 Example – Demonstration of Linearity Property of FS

clc

clear all

close all

% FS coefficients of periodic square waves

k = -50:50;

T1 = 0.25;

T=1;

ak = sin(k\*2\*pi\*(T1/T))./(k\*pi);

ak(51)=2\*T1/T; % Manual correction for a0 ?> ak(51)

t = -1.5:0.005:1.5;

xt = zeros(1,length(t));

for k = -50:50

xt = xt + ak(k+51)\*exp(j\*k\*2\*pi/T \*t);

end

T1 = 0.125;

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T=1;

k = -50:50;

bk = sin(k\*2\*pi\*(T1/T))./(k\*pi);

bk(51) = 2\*T1/T; % Manual correction for b0 ?> bk(51)

yt = zeros(1,length(t));

for k = -50:50

yt = yt + bk(k+51)\*exp(j\*k\*2\*pi/T \*t);

end

sum=xt+yt;

% Application of linearity property of FS

ck = ak+bk;

% Reconstruction with M=50

w0 = 2\*pi/T;

zt = zeros(1,length(t));

for k = -50:50

zt = zt + ck(k+51)\*exp(j\*k\*w0\*t);

end

figure(1);

plot(t,real(sum),'lineWidth',2);

xlabel('t');

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

title('original x(t)+y(t) with ak''s and bk''s with 101 terms');

grid;

figure(2);

plot(t,real(zt),'lineWidth',2);

xlabel('t');

ylabel('z(t)=x(t)+y(t)');

title('Reconstruction of y(t)from ak+bk''s with 101 terms');

grid;

Example – Demonstration of Time Shifting Property of FS

clc

clear all

close all

% FS coefficients of periodic square wave

k = ‐50:50;

T = 1;

T1 = 0.25;

ak = sin(k\*2\*pi\*(T1/T))./(k\*pi);

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ak(51)=2\*T1/T; % Manual correction for a0 ‐> ak(51)

t = -1.5:0.005:1.5;

w0 = 2\*pi/T;

xt = zeros(1,length(t));

% Amount of time shift

t0 = 0.25;

% FS coefficients of the time shifted signal w0 = 2\*pi/T;

bk = ak.\*exp(-j\*k\*w0\*t0);

%construction of original square wave

for k = ‐50:50

xt = xt + ak(k+51)\*exp(j\*k\*w0\*t); end

% Reconstruction from bk's with 101 terms (M=50) yt = zeros(1,length(t));

for k = -50:50

yt = yt + bk(k+51)\*exp(j\*k\*w0\*t);

end

figure(1);

subplot(2,1,1);

plot(t,xt,'lineWidth',2);

xlabel('t');

ylabel('x(t)');

title('Periodic Square Wave with ak’’s');

axis([‐1.5 1.5 ‐0.2 1.2]);

grid;

subplot(2,1,2);

plot(t,real(yt),'lineWidth',2);

xlabel('t'); ylabel('y(t)=x(t‐0.5)');

title('Reconstruction from bk''s with 101 terms'); axis([‐1.5 1.5 ‐0.2 1.2]);

Given the signal x(t) with ak’s

a) Plot the time reverse version of the signal x(‐t) directly,

b) Plot FS coefficients a‐k of time reversed signal,

c) Plot the reconstructed time reversed signal using FS coefficients a‐k

Hint : use bk = fliplr(ak); for flipping the ak’s.

Example – Demonstration of Time Scaling Property of FS having α = 0.5

clc

clear all

close all

% Generation of periodic square wave t = ‐1.5:0.005:1.5;

xcos = cos(2\*pi\*t);

xt = xcos>0;

% FS coefficients of periodic square wave k = ‐50:50;

T = 1;

T1 = 0.25;

ak = sin(k\*2\*pi\*(T1/T))./(k\*pi);

ak(51) = 2\*T1/T; % Manual correction for a0 ‐> ak(51)

% Time scaling parameters

alp1 = 0.5;

% w's for the time scaled signals w0 = 2\*pi/T;

w1 = alp1\*w0;

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% Reconstruction from ak's with 101 terms (M=50)

xat1 = zeros(1,length(t));

for k = ‐50:50

xat1 = xat1 +ak(k+51)\*exp(j\*k\*w1\*t);

end

figure(1);

subplot(2,1,1);

plot(t,xt,'lineWidth',2);

ylabel('x(t)');

title('Periodic Square Wave (T=1, T1=0.25)');

axis([‐1.5 1.5 ‐0.2 1.2]);

grid;

subplot(2,1,2);

plot(t,real(xat1),'lineWidth',2);

ylabel('x(t)');

title('Reconstruction from ak''s (alp1=0.5, w1=0.5\*w0)');

axis([‐1.5 1.5 ‐0.2 1.2]);

grid;

Given the periodic square wave x(t) with T = 1 & T1 = 0.25, rewrite the above code for time

scaling when value of alpha is 2 i.e. x(αt) = x(2t).