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Lab Assignment - 1

Signal Generation

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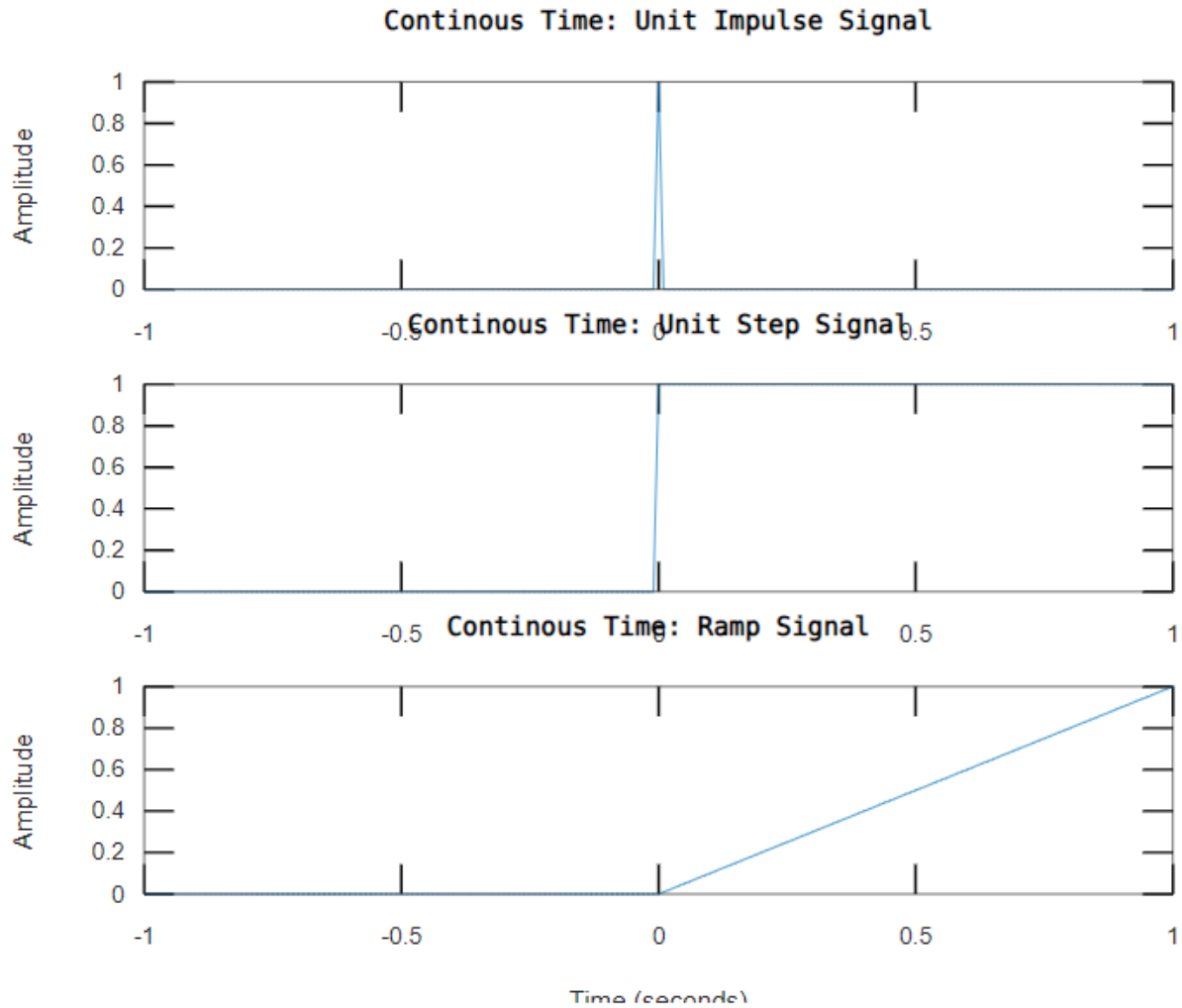
Course Outcome: CO1: Familiarise the basic concepts of communication systems

