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Lab Assignment - 1

Signal Generation

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Course Outcome: CO1: Familiarise the basic concepts of communication systems

.1. Plot the following **elementary signals**.

a. Unit Impulse

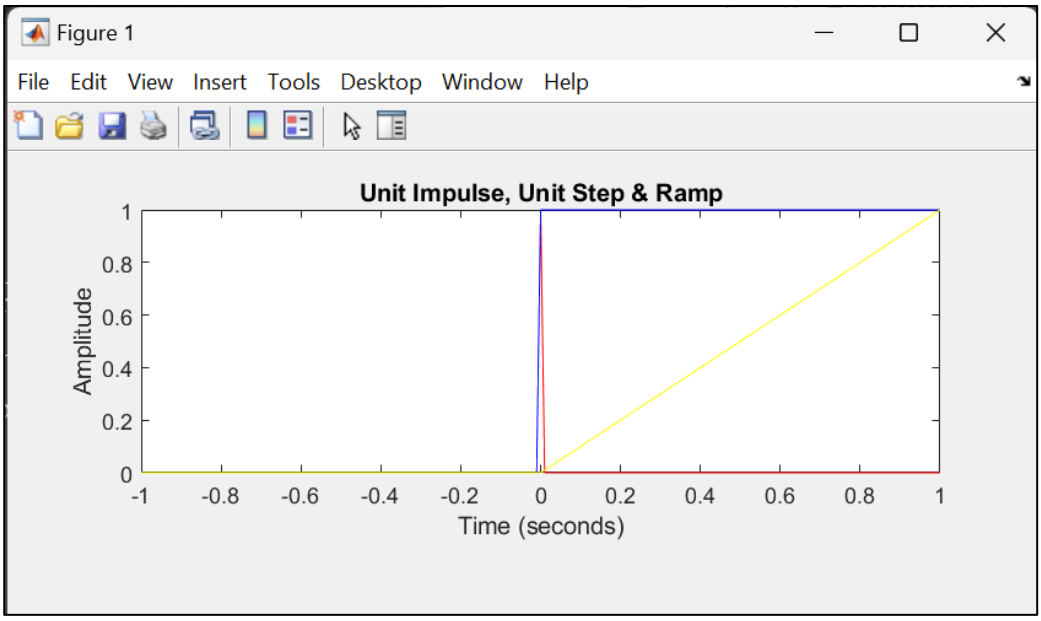
b. Unit Step

c. Ramp

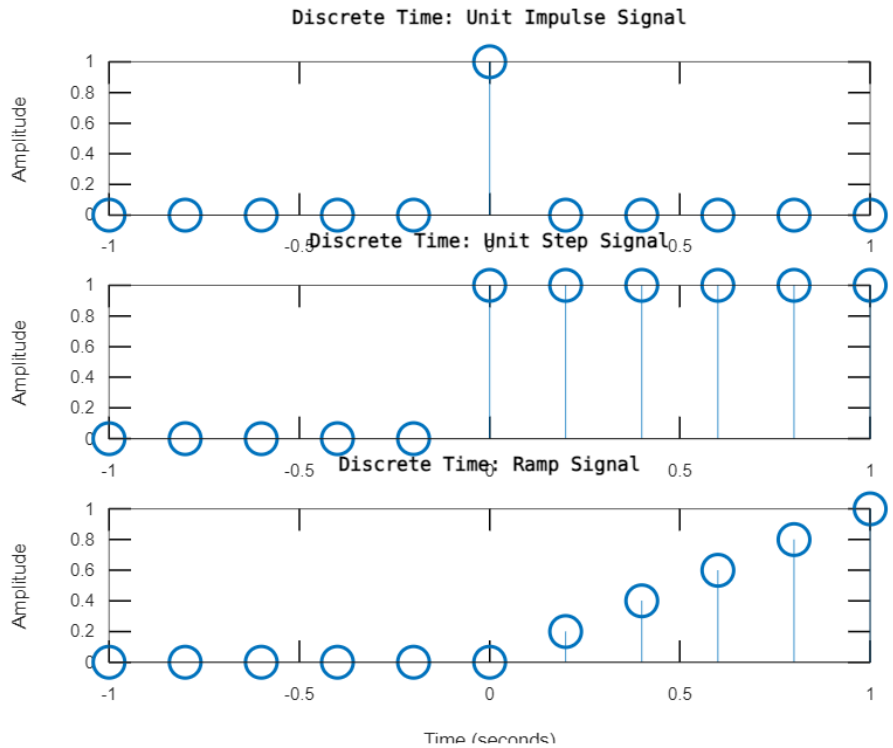
Continuous Signals

```
t = (-1:0.01:1)';
impulse = t==0; %in red
unitstep = t>=0; %in blue
ramp = t.*unitstep; %in yellow
subplot(2,1,1);
plot(t,impulse,'r', t, unitstep,'b',t, ramp,'y')
title('Unit Impulse, Unit Step & Ramp');
xlabel('Time (seconds)');
ylabel('Amplitude');
```

Plot:



```
Discrete Signals
t = -1:0.2:1;

impulse_discrete = zeros(size(t));
impulse_discrete(t == 0) = 1;

step_discrete = zeros(size(t));
step_discrete(t >= 0) = 1;

ramp_discrete = t .* (t >= 0);

subplot(3,1,1);
stem(t, impulse_discrete);
title('Discrete Time: Unit Impulse Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');

subplot(3,1,2);
stem(t, step_discrete);
title('Discrete Time: Unit Step Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');

subplot(3,1,3);
stem(t, ramp_discrete);
title('Discrete Time: Ramp Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');
```



2. Generate and plot the following continuous time signals (Define the time vector, t to range from 0 to 1 second, with a sampling rate of 1000 Hz)

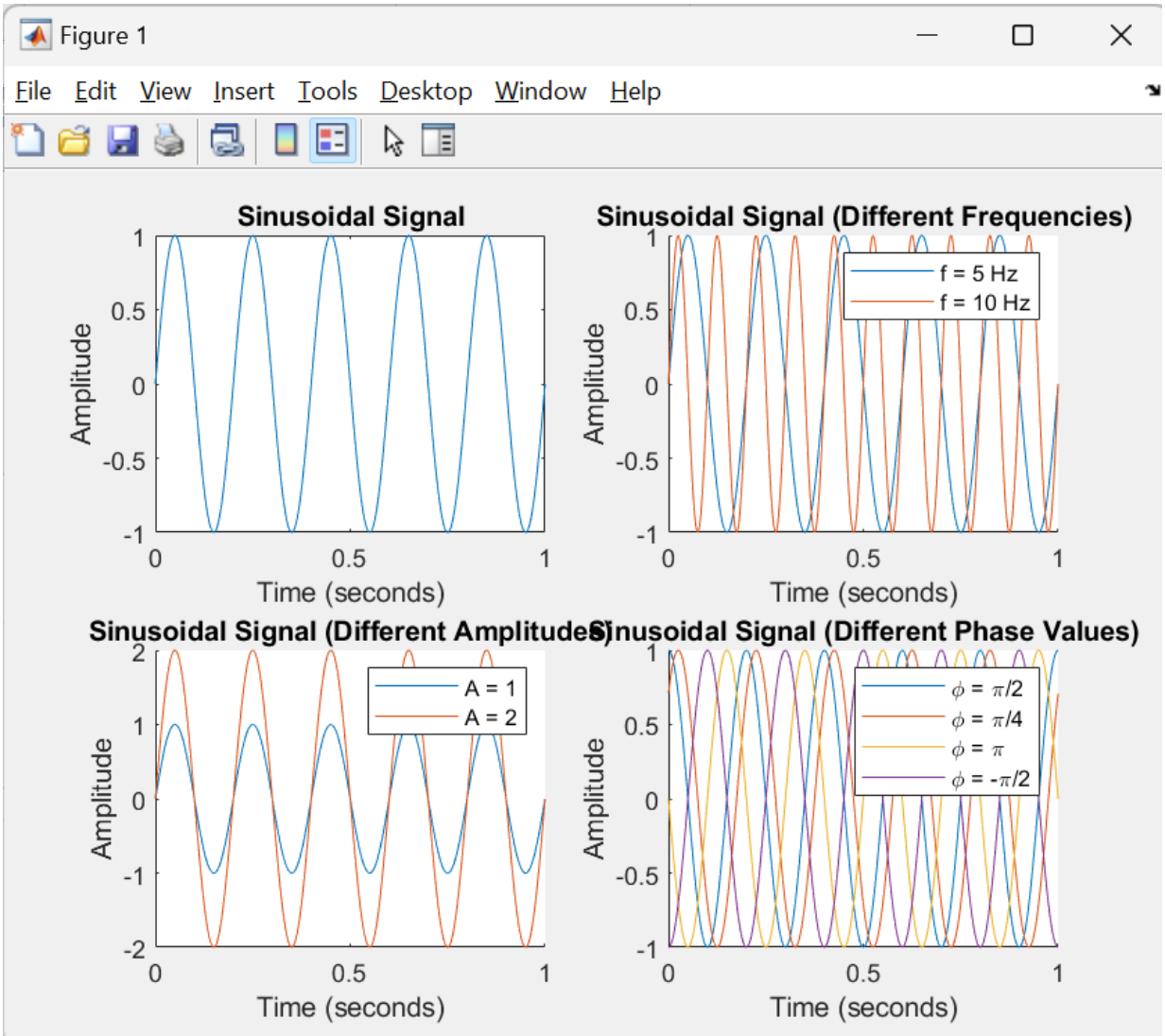
a. Sinusoidal Signal

Code:

i. What happens if you increase the frequency? How does it affect the waveform?

ii. How does changing the amplitude affect the waveform?

iii. How does changing the phase affects the waveform? (Plot for phi values pi/2, pi/4, pi, -pi/2)



b. square signal

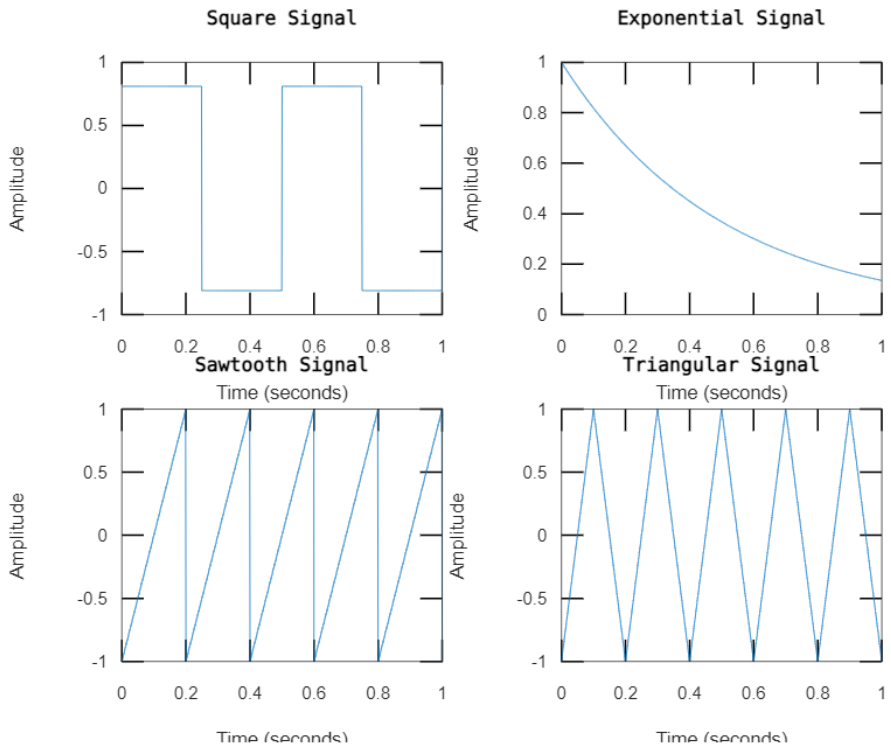
C. exponential signal

d. Sawtooth signal

e. Triangular signal

```
t = 0:0.001:1;
f =5;
A = 1;

A_square = 0.81;
```

```
T_square = 0.5;
y_square = A_square * square(2 * pi * (1 / T_square) * t);
subplot(2, 2, 1);
plot(t, y_square);
title('Square Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');


y_exp = exp(-2 * t);
subplot(2, 2, 2);
plot(t, y_exp);
title('Exponential Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');


y_sawtooth = sawtooth(2*pi*f*t);
subplot(2, 2, 3);
plot(t, y_sawtooth);
title('Sawtooth Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');


y_triangular = sawtooth(2 * pi * f*t, 0.5);
subplot(2, 2, 4);
plot(t, y_triangular);
title('Triangular Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');
```



3. Generate and plot the following signals. (Signal Operations)

a. x1(t) = sin(2*pi*t/T).*exp(-2*t)

b. x2(t) = 2*cos(2*pi*t/T2).*sin(2*pi*t/T3)

c. x3(t) = sin(2*pi*t/T).*exp(-2*t)+sin(2*pi*t/T1).*exp(-4*t)

d. x4(t) = aa*u(t), (take aa=5, u(t) is step signal, Plot both u(t) and x4(t))

```
figure;
t = 0:0.01:5;
T = 2;
T2 = 2;
T3 = 3;
T1 = 3;
aa = 5;
u_t = t >= 3;

x1 = sin(2*pi*t/T) .* exp(-2*t);
x2 = 2 * cos(2*pi*t/T2) .* sin(2*pi*t/T3);
x3 = sin(2*pi*t/T) .* exp(-2*t) + sin(2*pi*t/T1) .* exp(-4*t);
x4 = aa * u_t;

subplot(3, 2, 1);
plot(t, x1);
title('x1(t) = sin(2*pi*t/T).*exp(-2*t)');
xlabel('Time');
ylabel('Amplitude');
```

```
subplot(3, 2, 2);
plot(t, x2);
title('x2(t) = 2*cos(2*pi*t/T2).*sin(2*pi*t/T3)');
xlabel('Time');
ylabel('Amplitude');

subplot(3, 2, 3);
plot(t, x3);
title('x3(t) = sin(2*pi*t/T).*exp(-2*t)+sin(2*pi*t/T1).*exp(-4*t)');
xlabel('Time');
ylabel('Amplitude');

subplot(3, 2, 4);
plot(t, u_t, 'r', t, x4, 'b');
title('x4(t) = aa*u(t)');
xlabel('Time');
ylabel('Amplitude');
legend('u(t)', 'x4(t)');
```