Jake Garrison 1/9/16 EE 442 HW 1

CONV_M FUNCTION

```
function [y, ny] = conv_m(x, nx, h, nh)
nyb = nx(1) + nh(1);
nye = nx(length(x)) + nh(length(h));
ny = [nyb:nye];
y = conv(x,h);
end
```

PZ FUNCTION

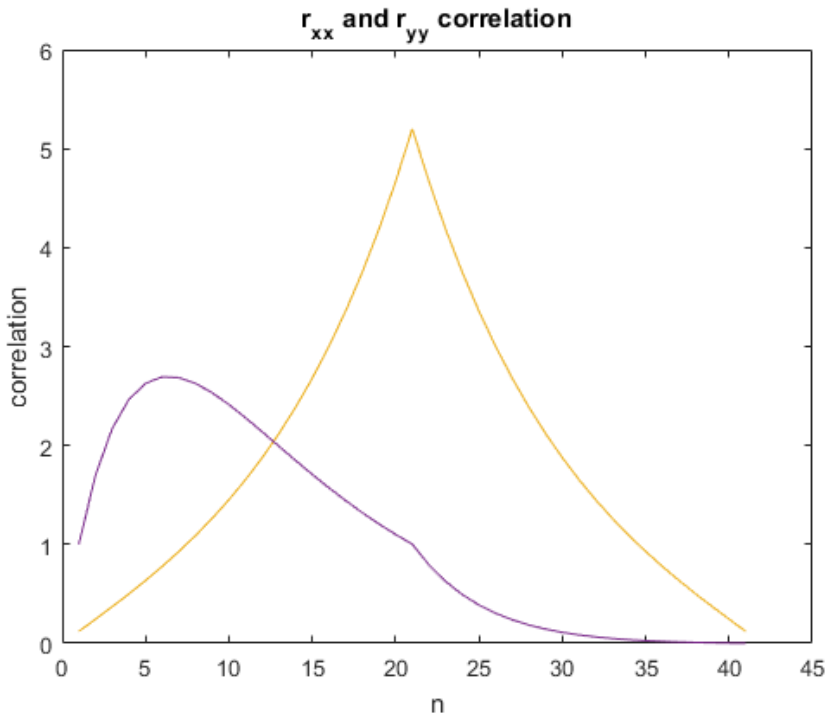
```
function [ z, p, k ] = pz( b, a )
fvtool(b,a,'polezero')
[b,a] = eqtflength(b,a);
[z,p,k] = tf2zp(b,a);
text(real(z)+.1,imag(z),'Zero')
text(real(p)+.1,imag(p),'Pole')

end
```

CODE AND PLOTS

```
%% Part 1
figure(1)
n = 0:20;
x = (0.9).^n;
n = -20:0;
y = (0.8).^-n;
% rxx
rxx = conv_m(x, n, fliplr(x), n);
plot(rxx); hold on
% rxy
ryy = conv_m(x, n, fliplr(y), n);
plot(ryy)

title('r_x_x and r_y_y correlation')
xlabel('n')
ylabel('correlation')
```



