**Lab3.m**

% Exercise 1

% b)

syms t

T = 2;

sum = 0;

x = abs(sin(pi\*t/T));

a0=2/pi;

for n=1:40

an=(2/T).\*int(x.\*cos(n\*t\*pi/T),t,0,T);

bn=0;

sum=sum+(an.\*cos(n\*t\*pi/T)+bn.\*sin(n\*t\*pi/T));

end

xt = a0 + sum;

fplot(xt, [-4,4]);

xlabel('Time');

ylabel('x(t)');

title('x(t) that considers the first 40 terms in the Fourier series');

% c)

t = -4:0.01:4;

x = abs(sin(pi\*t/T));

test = fft(x);

%exponeentail

subplot(2,1,1); %2 rows, 1 column, 1st spot

stem(t,abs(test))

xlabel('n');

ylabel('x(t)');

title('Magnitude Spectrum');

subplot(2,1,2); %2 rows, 1 column, 1st spot

stem(t,angle(test)\*180/pi) %radians

xlabel('n');

ylabel('x(t)');

title('Phase Spectrum');

% d

x = abs(sin(pi\*t/T));

fplot(x, [-10,20]);

xlabel('t');

hold on;

syms y(t)

T = 2;

eqn = diff(y,t) + 30.5\*y == 10.\*x;

Dy = diff(y,t);

cond = [y(0)== 5];

f = dsolve(eqn,cond);

fplot(f, [-10,20])

xlabel('t');

ylim([-1 2])

legend('x(t)','y(t)');

hold off;

ylabel('x(t) and y(t)');

% Exercise 2

% a)

t = -10:0.001:10;

xt = 0\*t;

for n=-25:25

if(n==0) % skip the zeroth term

continue;

end;

dn = (1/(2\*i\*n\*pi)) .\* (1- 2\*exp(-j\*n\*pi) + exp(-2\*j\*n\*pi)) ;

xt = xt + dn .\* exp(j\*n\*pi\*t) ;

end

plot(t, xt);

xlabel('t');

ylabel('x(t)');

title('Exponential Fourier series');

% b

t = -10:0.01:10;

ht = 8\* exp(-20\*t) .\* heaviside(t);

xt = 0\*t;

for n=-25:25

if(n==0) % skip the zeroth term

continue;

end;

dn = (1/(2\*i\*n\*pi)) .\* (1- 2\*exp(-j\*n\*pi) + exp(-2\*j\*n\*pi)) ;

xt = xt + dn .\* exp(j\*n\*pi\*t) ;

end

plot(t, ht)

hold on;

yt = conv(xt, ht);

plot(t, yt(1:length(t)));

hold on;

plot(t, xt);

xlabel('t');

legend('h2(t)', 'y2(t)', 'x2(t)');

hold off;

% c

t = -10:0.01:10;

ht = 8\* exp(-2\*t) .\* heaviside(t);

xt = 0\*t;

for n=-25:25

if(n==0) % skip the zeroth term

continue;

end;

dn = (1/(2\*i\*n\*pi)) .\* (1- 2\*exp(-j\*n\*pi) + exp(-2\*j\*n\*pi)) ;

xt = xt + dn .\* exp(j\*n\*pi\*t) ;

end

plot(t, ht)

hold on;

yt = conv(xt, ht);

plot(t, yt(1:length(t)));

hold on;

plot(t, xt);

xlabel('t');

legend('h2(t)', 'y2(t)', 'x2(t)');

hold off;

% extrac

t = -10:0.01:10;

ht = 8\* exp(-0.5\*t) .\* heaviside(t);

xt = 0\*t;

for n=-25:25

if(n==0) % skip the zeroth term

continue;

end;

dn = (1/(2\*i\*n\*pi)) .\* (1- 2\*exp(-j\*n\*pi) + exp(-2\*j\*n\*pi)) ;

xt = xt + dn .\* exp(j\*n\*pi\*t) ;

end

plot(t, ht)

hold on;

yt = conv(xt, ht);

plot(t, yt(1:length(t)));

hold on;

plot(t, xt);

xlabel('t');

legend('h2(t)', 'y2(t)', 'x2(t)');

hold off;

% Exercise 3

% a)

clear; % clear the MATLAB environment

num\_coeff = [100000000]; % coefficients of the numerator

% in decreasing powers of s

denom\_coeff = [1 50000 100000000]; % coefficient of the denominator

% in decreasing powers of s

sys = tf(num\_coeff,denom\_coeff) ;

% specify the transfer function

bode(sys,{0.01,100000000}); % sketch the Bode plots

%OR

L= 1e-3;

C=10e-6;

R =2;

sys = tf(1, [L\*C L/R 1]);

bode(sys);

% b)

num\_coeff = [100000000]; % coefficients of the numerator

% in decreasing powers of s

denom\_coeff = [1 500 100000000]; % coefficient of the denominator

% in decreasing powers of s

sys = tf(num\_coeff,denom\_coeff);

% specify the transfer function

bode(sys,{0.01,100000000}); % sketch the Bode plots

% OR

L= 1e-3;

C=10e-6;

R =200;

sys = tf(1, [L\*C L/R 1]);

bode(sys);

% c)

% extra c) resuce R value

clear; % clear the MATLAB environment

num\_coeff = [100000000]; % coefficients of the numerator

% in decreasing powers of s

denom\_coeff = [1 500000 100000000]; % coefficient of the denominator

% in decreasing powers of s

sys = tf(num\_coeff,denom\_coeff);

% specify the transfer function

bode(sys,{0.01,100000000}); % sketch the Bode plots

% OR

L= 1e-3;

C=10e-6;

R =0.2;

sys = tf(1, [L\*C L/R 1]);

bode(sys);