

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

Course Name: Analog Communication
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.

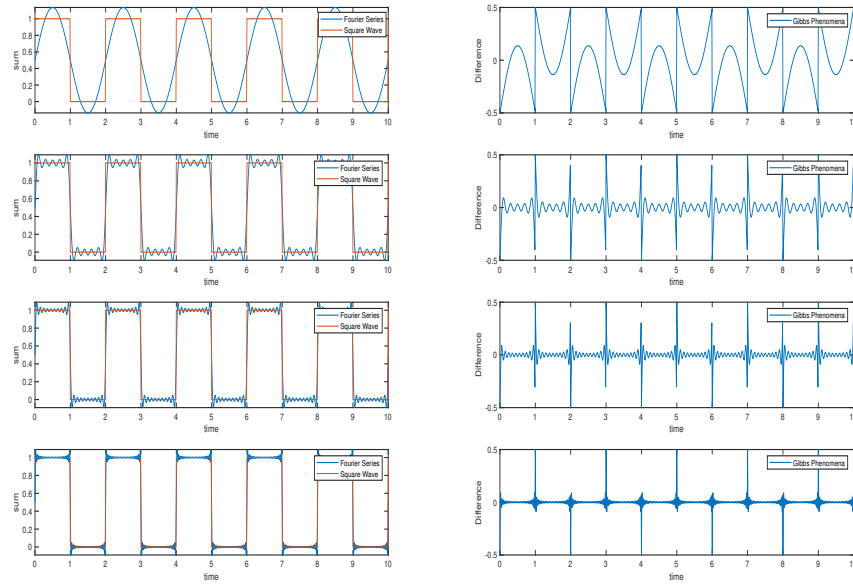
Materials Required – MATLAB software, laptop.

Calculation-

```
clc; syms t n; %symbolic variable
t1=0:0.01:10; % range of time axis
y=.5+.5*sqrt(pi*t1); %square wave generation
plot(t1,y) w0=pi; t0=2;%fundamental period
n=1:100; % number of harmonics
a0=(1/t0)*int(1,t,0,1); an=(2/t0)*int(1*cos(n*pi*t),t,0,1); bn=(2/t0)*int(1*sin(n*w0*t),t,0,1);
% a0, an and bn are Fouries series coefficient.
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(4,2,m);
m=m+1;
plot(t1,sum,t1,y);
xlabel('time');
ylabel('sum');
legend('Fourier Series', 'Square Wave');
subplot(4,2,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.