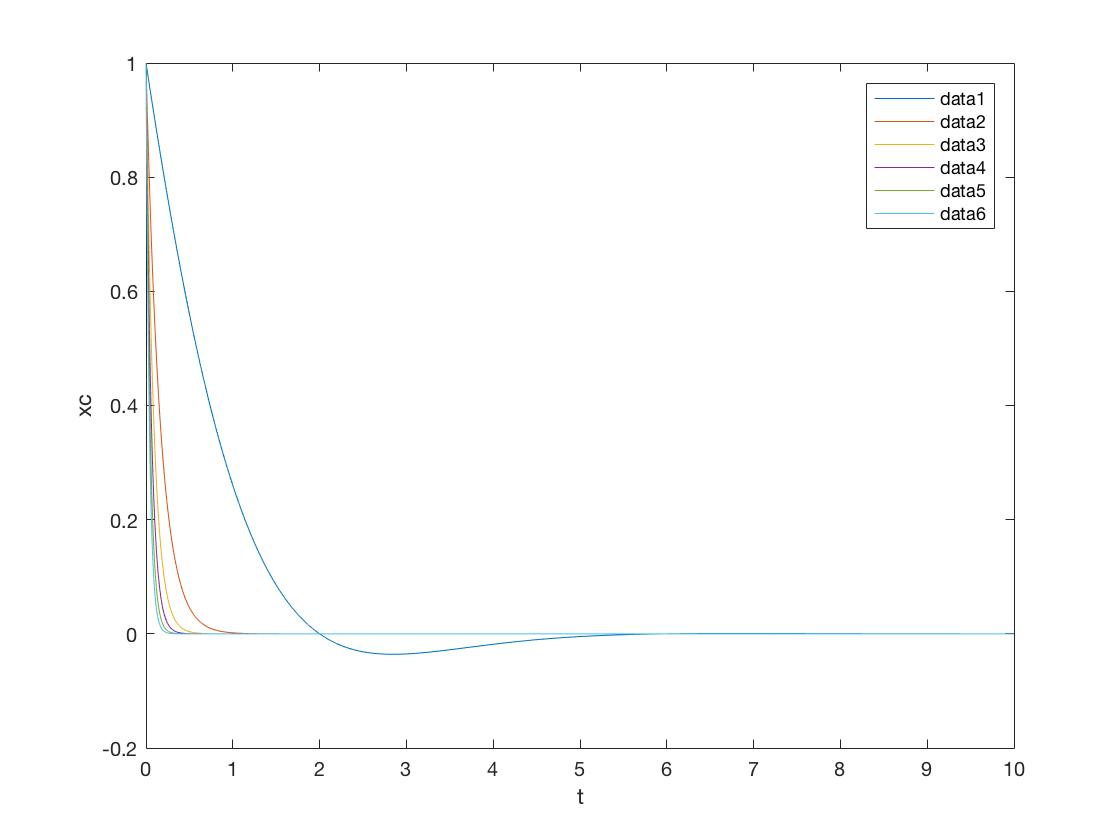
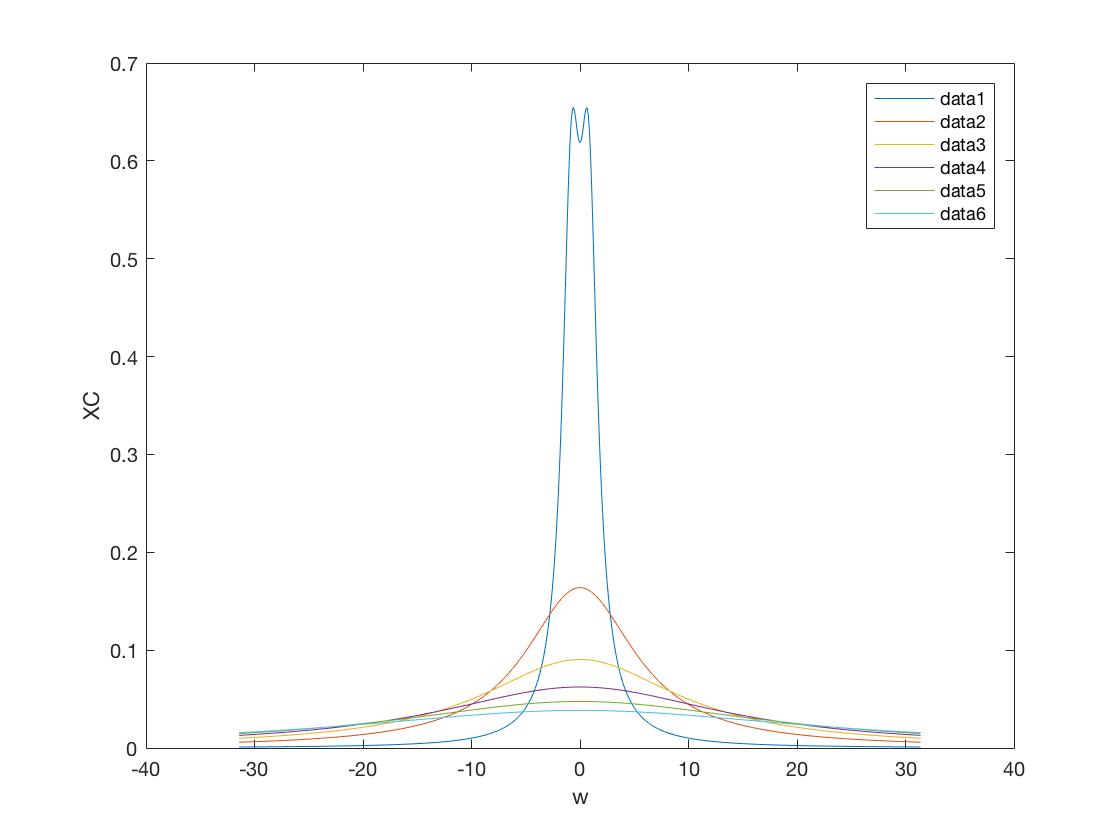
Questions from Part A

