Ministry of Higher Education and Scientific Research
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Computer Technical Engineering

DIGITAL SIGNAL PROCESSING LAB MANUAL

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Exp. No:01

GENERATION of DISCRETE TIME SIGNALS

AIM: -To write a unit MATLAB program to generator of discreet line signal unit impulse, unit step, unit ramp, exponential signal and saw tooth signals.

SOFTWARE REQURIED: -

PC and MATLAB Software (2019b 9.7version)

PROCEDURE: -

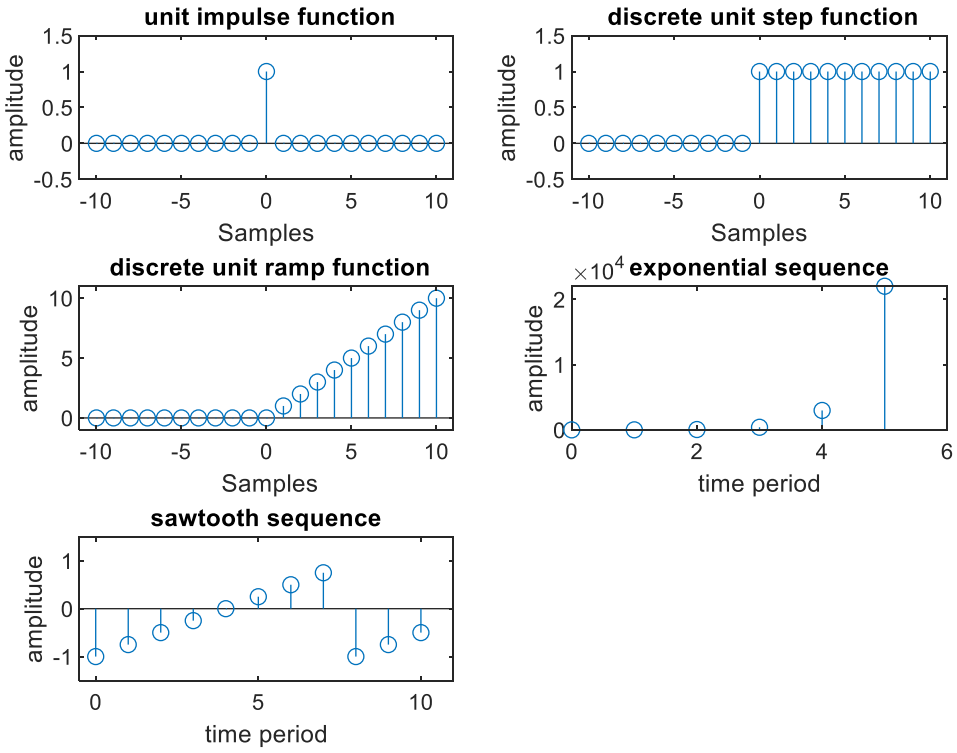
- Open MATLAB
- Open new M-file
- Type the program
- Save in current directory
- Compile and Run the program
- For the output see command window

CODE: –

```
%unit impulse function%
%Discrete%
n=-10:10;
Xn=(n==0);
subplot(3,2,1);
stem(n,Xn);
axis([-11 11 -0.5 1.5]);
xlabel('Samples');
ylabel('amplitude');
title(' unit impulse function');

%unit step function%
%Discrete%
n=-10:10;
Xn=(n>=0);
subplot(3,2,2);
stem(n,Xn);
axis([-11 11 -0.5 1.5]);
xlabel('Samples');
ylabel('amplitude');
title(' discrete unit step function');

%unit ramp function%
%Discrete%
n=-10:10;
Xn=(n>=0).*n;
subplot(3,2,3);
stem(n,Xn);
axis([-11 11 -1 11]);
xlabel(' Samples');
ylabel('amplitude');
```

```
title(' discrete unit ramp function');
% exponential signal:
%Discrete%
n2=input('enter the length of the exponential sequence');
t=0:n2;
a=input('enter the a value');
y2=exp(a*t);
subplot(3,2,4);
stem(t,y2);
ylabel('amplitude');
xlabel('time period');
title('exponential sequence')

%sawtooth signal
%Discrete%
n=0:10;
Xn=sawtooth(pi*n/4);
subplot(3,2,5);
stem(n,Xn);
axis([-0.5 11 -1.5 1.5])
xlabel('time period');
ylabel('amplitude');
title('sawtooth sequence');
```

OUTPUT:–



QUESTIONS:

1. Define impulse, unit step, ramp signals and write their expressions?

An impulse signal is a discrete-time signal that has a value of 1 at n = 0 and 0 elsewhere. It's denoted as $\delta[n]$. The unit step signal has a value of 0 for $n < 0$ and 1 for $n \geq 0$, denoted as $u[n]$. A ramp signal increases linearly with time and is defined as $r[n] = n \cdot u[n]$.

2. Define exponential and sinusoidal signals and write their expressions?

An exponential signal follows the form $x[n] = a^n$ where 'a' is a real or complex number. A sinusoidal signal is periodic and can be expressed as $x[n] = A \cdot \sin(\omega n + \varphi)$, where A is amplitude, ω is angular frequency, and φ is phase.

3. Express unit step signal in terms of unit impulse?

The unit step signal can be derived from the impulse signal using summation of unit impulse signals from 0 to ∞:

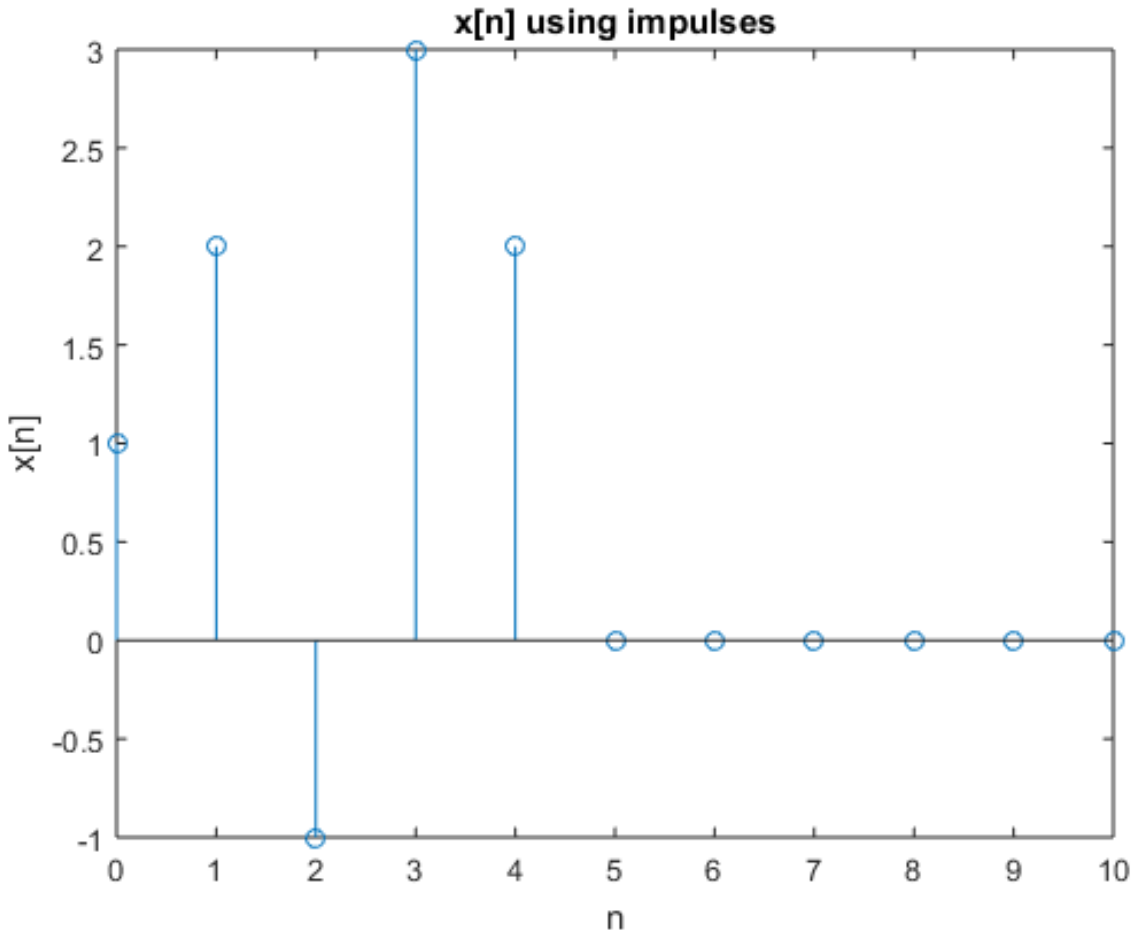
$u[n] = \Sigma\, \delta[k]$ from $k = 0$ to ∞.

4. Express ramp signal in terms of unit step signal?

The ramp signal can be constructed using the step function: $r[n] = n \cdot u[n]$, meaning it starts at zero and increases with n.

5. Represent the signal x[n]={1,2,-1,3,2} using impulse signal?

$x[n] = 1\cdot\delta[n] + 2\cdot\delta[n-1] - 1\cdot\delta[n-2] + 3\cdot\delta[n-3] + 2\cdot\delta[n-4]$.



Exp. No:02

GENERATE SUM OF TWO SINUSOIDAL SIGNALS

AIM: - To write a MATLAB program to find the sum of two sinusoidal signals and to find frequency response (magnitude and phase).

SOFTWARE REQURIED: -

- PC and MATLAB Software (2019b 9.7version)

PROCEDURE: -

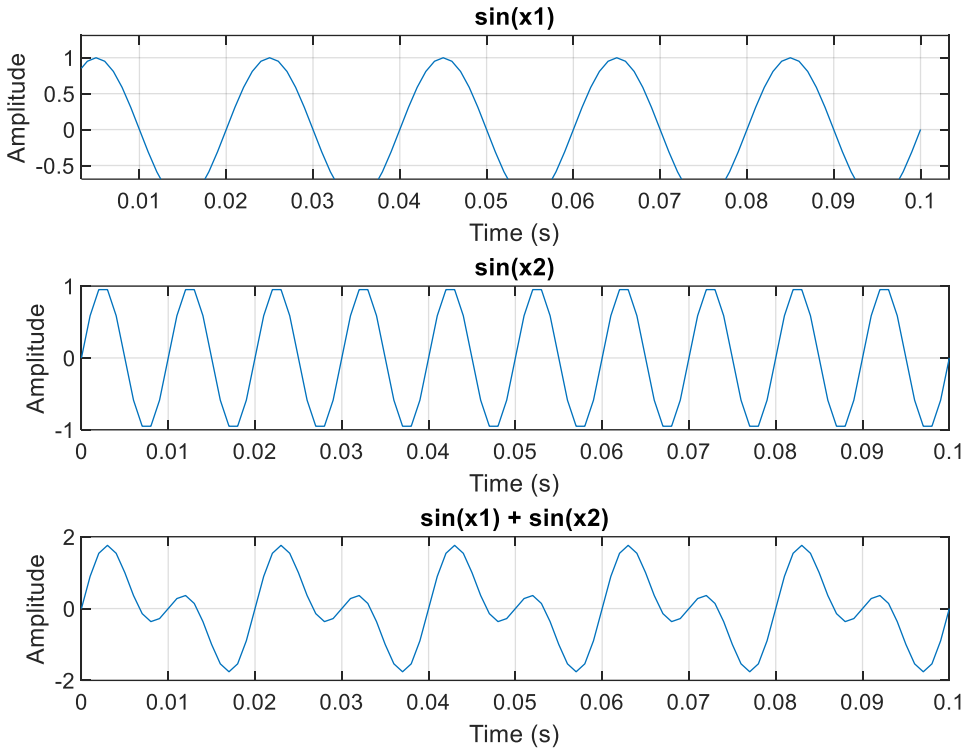
- Open MATLAB
- Open new M-file
- Type the program
- Save in current directory
- Compile and Run the program
- For the output see command window\ Figure window

CODE: -

```
clc;
clearvars;
close all;

t = 0:0.001:0.1;
f1 = 50;
x1 = 2 * pi * f1 * t;
y1 = sin(x1);

f2 = 100;
x2 = 2 * pi * f2 * t;
y2 = sin(x2);

y = y1 + y2;

figure;

subplot(3,1,1);
plot(t, y1);
title('sin(x1)');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;

subplot(3,1,2);
plot(t, y2);
title('sin(x2)');
xlabel('Time (s)');
```

```
ylabel('Amplitude');
grid on;

subplot(3,1,3);
plot(t, y);
title('sin(x1) + sin(x2)');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;
```

OUTPUT: –



QUESTIONS:

1. How do you find sum of sinusoid?

To sum two sinusoids, you add their time-domain expressions point-by-point. If they share the same frequency, trigonometric identities can simplify the sum into a single sinusoid.

2. How do you add two sinusoidal currents?

Sinusoidal currents are added by phasor representation or time-domain addition. Use vector addition in the phasor domain for efficiency.

3. What is amplitude of sinusoidal function?

Amplitude is the peak value of the sinusoidal function. It defines the signal's maximum strength or magnitude.

4. What is meant by sinusoidal signal?

A sinusoidal signal is a continuous, smooth periodic waveform characterized by its amplitude, frequency, and phase.

5. What is phase of sinusoidal function?

Phase is the initial angle of the sinusoid at time zero. It determines the horizontal shift of the waveform.