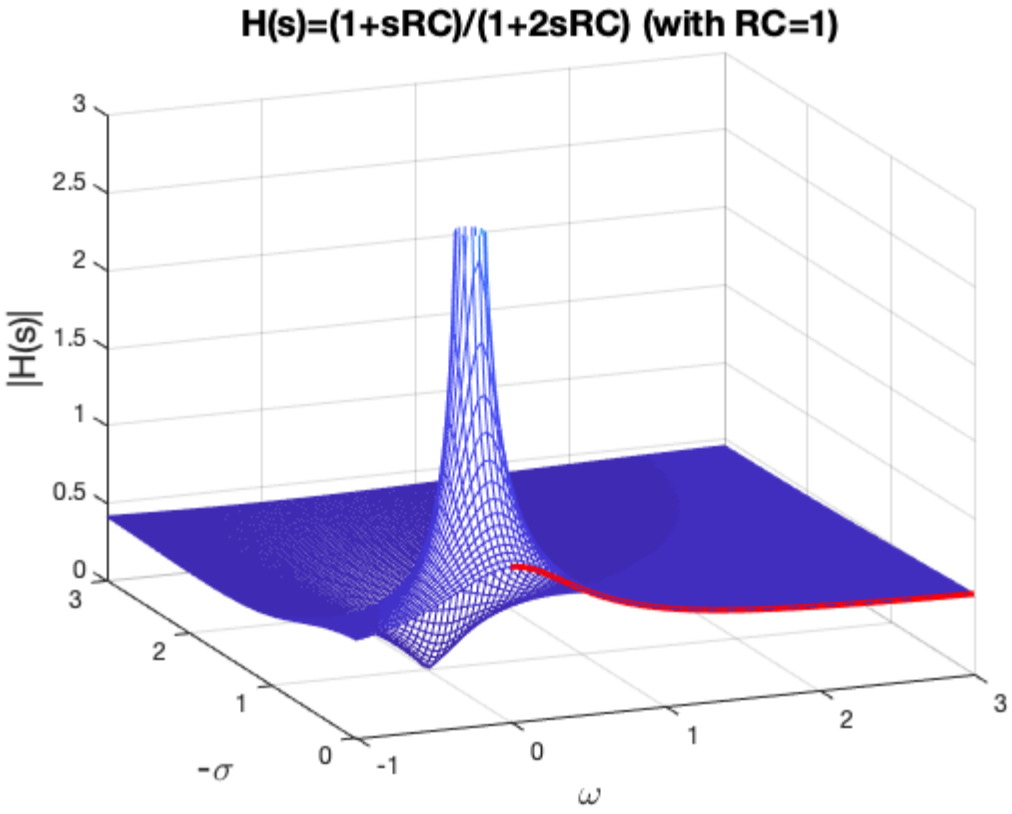
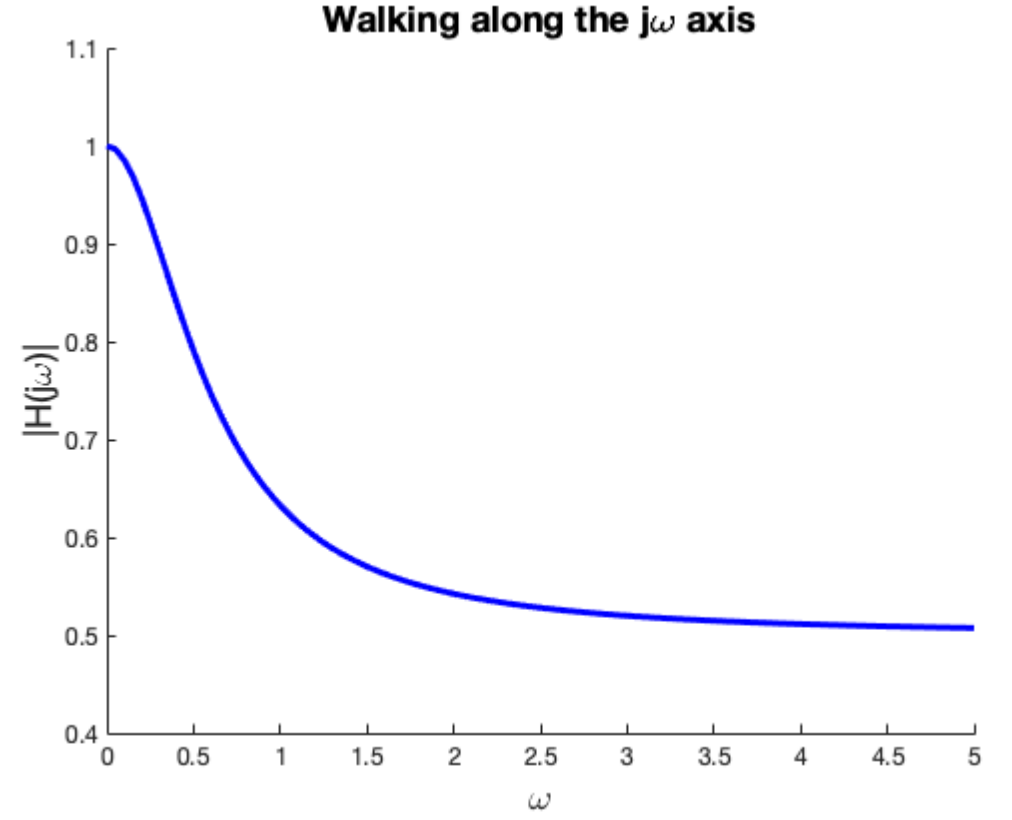
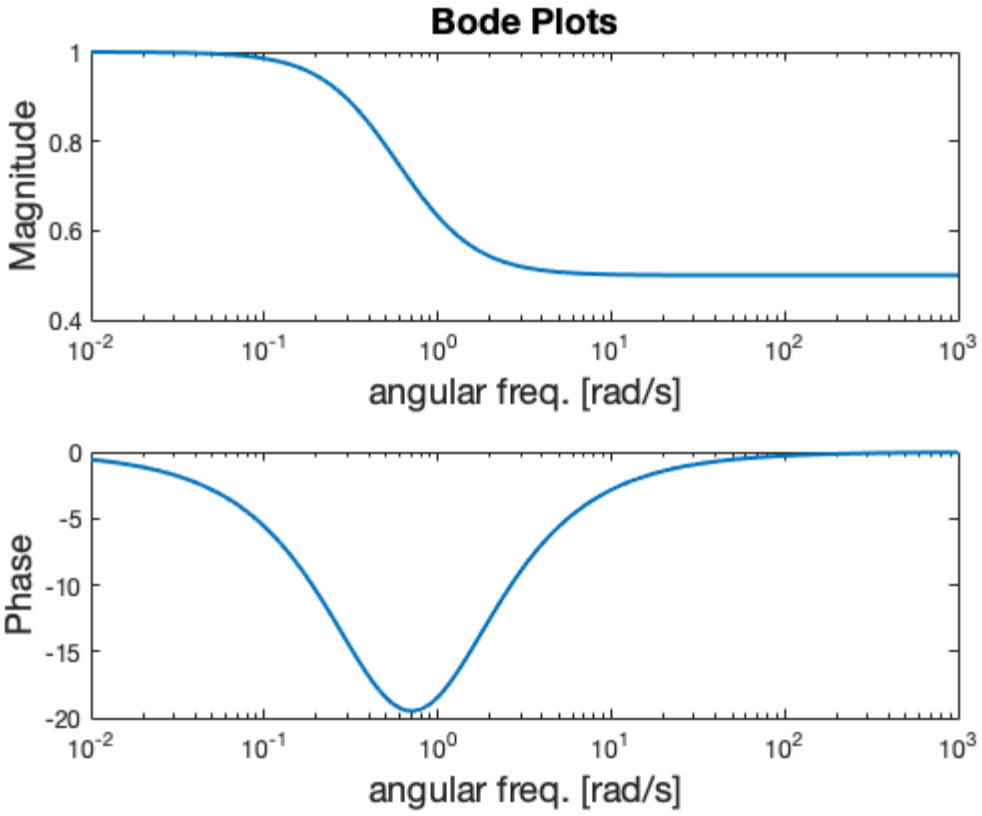
```
% C. Talarico - polezero.m
% illustration of system with a pole and a zero
% H(s) = (1 + sRC) / (1 + 2sRC) ( s = sigma + j*omega )
% H(s) = (1 - s/z)/(1 - s/p)
% z = -1/RC
% p = -1/(2RC)
% set RC=1 for simplicity

clear all; clc; close all;
sigma = linspace(3,0,100);  % Note: in reality we are interested in sigma
                            % in the negative range, but we want to get
                            % sigma=0 toward the front of the plot
omega = linspace(-1,3,100);
[x y] = meshgrid(sigma, omega);
n = 1 - x + j*y;     % trick: flip sigma to consider the negative range
d = 1 - 2*x + j*2*y;
h = n./d;
h_mag = abs(h);
figure(1);
mesh(y,x,h_mag);  % swap the position of the sigma and omega axis in the plot
ax = gca;
ax.XAxis.FontSize = 12;