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

a. Unit Impulse
b. Unit Step
c. Ramp

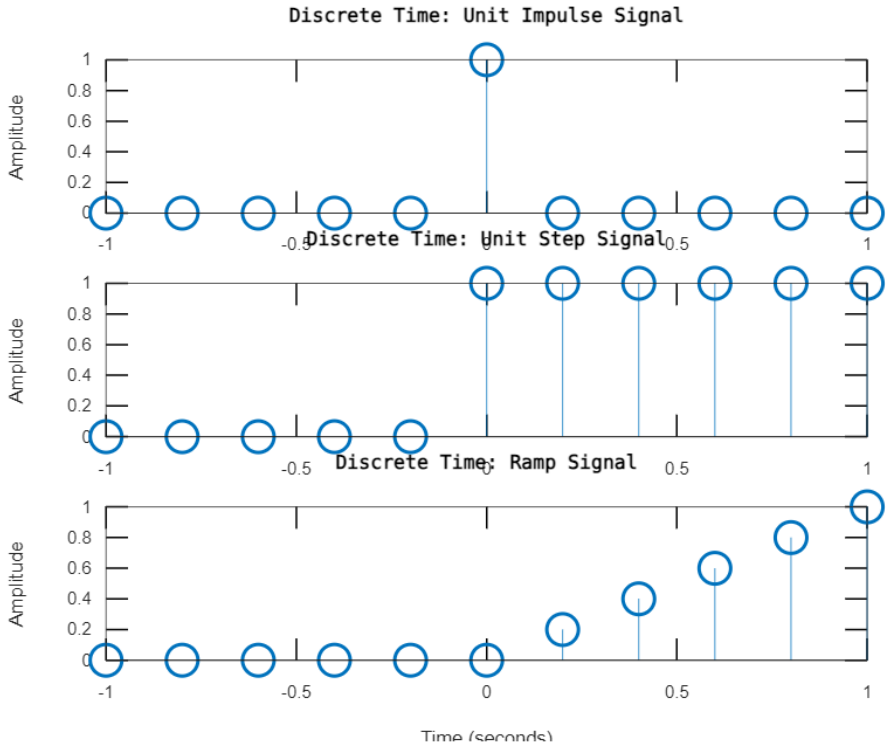
Continous Signal

```
t = -1:0.01:1;

impulse_continous = t==0;
step_continous = t >= 0;
ramp_continous = t .* (t >= 0);

subplot(3,1,1);
plot(t, impulse_continous);
title('Continous Time: Unit Impulse Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');

subplot(3,1,2);
plot(t, step_continous);
title('Continous Time: Unit Step Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');

subplot(3,1,3);
plot(t, ramp_continous);
title('Continous Time: Ramp Signal');
xlabel('Time (seconds)');
ylabel('Amplitude');
```



