Indian Institute of Information Technology, Allahabad
Department of Electronics and Communication Engineering

Course Name: AnalogCommunication
EXPERIMENT NO: 2
Fourier series of square pulse train: Effect of duty cycle on the line spectra and the Gibbs phenomenon

Objective – Write MATLAB code to study sine cosine Fourier series representation of a square wave with fundamental period 2 and unity amplitude level. Plot the Fourier series representation for n = 1, 10, 20 and 50 and comment on the plots by comparing with the original function. Also, find difference with original function and explain Gibbs Phenomena.
Materials Required – MATLAB software, laptop.
Calculation-

```
syms t n
w0=pi;
t0=2;
n=1:100;
a0=(1/t0)*int(1,t,0,1);
an=(2/t0)*int(1*cos(n*w0*t),t,0,1);
bn=(2/t0)*int(1*sin(n*w0*t),t,0,1);
t1=0:.01:10;
y=.5+.5*square(pi*t1);
m=1;
for r=[1 10 20 50]
sum=a0;
for j=1:2:r
sum=sum+(an(j))*cos(n(j)*w0*t1)+(bn(j))*sin(n(j)*w0*t1);
end
subplot(2,4,m);
m=m+1;
plot(t1,sum,t1,y);
xlabel('time');
ylabel('sum');
legend('Fourier Series', 'Square Wave');
subplot(2,4,m);
m=m+1;
plot(t1,sum-y);
xlabel('time');
ylabel('Difference');
```

legend('Gibbs Phenomena');
end

Results - Result obtain by the code.

Precautions- All the required precautions in performance of experiment is to write code very carefully.

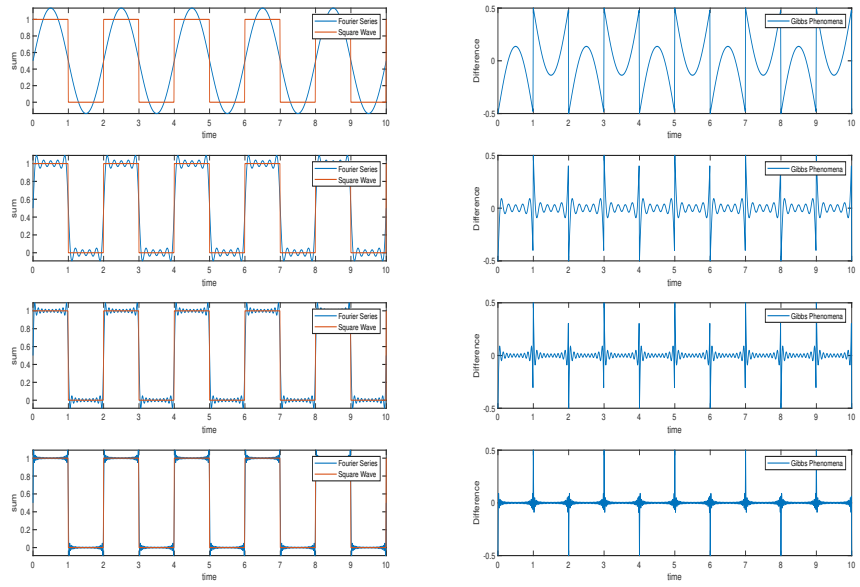

Figure 1: Result of time and frequency domain analysis of 3 tone signal.