$

   (a) Assume $T = 1/100$ and sampling frequency $f_s = 350$, plot the signal $x(t)$ in the time interval $[-5, 5]$ and the magnitude and phase spectrum of the signal $x(t)$.

   (b) Change $T = 1/150$ and repeat (a).

   (c) Repeat (a) but change $f_s = 50$.

   Explain the results of (a), (b) and (c).

   Hint: To compute the phase spectrum, use MATLAB command "phase" or "angle". If you have no idea how to use them, you can search them in "help".

2. A signal $x(t)$ with period $T_0 = 12$ is defined by $x(t) = \Pi(t/6)$ for $|t| \le 6$. The rectangular signal $\Pi(t)$ is defined by

$$\Pi(t) = \begin{cases} 1, & |t| < \dfrac{1}{2} \\ \dfrac{1}{2}, & t = \pm\dfrac{1}{2} \\ 0, & \text{otherwise} \end{cases}$$

   This signal passes through an LTI system with an impulse response given by

$$h(t) = \begin{cases} e^{-10t} + e^{-t^2/2}, & 0 \le t \le 4 \\ 0, & \text{otherwise} \end{cases}$$

   Numerically determine and plot the discrete spectrum of the output signal.