Experiment No:1 Date:1/08/2024

SIMULATION OF BASIC TEST SIGNALS

Aim

To generate continuous and discrete waveforms for the following:

1) Unit Impulse Signal
2) Bipolar Pluse
3) Unipolar Pluse
4) Ramp Signal
5) Triangular Signal
6) Sinusoidal Signal
7) Cosine Signal
8) Exponential Signal
9) Unit Step Signal

Theory

1.Impulse signal

An impulse signal is a theoretical pulse that is infinitely narrow and happens at a specific moment in time, usually at t=0.It is represented mathematically by the Dirac delta function, denoted as

$$\delta(t) = \begin{cases} 0, & \text{if } t \neq 0 \\ \infty, & \text{if } t = 0 \end{cases}$$

2.Bipolar Pluse

A bipolar pulse is a type of signal that alternates between positive and negative amplitude, typically with equal magnitudes. It is used in digital communication systems to represent binary data, where the positive pulse represents one binary state (e.g., "1") and the negative pulse represents the opposite state (e.g., "0"). This alternating pattern helps reduce signal drift and minimizes DC offset, making it more efficient for transmission over long distances.

3.Unipolar Pluse

A unipolar square wave is a periodic signal that alternates between 0 and a positive voltage level (e.g., V_max) with abrupt transitions. It has no negative amplitude. The signal is typically represented as:

f(t)=Vmax, for $0 \leq t < T/2$ f(t)=0, for $T/2 \leq t < T$

Where T is the period of the waveform.

4. Ramp Signal

A ramp signal is a signal that increases linearly with time, starting from zero. The ramp function is denoted as

$$r(t) = \begin{cases} t, & if\ t \geq 0 \\ 0, & if\ t < 0 \end{cases}$$

5. Triangular Signal

A triangular signal is a periodic waveform that alternates between a peak and a trough in a linear fashion, forming a triangle-like shape. The rise and fall between the maximum and minimum values occur smoothly, resulting in a gradual, consistent slope.

6. Sinusoidal Signal

A sine signal is a continuous waveform that oscillates smoothly and periodically, following the form of a sine or cosine function. Its general form is expressed as:

$$x(t) = Asin(\omega t + \phi)$$

where,

• Ais the amplitude of the signal (the peak value),

• ω is the angular frequency in radians per second, where $\omega = 2\pi f$, f is the frequency in Hertz,

• t is the time variable

• ϕ is the phase shift, which determines the initial angle at t=0.

7.Cosine signal A cosine signal is a type of sinusoidal signal that oscillates in a smooth, periodic manner over time, following the shape of a cosine function. The general form of a

$$x(t) = Asin(\omega t + \phi)$$

cosine signal is given by:

Where:

• A is the amplitude of the signal (the peak value),

• ω is the angular frequency in radians per second, where $\omega = 2\pi f$ and f is the frequency in Hertz.

• t is the time variable

• ϕ is the phase shift, which determines the initial angle at $t = 0$.

8.Exponential signal

An **exponential signal** is a signal whose amplitude varies exponentially with time. It can either grow or decay depending on the sign of the exponent. The exponential signal is generally expressed as

$$x(t) = Ae^{\alpha t}$$

Where:

- A is the amplitude of the signal,
- α is the exponent that determines the rate of growth or decay,
- t is the time variable.
- If $\alpha > 0$, the signal represents exponential growth.
- If $\alpha < 0$, the signal represents exponential decay.

9.Unit step signal

is a function that jumps from 0 to 1 at a specified time, typically at t=0. The unit step function is denoted as