a)

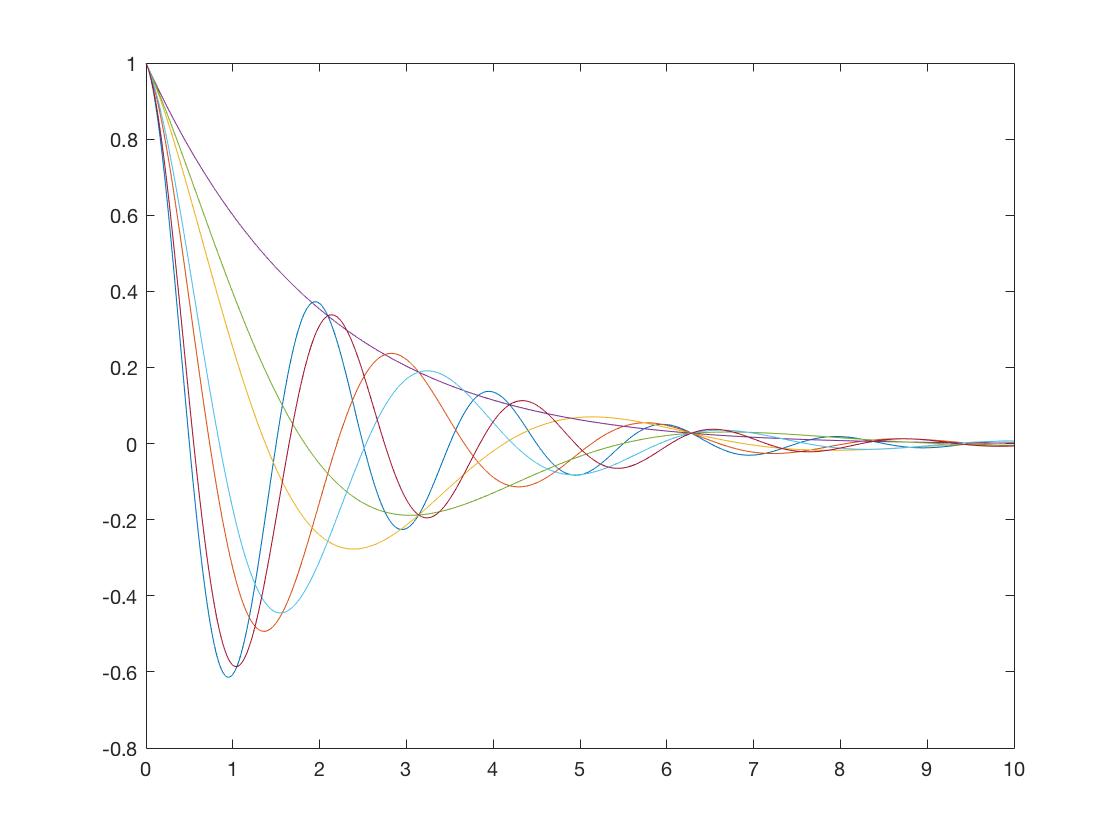
If

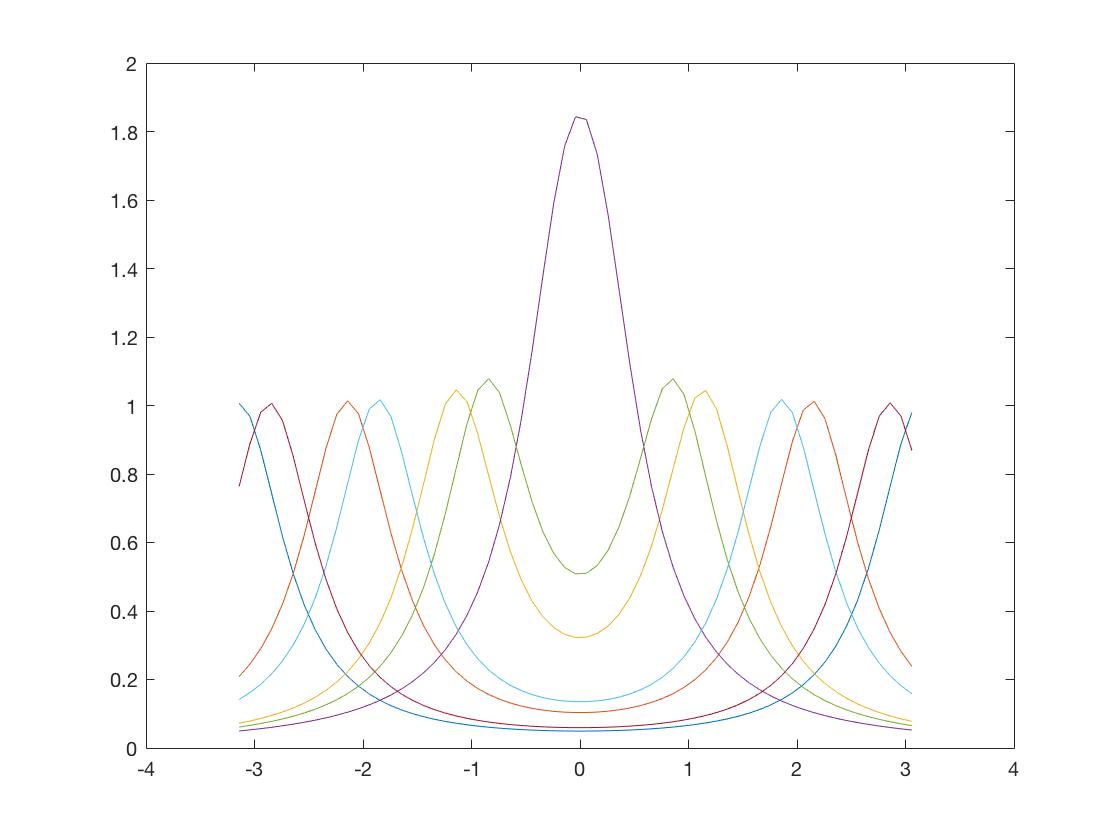
Fix , change . The diagram of and showed as below:





Fix , change. The diagram of and showed as below:





From the diagram, it can be observed that if keep the value of , then changing , for , the rise time and set time are changed with , for , the peak value increases with , but the number of peak decreases as goes up. While if is changing, is a constant.

