**Q ) CONSIDER A SQUARE WAVE HAVING PERIOD OF 4s AND AMPLITUDE OF 1 UNIT. FIND THE FOURIER SERIES COEFFICIENTS FOR THIS SYMMETRICAL SQUARE WAVE,PLOT THE PARTIAL SUM OF 1,2,3,4,5,6 COMPONENTS AND DEMONSTRATE GIBBS PHENOMENA.**

**DESCRIPTION**

**A Fourier series is an expansion of a periodic function f(x) in terms of an infinite sum of sines and cosines.**

**Fourier series of a function f(x) is given by:**

**Fourier series coefficient ao of our function is given by:**

**Similarly,Fourier cosine coefficient an of our function is given by:**

; n=1,2,...

**Fourier sine coefficient bn of our function is given by:**

; n=1,2,...

**Gibbs' phenomenon occurs near a jump discontinuity in the signal. It says that no matter how many terms you include in your Fourier series there will always be an error in the form of an overshoot near the discontinuity**

**In this process for creating square wave plots,we have used sampling.**

**Sampling is a process of converting a continuous time signal (analog signal) x(t) into a discrete time signal x[n], which is represented as a sequence of numbers.**

**For having more accurate square wave,we require larger value of N so that Gibbs phenomena is minimum.**

**MATLAB CODE**

function [a0,an,bn]=mysquare()

N=100;

T=4;

syms t n

w0=2\*pi/T;

a0=1/T\*(int(2,t,T,T));

an=2/T\*(int(2\*cos(n\*w0\*t),t,0,T/2));

bn=2/T\*(int(2\*sin(n\*w0\*t),t,0,T/2));

yy=[a0,an,bn]; %List of fourier series coefficients

disp('List of fourier series coefficients')

disp(yy)

%Gibbs phenomena is shown at max and min amplitude

n1=1;

n2=1;

while n1<12 %PARTIAL SUM OF 1,2,3,4,5,6 COMPONENTS

An=sum(subs(an\*cos(n\*w0\*t),n,1:n1));

Bn=sum(subs(bn\*sin(n\*w0\*t),n,1:n1));

ft=a0+An+Bn;

%title("Square wave graph with partial sum of components and Gibbs Phenomena")

caption = sprintf('( sum till n= %d )', n2);

subplot(1,7,n2)

n2=n2+1;

if(n1<12)

fplot(ft)

xlabel(caption)

end

n1=n1+2;

end

n1=n1-1;

subplot(1,7,n2)

An1=sum(subs(an.\*cos(n\*w0\*t),n,1:N));

Bn1=sum(subs(bn.\*sin(n\*w0\*t),n,1:N));

ft1=a0+An1+Bn1;

caption = sprintf('( FINAL PLOT)');

fplot(ft1)

xlabel(caption)

end

**OUTPUT**

**IT SHOWS THE PARTIAL SUM PLOTS FOR N=1,2,3,4,5 AND 6 COMPONENTS OF THIS SQUARE WAVE WITH GIBBS PHENOMENA(DISTURBANCES) OCCURING AT MAX. AND MIN. AMPLITUDES**