***3.1) Output of an LTI system with impulse response :-***

function [N,A,x] = partial\_sum(A)

T = 2\*pi;

%time period 2pi

t = -3\*2\*pi:0.001:3\*2\*pi;

x=zeros(size(t));

%declaring a row vector of size (1,no. of values in t)

N=(length(A)-1)/2;

%finding the no. of fourier coefficients from A

for k=-N:N

x=x+A(k+N+1)\*exp(1i\*k\*(2\*pi/T)\*t);

x= real(x);

%calcuating y(t) using ak\*e^(jWot)

end

end

***Calculating and plotting the output signal after passing the input signal through Lowpass Filter:***

w = 3.5;

% angular frequency 3.5 rad/sec

B = zeros(1,2\*N+1);

%vector of size(1,(2\*N+1))

for k = -N:N

if(abs(k)>w)

B(k+N+1)=0;

%all frequency coefficients other than [-w,w] are zero

else

B(k+N+1)=A(k+N+1);

%all frequency coefficients between [-w,w] are same as input

%signals coefficients

end

end

[N,B,y] = partial\_sum(B);

%calculating time domain output signal from the fourier coefficients

subplot(2,1,1);

plot(-6\*pi:0.001:6\*pi,x);

%plotting the time domain input signal

title("Input Periodic Signal")

xlabel("time")

ylabel("x(t)")

subplot(2,1,2);

plot(-6\*pi:0.001:6\*pi,y);

%plotting the time domain output signal

title("Lowpass Output Signal")

xlabel("time")

ylabel("y(t)")

***Calculating and plotting the output signal after passing the input signal through Highpass Filter:***

w = 3.5;

% angular frequency 3.5 rad/sec

B = zeros(1,2\*N+1);

%vector of size(1,(2\*N+1))

for k = -N:N

if(abs(k)<=w)

B(k+N+1)=0;

%all frequency coefficients between [-w,w] are zero

else

B(k+N+1)=A(k+N+1);

%all frequency coefficients other than [-w,w] are same as input

%signals coefficients

end

end

[N,B,z] = partial\_sum(B);

%calculating time domain output signal from the fourier coefficients

subplot(2,1,1);

plot(-6\*pi:0.001:6\*pi,x);

%plotting the time domain input signal

title("Input Periodic Signal")

xlabel("time")

ylabel("x(t)")

subplot(2,1,2);

plot(-6\*pi:0.001:6\*pi,z);

%plotting the time domain output signal

title("Highpass Output Signal")

xlabel("time")

ylabel("z(t)")

***Calculating and plotting the output signal after passing the input signal through H(jw)=1/(1+jw)***

B = zeros(1,2\*N+1);

%vector of size(1,(2\*N+1))

for k = -N:N

B(k+N+1)=A(k+N+1)/(1+1i\*k); %fourier coefficients of output signal

end

[N,B,w] = partial\_sum(B);

%calculating the time domain output signal

subplot(2,1,1);

plot(-6\*pi:0.001:6\*pi,x);

%plotting input signal vs time

title("Input Periodic Signal")

xlabel("time")

ylabel("x(t)")

subplot(2,1,2);

plot(-6\*pi:0.001:6\*pi,w);

%plotting output signal vs time

title("H(jw)=1/(1+jw) Output Signal")

xlabel("time")

ylabel("w(t)")

***3.2) Fourier Series to Fourier transform by increasing time period of rectangular impulse train :-***

function [C] = fourierseries()

T1=1/4;

%time duration of the rectangular pulse

for T = 1:0.5:20

%time period of the rectangular pulse

N=round(2\*T/T1);

C=zeros(1,2\*4\*T+1);

%vector of size (2\*4\*T+1)

for k = -N:N

%if k==0 manually calculated a0=integral(y(t))over the time period

if(k==0)

C(k+N+1)=2\*T1/T;

else

%calculating ak using the sin(kWoT1)/(k\*pi)

C(k+N+1)=sin(k\*T1\*2\*pi/T)/(k\*pi);

end

end

sq = pulstran(0:1/1e4:20,0:T:20,@rectpuls);

%rectangular pulse with time period T

subplot(2,1,1)

plot(0:1/1e4:20,sq);

%plotting rectangular pulse vs time

title(["Rectangular Pulse for time period T\_{o}=",T,"sec"])

xlabel("time")

ylabel("x(t)")

subplot(2,1,2)

stem(T\*C);

%plotting fourier transform of the rectangular pulse

title(["Fourier transform of rectangular pulse for time period T\_{o}=",T,"sec"])

xlabel("angular frequency(w)")

ylabel("X(jw)")

pause(1.5);

%pausing the execution for 1.5 sec

end

end