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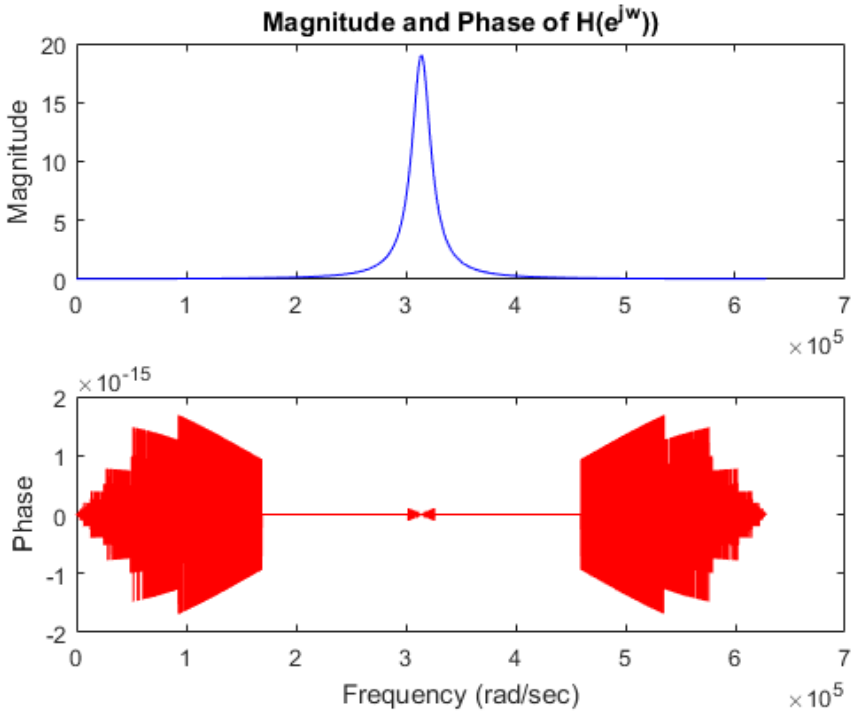
```
%% Part 2
figure(2)
w = -pi:0.00001:pi;
H = 0.9*exp(1i*w)./(1-0.9*exp(1i*w)) + 1./(1-0.9*exp(-1i*w));
subplot(2,1,1); plot(abs(H), 'b')
title('Magnitude and Phase of H(e^j^w))')
ylabel('Magnitude')
subplot(2,1,2); plot(angle(H), 'r')
ylabel('Phase')
xlabel('Frequency (rad/sec)')
```




```
%% Part 3
syms n
z_tran = ztrans(2*dirac(n-2) + 3*heaviside(n-3));

N = [0 0 2 1];
D = [1 -1 0 0]
[ z, p, k ] = pz(N, D)


% Using ztrans, the transfer function was verified. Also using my pz (pole zero)
function, I verified the pole zero plot
```

