Experiment No: 1 Date: 29/07/24

Simulation of Basic Test Signals

Aim:

To generate continuous and discrete waveforms for the following:

1. Unit Impulse Signal
2. Bipolar Pulse Signal
3. Unipolar Pulse Signal
4. Ramp Signal
5. Triangular Signal
6. Sine Signal
7. Cosine Signal
8. Exponential Signal
9. Unit Step Signal

Theory:

1. Unit Impulse Signal:

- A signal that is zero everywhere except at one point, typically at t=0 where its value is 1.
- **Mathematically** $\delta(t) = \{ \begin{matrix} \infty; t = 0 \\ 0; t \neq 0 \end{matrix} \}$

2. Bipolar Pulse Signal:

- A pulse signal that alternates between positive and negative values, usually rectangular in shape. It switches between two constant levels (e.g., -1 and 1) for a defined duration.
- **Mathematically p(t) = A for |t| ≤ τ/2, p(t) = 0 otherwise**

3. Unipolar Pulse Signal:

- A pulse signal that alternates between zero and a positive value. It remains at zero for a specified duration and then jumps to a positive constant level (e.g., 0 and 1).
- **Mathematically p(t) = A for |t| ≤ τ/2, p(t) = 0 otherwise (assuming A is positive)**

4. Ramp Signal:

- A signal that increases linearly with time.
- **Mathematically** ***r(t)*** **=**$\{\begin{matrix} \boldsymbol{t; t \geq 0} \\ \boldsymbol{0; t < 0} \end{matrix}\}$

5. Triangular Signal:

- A periodic signal that forms a triangle shape, linearly increasing and decreasing with time, typically between a positive and negative peak.
- **Mathematically: Λ(t) = 1 - |t| for |t| ≤ 1, Λ(t) = 0 otherwise**

6. Sine Signal:

- A continuous periodic signal. It oscillates smoothly between -1 and 1.
- **Mathematically: y(t)=Asin(2πft)**

7. Cosine Signal:

- A continuous periodic signal like the sine wave but phase-shifted by π\2.
- **Mathematically: y(t)=Acos(2πft)**

8. Exponential Signal:

- A signal that increases or decreases exponentially with time. The rate of growth or decay is determined by the constant a.
- **Mathematically: e^(at)**

9. Unit Step Signal:

- A signal that is zero for all negative time values and one for positive time values.
- **Mathematically** ***u(t)*** **=**$\{\begin{matrix} \boldsymbol{1; t \geq 0} \\ \boldsymbol{0; t < 0} \end{matrix}\}$

Program:

```
clc;

clear all;
```

```
close all;
subplot(3,3,1);

t = -5:1:5;

y = [zeros(1,5),ones(1,1),zeros(1,5)];

stem(t,y);

xlabel("Time(s)");

ylabel("Amplitude");

title("Unit Impulse Signal");


subplot(3,3,2);

t2 = 0:0.01:1;

f = 5;

y2 = square(2*pi*f*t2);

stem(t2,y2);

hold on;

plot(t2,y2);

xlabel("Time(s)");

ylabel("Amplitude");

title("Bipolar Pulse Signal");

legend("Discrete","Continuous");


subplot(3,3,3);

t3 = 0:0.1:1;

f = 5;

y3 = abs(square(2*pi*f*t3));

stem(t3,y3);

hold on;

plot(t3,y3);

xlabel("Time(s)");
```

```
ylabel("Amplitude");
title("Unipolar Pulse Signal");
legend("Discrete","Continuous");

subplot(3,3,4);
t4 = -5:1:5;
y4 = t4 .*(t4>=0);
stem(t4,y4);
hold on;
plot(t4,y4);
xlabel("Time(s)");
ylabel("Amplitude");
title("Unit Ramp Signal");
legend("Discrete","Continuous");

subplot(3,3,5);
t5 = 0:0.025:1;
f = 10;
y5 = sawtooth(2*pi*f*t5,0.5);
stem(t5,y5);
hold on;
plot(t5,y5);
xlabel("Time(s)");
ylabel("Amplitude");
title("Triangular Signal");
legend("Discrete","Continuous");

subplot(3,3,6);
t6 = 0:0.001:1;
f = 10;
```

```
y6 = sin(2*pi*f*t6);
stem(t6,y6);
hold on;
plot(t6,y6);
xlabel("Time(s)");
ylabel("Amplitude");
title("Sine Wave");
legend("Discrete","Continuous");

subplot(3,3,7);
t7 = 0:0.001:1;
f = 10;
y7 = cos(2*pi*f*t7);
stem(t7,y7);
hold on;
plot(t7,y7);
xlabel("Time(s)");
ylabel("Amplitude");
title("Cosine Wave");
legend("Discrete","Continuous");

subplot(3,3,8);
t8 = -5:1:5;
y8 = exp(t8);
stem(t8,y8);
hold on;
plot(t8,y8);
xlabel("Time(s)");
ylabel("Amplitude");
title("Exponential Signal");
```

```
legend("Discrete","Continuous");

subplot(3,3,9);
t9 = -5:1:5;
y9 = [zeros(1,5),ones(1,6)];
stem(t9,y9);
xlabel("Time(s)");
ylabel("Amplitude");
title("Unit Step Signal");
```

Result:

Generated and Verified various Continuous and Discrete waveforms for basic test signals.

Observation: