Homework #9

Signals

Given the signal $x(t) = \frac{sin(2\pi B(t-\tau))}{\pi(t-\tau)} \cdot \cos(\pi B t)$ and the filter with impulse response: $h(t) = B \cdot sinc(Bt)$

1) Draw the graphs of magnitude and phase of $X(f)$ when τ =1/(4B)
2) Compute y(t) and Y(f) for a generic value of τ

Modulation

Let x(n) a be sequence of N samples derived by sampling the continuous signal x(t) = rect(t) each T=0.2 s

(1) Is the sampling rate enough to allow for the reconstruction of x(t) from x(n) ?
(2) Compute the DFT of x(n) and of the sequence y(n) = x(n-2)
(3) Evaluate the FT of y(n), Y(f), for f=k/5 (k being any integer)

Processes

Let x(t) be a continuous-time stochastic process, with Normal distribution $N(m_x, \sigma_x^2)$ and correlation coefficient $\rho_x(\tau) = sinc(\frac{\tau}{T})$

1) Compute the power, the autocorrelation and the power spectrum of x(t) and plot them
2) Compute the power, the autocorrelation and the power spectrum of the discrete process x(nT)
3) Compute the autocorrelation and the power spectrum of the discrete process: $y(nT) = \frac{1}{2}x(nT) + \frac{1}{4}x(nT - T) + \frac{1}{4}x(nT + T)$
4) Compute the power of the process $z(n) = y(n) - y(n - 10)$