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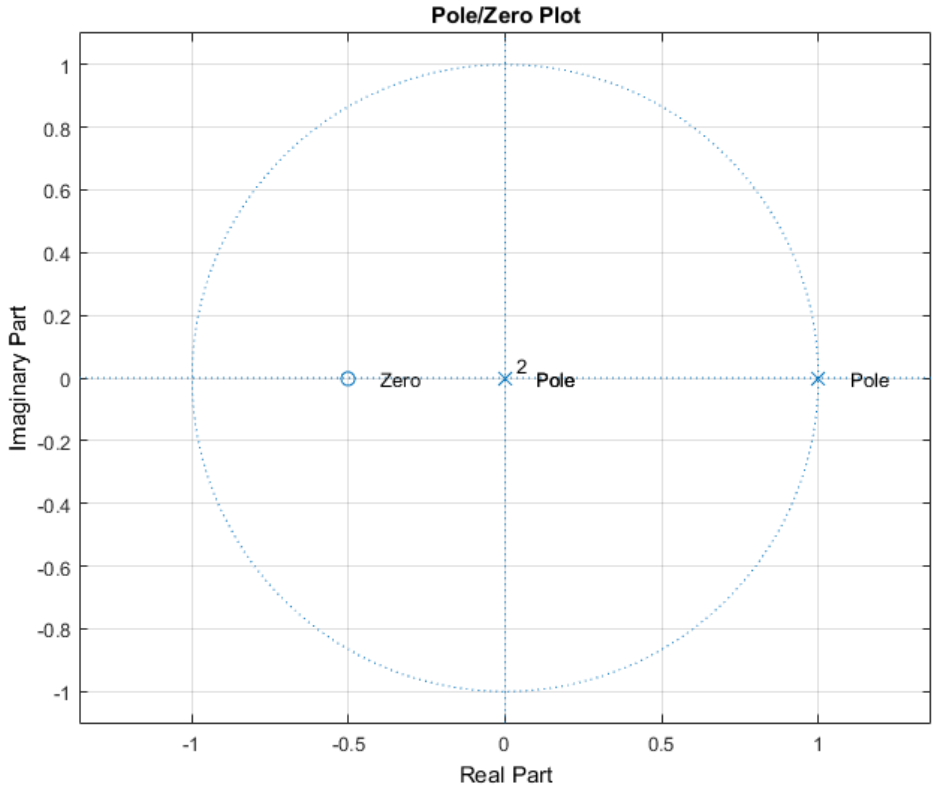
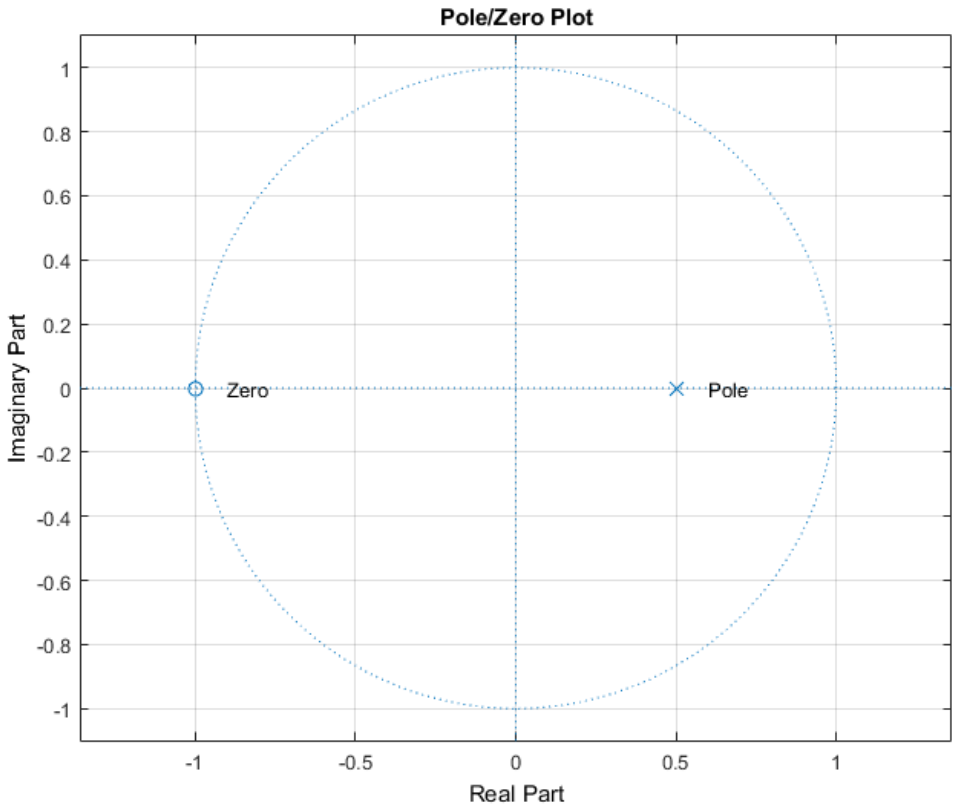



```
%% Part 4
N = [1 1];
D = [1 -0.5];
[ z, p, k ] = pz(N, D)
```



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```
%% Part 5
figure(3)
n= -100:0.1:100;
w = 100*n*2*pi/length(n);
x = heaviside(n)-heaviside(n-50);
x_shif = x.*exp(1i*pi/3*n);
x_shif2 = x.*exp(1i*pi/3*n);

% plots
subplot(5,1,1); plot(n, x)
title('Shifting rect in frequency
domain')
xlabel('n')
ylabel('Magnitude')
subplot(5,1,2); plot(n, x_shif)
xlabel('n (times exp)')
ylabel('Magnitude')
X = fftshift(fft(x));
X_shif = fftshift(fft(x_shif));
X_shif2 = fftshift(fft(x_shif2));

% plots
subplot(5,1,3); plot(w, abs(X))
xlabel('w')
xlim([-2*pi, 2*pi])
ylabel('Magnitude')
subplot(5,1,4); plot(w, abs(X_shif));
xlabel('w (shifted pi/3')
xlim([-2*pi, 2*pi])
ylabel('Magnitude')
subplot(5,1,5); plot(w, abs(X_shif));
xlabel('w (shifted 11*pi/3)')
xlim([-2*pi, 2*pi])
ylabel('Magnitude')
```