ax.YAxis.FontSize = 12;
ax.ZAxis.FontSize = 12;
ylabel('-\sigma', 'fontsize', 18)
xlabel('\omega', 'fontsize', 18)
zlabel('|H(s)|','fontsize',18);
title('H(s)=(1+sRC)/(1+2sRC) (with RC=1)','fontsize',18);
axis([-1 3 0 3 0 3]) % omega, sigma, H
view(-22,20);

hold on;
x = zeros(100,1);       % set sigma = 0
y = linspace(0,3,100);  % start omega from 0
n = 1 - j*y;
d = 1 - j*2*y;
h = n./d;
h_mag = abs(h);
plot3(y,x,h_mag, 'linewidth', 3, 'color', 'red');


figure(2)
% set sigma=0
x = zeros(100,1);      % set sigma = 0
y = linspace(0,5,100); % start omega from 0
n = 1 + j*y;
d = 1 + j*2*y;
h = n./d;
h_mag = abs(h);
plot3(y,x,h_mag, 'linewidth',3, 'color', 'blue');
ax = gca;
ax.XAxis.FontSize = 12;
ax.YAxis.FontSize = 12;
ax.ZAxis.FontSize = 12;
ylabel('-\sigma', 'fontsize', 18)
xlabel('\omega', 'fontsize', 18)
zlabel('|H(j\omega)|','fontsize',18)
