Control and Instrumentation Laboratory (EC692)
Experiment No.: 2

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***Abstract*—Familiarization with MATLAB and generation of various types of signals.**

I. Brief Description of The Experiment

a) Generation of the following signals and their plots plot in MATLAB
   i) a unit impulse at t=0,
   ii) a unit step,
   iii) a ramp,
   iv) an aperiodic pulse of duration 0.25 ms
b) Generation and plot of a square wave with period 0.5s and amplitude 0.81.
c) Generation of a delayed versions of the signals generated in the previous problem. Delay time = 2ms.
d) Generation of the following signals,
   i) An impulse train with period 1ms.
   ii) A pulse train with period 1ms and a duty cycle of (i) 0.25, (ii) 0.5. Plot atleast 10 cycles.

II. MATLAB Scripts

Exercise - 1

```
%Exercise−1:
%Generate the following signals and plot in MATLAB
%(a) a unit impulse at t=0
%(b) a unit step
%(c) a ramp
%(d) an aperiodic pulse of duration 0.25 ms

t=−1:1e−6:1;

u = heaviside(t);

i = t==0;

r = t.*u;
rand = (t>=0 & t<=.25e−3);

subplot(4,1,1); plot(t,u);
title("Unit Step Function");
subplot(4,1,2); plot(t,i);
title("Unit Impulse Function");
subplot(4,1,3); plot(t,r);
title("Unit Ramp Function");
subplot(4,1,4); plot(t,rand);
xlim([−1e−3,3e−3]);
title("0.25ms Pulse");
```

Exercise - 2

```
%Exercise − 2
%Generate and plot a square wave with period 0.5 and amplitude 0.81.
T = 0.5; %period in seconds.
A = 0.81; %amplitude

t=0:1e−6:1;
sqSig = A.*square(1./T.*2*pi.*t);
figure;
plot(t,sqSig);
```

Exercise - 3

```

%Exercise − 3
%Generate delayed versions of the signals generated in the previous problem. Plot both , the original signal and its delayed version. Use delay time =2ms;
d = 2e−3; %Time Delay in seconds.

sqSig = A.*square(1./T.*2*pi.*(t−d));
hold on;
plot(t,sqSig);
```

Exercise - 4

```
%Exercise − 4
%Generate the following signals,
%(a) An impulse train with period 1ms. Plot atleast 5−10 cycles.
%(b) A pulse train with period 1ms and a duty cycle of (i) 0.25, (ii) 0.5. Plot atleast 10 cycles. Hint: You could use the impulse train in (a) to generate the pulse train

t=−1:1e−6:1;

%(a)
i= @(t) t==0|abs(t)<=1e−6;
x=linspace(−1,1,15);
figure;hold on;
for j = 1:length(x)
    plot(t,i(t−x(j)));
```

```
14  end
15
16  %(b)
17  t=0:1e-6:10e-3;
18
19  T=1e-3; %Time Period in seconds
20  sqSig = @(D) square(1./T.*2*pi.*t,D*100); %D=Duty Cycle in fraction
21  figure;
22  subplot(2,1,1); plot(t,sqSig(0.25));
23  subplot(2,1,2); plot(t,sqSig(0.5));
```