$$u(t) = \begin{cases} 0, & if\ t < 0 \\ 1, & if\ t \geq 0 \end{cases}$$

Program

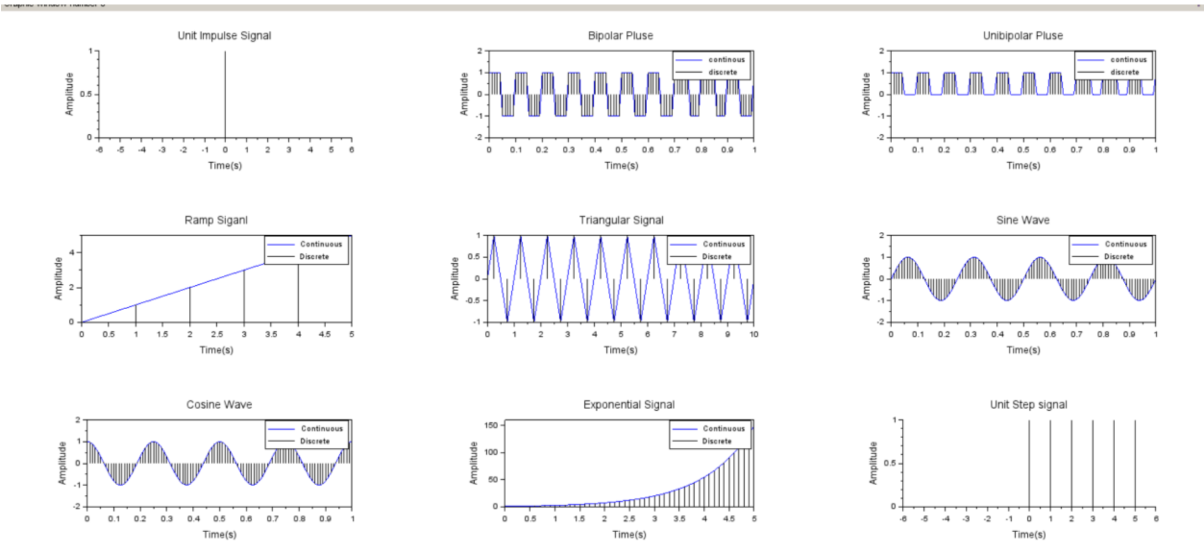
```
clc;
clear;
close;
clf;
```

```
t=-5:1:5;
y1=[zeros(1,5),ones(1,1),zeros(1,5)];
subplot(3,3,1);
plot2d3(t,y1);
xlabel('Time(s)');
ylabel('Amplitude');
title('Unit Impulse Signal');
t2 = 0:0.01:1;
f =10
y2=squarewave(2*%pi*f*t2);
subplot(3,3,2);
plot(t2,y2);
plot2d3(t2,y2);
mtlb_axis([0 1 -2 2]);
legend('continous','discrete');
xlabel('Time(s)');
ylabel('Amplitude');
title('Bipolar Pluse');
t3 = 0:0.01:1;
f =10
y3=sqrt(squarewave(2*%pi*f*t3));
subplot(3,3,3);
plot(t3,y3);
plot2d3(t3,y3);
mtlb_axis([0 1 -2 2]);
legend('continous','discrete');
xlabel('Time(s)');
ylabel('Amplitude');
title('Unibipolar Pluse');
```

```
t4=0:1:5;
y4=[t4];
subplot(3,3,4);
plot(t4,y4);
plot2d3(t4,y4);
xlabel('Time(s)');
ylabel('Amplitude');
title('Ramp Siganl');
legend("Continuous","Discrete");
t5=0:0.25:50;
f5=5;
subplot(3,3,5);
plot(t5,sin(2*%pi*f5*t5));
plot2d3(t5,sin(2*%pi*f5*t5));
mtlb_axis([0 10 -1 1]);
 xlabel('Time(s)');
ylabel('Amplitude');
title('Triangular Signal');
legend("Continuous","Discrete");
t6=0:0.01:1;
 f6=4;
subplot(3,3,6);
plot(t6,sin(2*%pi*f6*t6));
plot2d3(t6,sin(2*%pi*f6*t6));
mtlb_axis([0 1 -2 2]);
 xlabel('Time(s)');
ylabel('Amplitude');
title('Sine Wave');
legend("Continuous","Discrete");
```

```
t7=0:0.01:1;
f7=4;
subplot(3,3,7);
plot(t7,cos(2*%pi*f7*t7));
plot2d3(t7,cos(2*%pi*f7*t7));
mtlb_axis([0 1 -2 2]);
xlabel('Time(s)');
ylabel('Amplitude');
title('Cosine Wave');
legend("Continuous","Discrete");
t8=0:0.1:5;
y8=exp(t8);
subplot(3,3,8);
plot(t8,y8);
plot2d3(t8,y8);
xlabel('Time(s)');
ylabel('Amplitude');
title('Exponential Signal')
legend("Continuous","Discrete");
t9=-5:1:5;
y9=[zeros(1,5),ones(1,6)];
subplot(3,3,9);
plot2d3(t9,y9);
xlabel('Time(s)');
ylabel('Amplitude');
title('Unit Step signal');
```

OUTPUT



Unit Impulse Signal
Bipolar Pluse
Unibipolar Pluse
Ramp Siganl
Triangular Signal
Sine Wave
Cosine Wave
Exponential Signal
Unit Step signal
Amplitude
Time(s)
continous
discrete
Continuous
Discrete

Result

Generated and plotted following elementary signal in Scilab:

1) Unit Impluse Signal
2) Bipolar Pluse
3) Unipolar Pluse
4) Ramp Signal
5) Triangular Signal
6) Sinusoidal Signal
7) Cosine Signal
8) Exponential Signal
9) Unit Step Signal