

ECE 218 Signals and Systems Laboratory 5

I. PREPARATION

1) A triangle function can be generated using the ramp functions. Try the following matlab code and see how a triangle is generated using discrete time ramp functions. Use rampDT function from Lab5.

```
function y=tri(n)
y=rampDT(n+10)-2*rampDT(n)+rampDT(n-10);
```

2) A periodic signal is obtained by shifting a non-periodic signal to the left and write by multiples of a period and summing the shifted replicas. A periodic triangle function is generated as follows. Try it and understand how it is written.

```
n=-150:150;
N=25; %Period of the signal
periodicTriangle=zeros(1,length(n));
for k=-5:5
periodicTriangle=periodicTriangle+tri(n-k*N);
end
figure;
stem(n,periodicTriangle);
```

3) Modify 1 and 2 for continuous time triangle signal.

4) Write a matlab function that generates a rectangle signal around origin, use unit step functions (both in continuous time and discrete time).

5) Using the rectangle function in 3, write a matlab code that generates period rectangle signals. Decide the all the parameters yourself (i.e., time length, rectangle length, period).

6) How do you find the energy of a continuous and discrete time signal. Review the concepts.

7) Using matlab help utility learn the usage of the following matlab function "trapz".

8) Look at the following matlab code and understand how the energy of a continuous time signal is found using integration.

```
t=-7:0.1:13;
xt=tri((t-3)/10);% tri(t) is the your C.T. triangle function
```

in step 3

```
xt_sq=xt.^2;
Ex=trapz(t,xt_sq);
disp(' Energy of the signal is: ');
disp(Ex);
```

II. EXPERIMENTAL WORK

1) Generate the following signals using matlab.

a) $x(t) = e^{-2t}(u(t) - u(t - 4))$

b) $x[n] = e^{-n}(u[n] - u[n - 4])$

c) Using signals in (a) and (b) generate periodic signals.

d) Find the energy of the signals in parts (a) and (b).

2) Using matlab find the energy of the following signals.

a) $x[n] = \cos\left(\frac{\pi n}{3}\right)(u[n] - u[n - 6])$

b) $x[n] = \frac{(-1)^n}{3}u[n]$

3) Using matlab find the power of the following signals

a) $x[n] = u[n]$

b) $x[n] = (-1)^n$

c) $x[n] = e^{-j\pi n/2}$

4) Sketch the following signal.

a) $g[n] = \left(\frac{j}{4}\right)^n |u[n]$

b) Sketch the even and odd part of the signal in part a.

5) Sketch the magnitude and phase of the following signal

a) $x[k] = \text{sinc}(k/2)e^{-j(2\pi k/4)}$

b) Find its energy using matlab.