title('Walking along the j\omega axis','fontsize',18);
axis([0 5 0 2 0.4 1.1])
```

```
view(0, 0)

figure(3);
subplot(2,1,1);
s=tf('s');
N = (1 + s);
D = (1 + 2*s);
H = N/D;
w = logspace(-2,3,100*5);
[mag, phase] = bode(H,w);
M = squeeze(mag);
semilogx(w, M,'linewidth', 2);
ax = gca;
ax.XAxis.FontSize = 12;
ax.YAxis.FontSize = 12;
xlabel('angular freq. [rad/s]', 'fontsize', 18)
ylabel('Magnitude', 'fontsize', 18);
title('Bode Plots','fontsize',18);
subplot(2,1,2);
angle = squeeze(phase);
semilogx(w,angle, 'linewidth', 2);
ax = gca;
ax.XAxis.FontSize = 12;
ax.YAxis.FontSize = 12;
xlabel('angular freq. [rad/s]', 'fontsize', 18)
ylabel('Phase', 'fontsize', 18);
```


H(s)=(1+sRC)/(1+2sRC) (with RC=1)
|H(s)|
3
2.5
2
1.5
1
0.5
0
3
2
1
0
-σ
-1
0
1
2
3
ω


Walking along the jω axis
|H(jω)|
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
ω



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