From the graphs, they show that there are more vibration before the curve coms to a stable value in . Meanwhile, with the changing of , the number of peak decreases as the value of close to 0, while the curve becomes lower with the increasing of .

The code in Matlab to get the diagram

Fix , change :

%xc = exp(-a\*t)\*cos(OMG1\*t), XC = (a+jw)/((a+jw)^2+OMG^2)

%fix OMG, change a

clc

clear all

%a = 0.12;

for a = (1:5:30);

    OMG = 0.25\*pi;

    %xc = exp(-a.\*t).\*cos(OMG1.\*t);

    t = (0:0.01:10);

    w=(-10\*pi:0.1:10\*pi);

    xc = exp(-a.\*t).\*cos(OMG.\*t);

    XC = (a+1i\*w)./((a+1i\*w).^2+ OMG.^2);

    figure(1);

    plot(t, xc);

    xlabel('t');

    ylabel('xc')

    hold on

    figure(2);

    plot(w, XC);

    xlabel('w');

    ylabel('XC')

    hold on

end

Fix , change:

%xc = exp(-a\*t)\*cos(OMG1\*t), XC = (a+jw)/((a+jw)^2+OMG^2)

%fix a, change OMG

clc

clear all

a = 0.5;

for OMG = -pi:pi

    %OMG = 0.25\*pi;

    %xc = exp(-a.\*t).\*cos(OMG1.\*t);

    t  = [0:0.01:10];

    xc = exp(-a.\*t).\*cos(OMG.\*t);

    figure(1);

    plot(t, xc);

    hold on

    figure(2);

    w = [-pi:0.1:pi];

    XC = (a+1i\*w)./((a+1i\*w).^2+ OMG.^2);

    plot(w, XC);

    hold on

end

b)

If

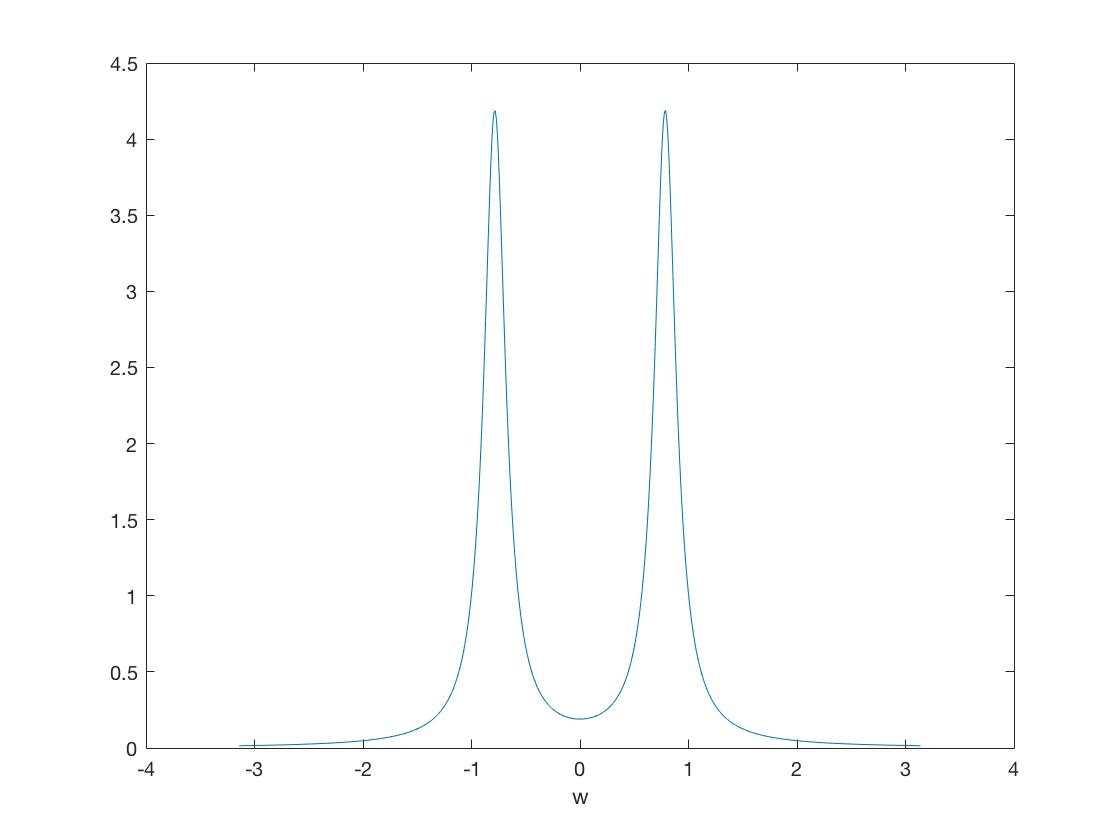
DTFT of is

If ,

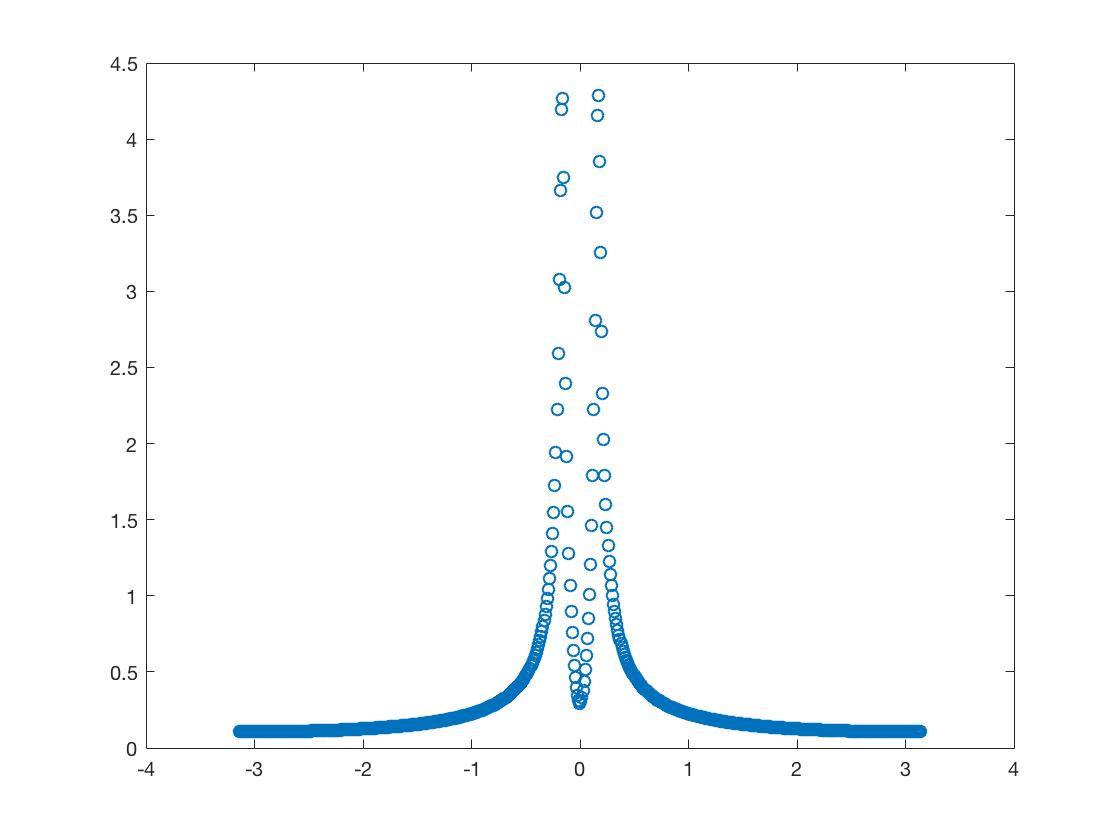
DTFT of is

c)

The diagram of



The diagram of



The command **freqz ,** [f w] = freqz (A , B , w), returns the frequency response vector f, and the corresponding angular frequency vector w, for the digital filter with numerator and denominator polynomial coefficients stored in B and A, respectively.