III. Output Results and Plots

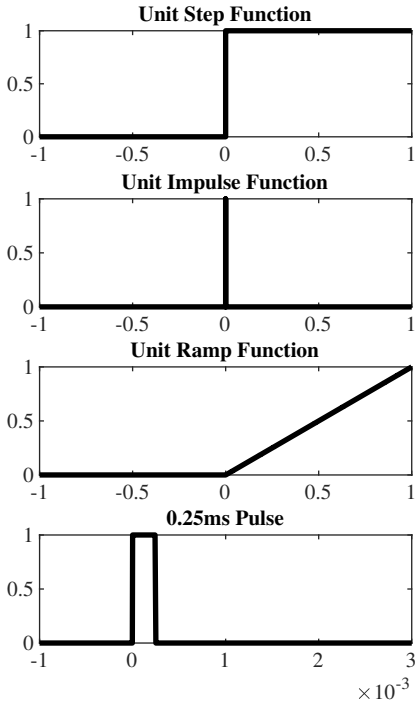

Figure 1. Plot of various signals specified in Exercise 1

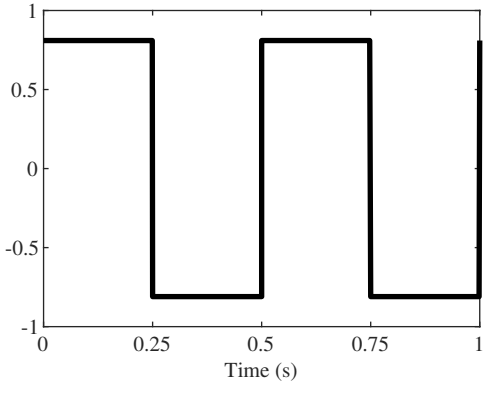

Figure 2. Plot of Exercise-2

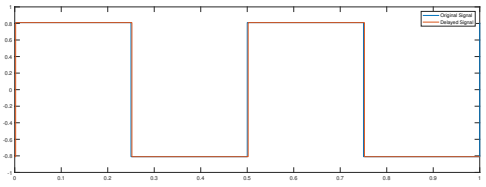

Figure 3. Plot of a delayed signal

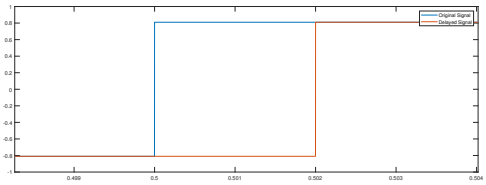

Figure 4. A close inspecection around 0.5s of Fig.3

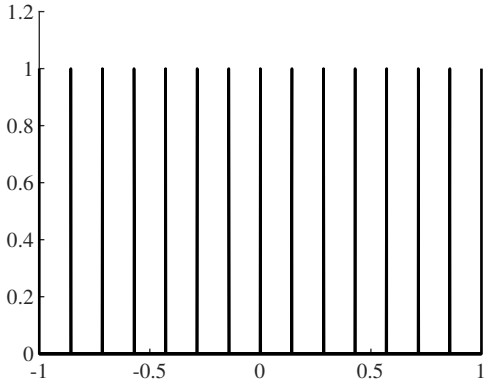

Figure 5. Plot impulse train specified in Exercise 4(i)

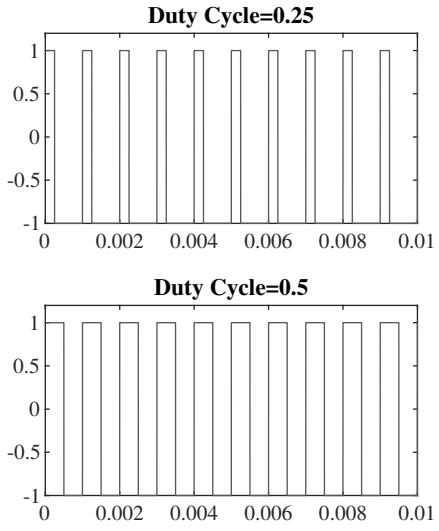

Figure 6. Plot of two suare waves of same period but different Duty Cycle specified in Exercise 4(ii)

IV. Observations & Conclusion

Test signals are always a useful tool in analysis of a system. Previously we've learned to analyze systems in both Time-Domain and Frequency-Domain analytically. And now that we have learned how to generate the test signals in MATLAB, it'll be helpful for analyzing systems numerically.

V. Acknowledgment

We would like to express our sincere gratitude to our course instructor Mr. Mirwaiz Rahaman and Mrs. Purba Basu for providing their invaluable guidance, comments and suggestions.