ECE 376 - Homework #11

z-Transforms and Digital Filters

Fiters in the s-Plane

1) Assume X and Y are related by the following transfer function

$$Y = \left(\frac{10(s+1)}{(s+0.5)(s+2)(s+8)} \right) X$$

a) What is the differential equation relating X and Y?

b) Find y(t) assuming

$$x(t) = 2 + 4\sin(3t)$$

Filters in the z-Plane

2) Assume X and Y are related by the following transfer function

$$Y = \left(\frac{0.02(z+1)}{(z-0.94)(z-0.88)} \right) X$$

a) What is the difference equation relating X and Y?

b) Find y(t) assuming a sampling rate of T = 0.01 second

$$x(t) = 3 + 4\sin(5t)$$

s to z Conversion

Problem 3) Assume G(s) is a low-pass filter with real poles:

$$G(s) = \left(\frac{10(s+1)}{(s+0.5)(s+2)(s+8)} \right)$$

3) Design a digital filter, G(z), which has approximately the same gain vs. frequency as G(s). Assume a sampling rate of T = 0.01 second.

Plot the gain vs. frequency for both filters from 0 to 20 rad/sec.

Problem 4) Assume G(s) is the following band-pass filter:

$$G(s) = \left(\frac{8s}{(s+2+j10)(s+2-j10)} \right)$$

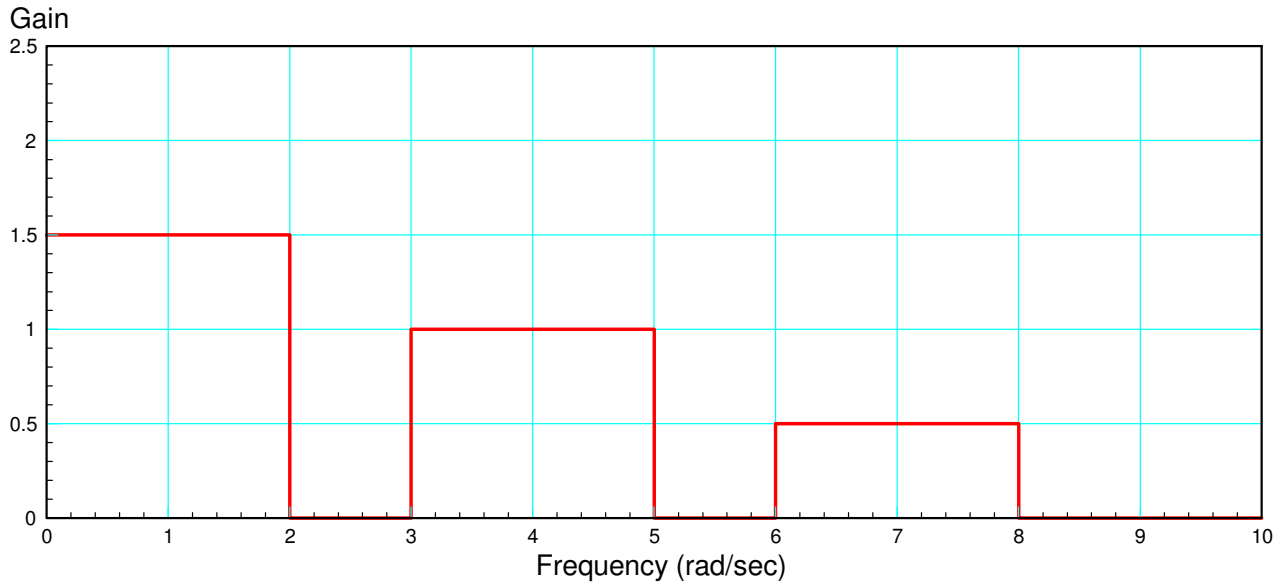
Design a digital filter, G(z), which has approximately the same gain vs. frequency as G(s). Assume a sampling rate of T = 0.01 second.

Plot the gain vs. frequency for both filters from 0 to 20 rad/sec.

Problem 5) Write a C program to implement the digital filter, G(z)

FIR Filters

6) Find the impulse response of a FIR filter which has approximately the following gain vs. frequency:



7) Plot the gain vs. frequency for your FIR filter