The code in Matlab to plot

%XC after sampling is

clear all

clc

close all

a = 0.12;

OMG = 0.25\*pi;

T = 1/4.8;

%fundamental frequency range

w = -pi:0.01:pi;

XC = (a+1i\*w)./((a+1i\*w).^2+ OMG.^2);%continues time FT

%abs(xc) only plot the magnetude

%NOW plot the sampled DTFT

A = [1 -exp(-a\*T)\*cos(OMG\*T) 0];

B = [1 -2\*exp(-a\*T)\*cos(OMG\*T) exp(-2\*a\*T)];

[f w] = freqz (A , B , w);

hold on;

%w/T=continuous time frequency

%abs(f)\*T

figure(2);

plot ( w, abs(f)\*T, 'o');

hold on

end

d) Proof:

If

From Euler Formula

Focus on the stability

Because

The only pole of the signal is ;

So and ;

Plot and

Diagram of

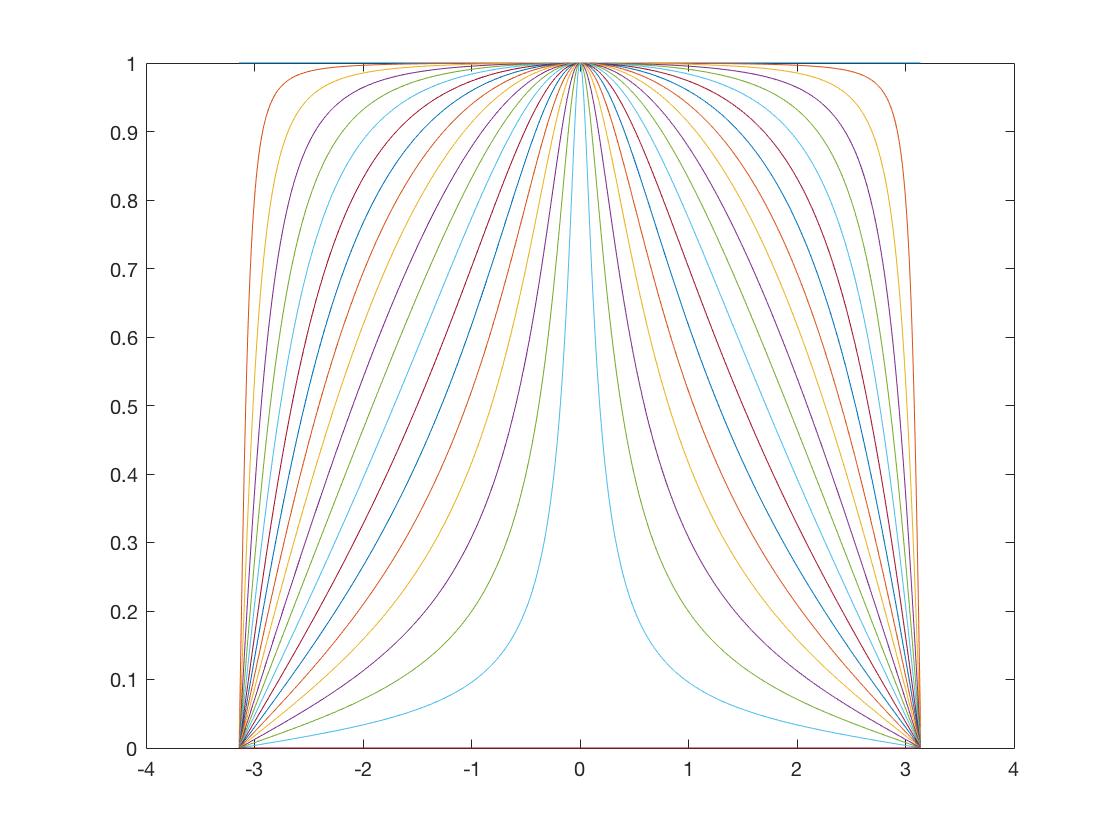
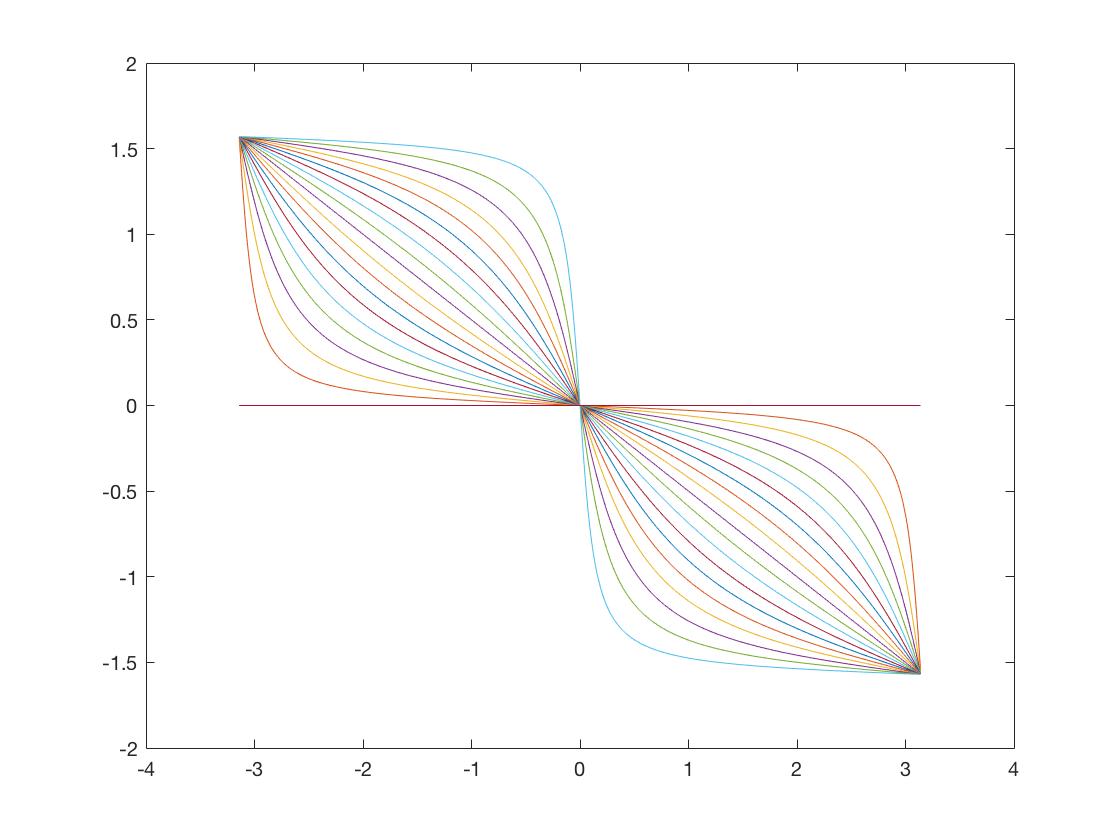


Diagram of



From the diagram above it can be observed that as the value of changing from -1 to 1, the peak of diagram of does not change, but the value of [-1,0] and [0,1] are closer to 0 as the increasing of .

When talking to diagram of , if the value of , then the curve of is just like the function y=-x. When , the relative curves of are all below the curve which has . As the becomes smaller, the curves are closer to real axis. When the , the relative curves are all above the curve which has . With the increasing of value of , these curves are closer to the imaginary axis.

The code in Matlab to plot the diagram of and

clear all

clc

%H = (1 - a) / 2 \* (1 + 1/z) / (1 - a/z)

%where z = e^jw=exp(i\*w), where w = -pi :0.01: pi

%and a should vary

%a = 0.8;

for a = -1:0.1:1;

    H = zeros(0, 629);

    i = 1;

    for w = -pi :0.01: pi

        z = exp(j\*w);

        H(i) = (1 - a) / 2 \* (1 + 1/z) / (1 - a/z);

        i = i+1;

    end

     figure(1);

     plot(-pi :0.01: pi, abs(H));

     hold on;

    figure(2);

    plot(-pi :0.01: pi, angle(H));

    hold on;