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');
```

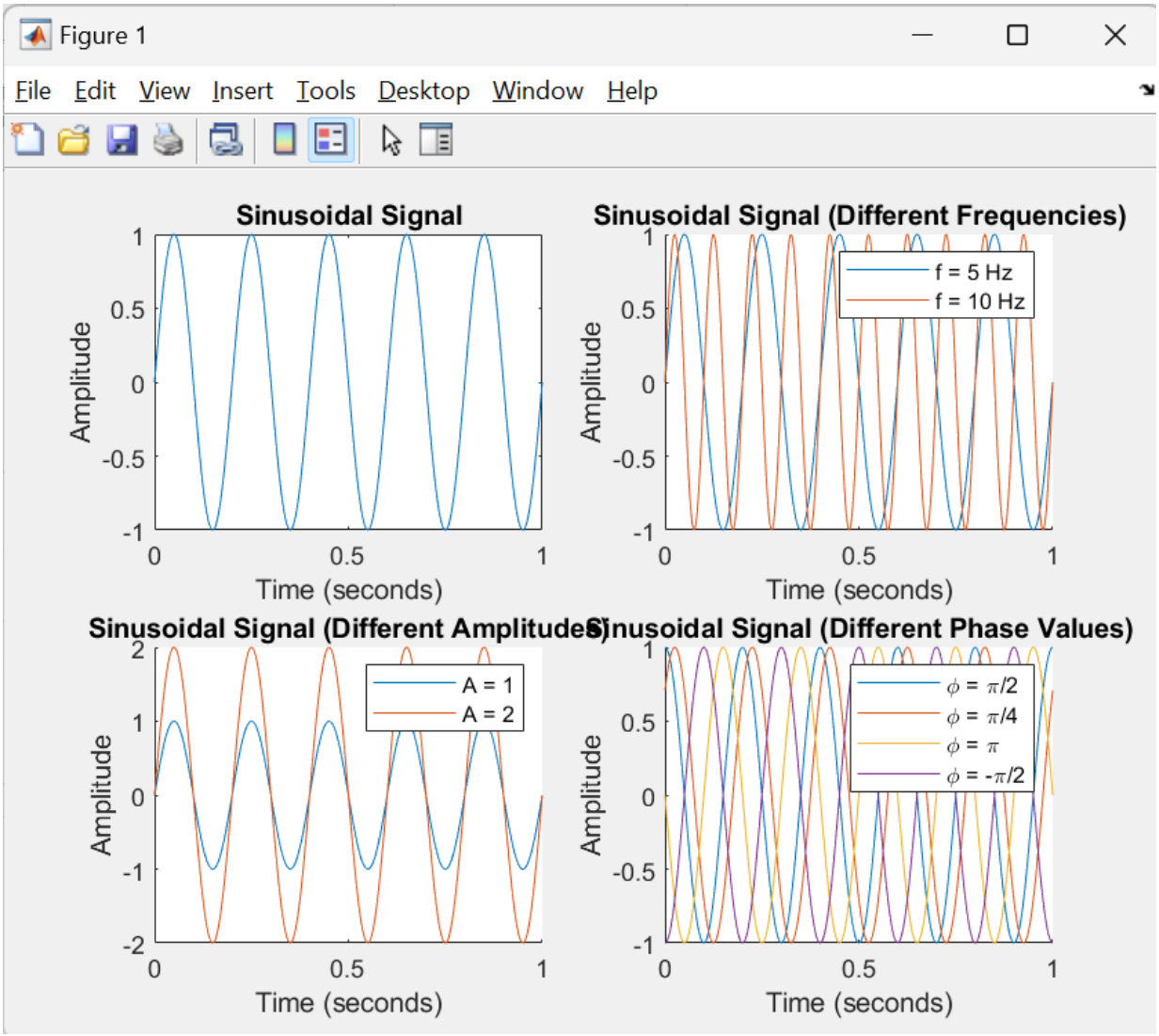


2. Generate and plot the following continuous time signals (Define the time vector, t to range from 0 to 1 second, with a sampling rate of 1000 Hz)

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

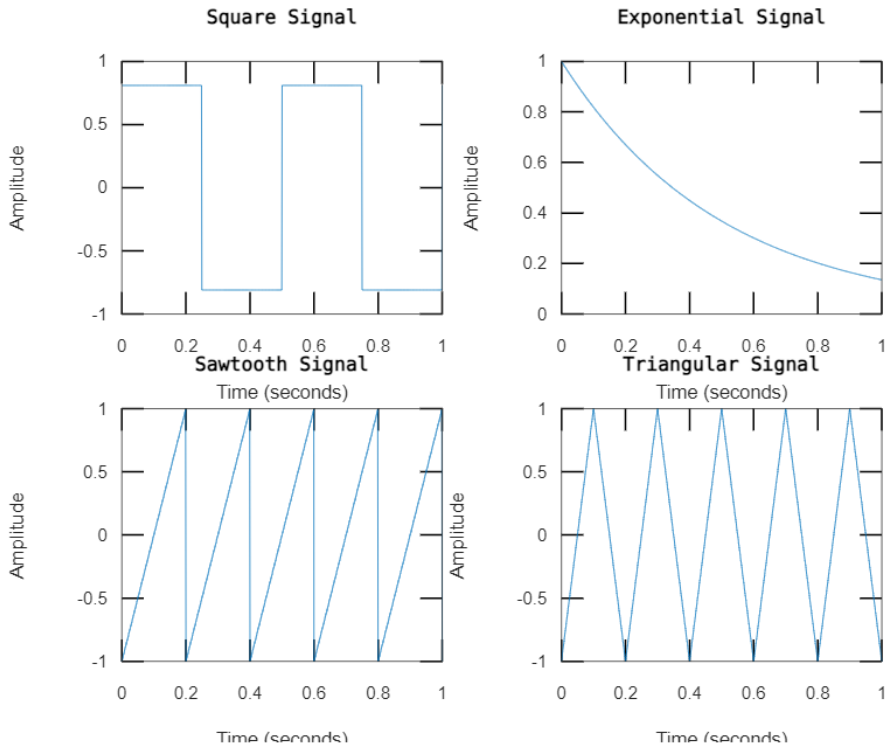
C. exponential signal

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)

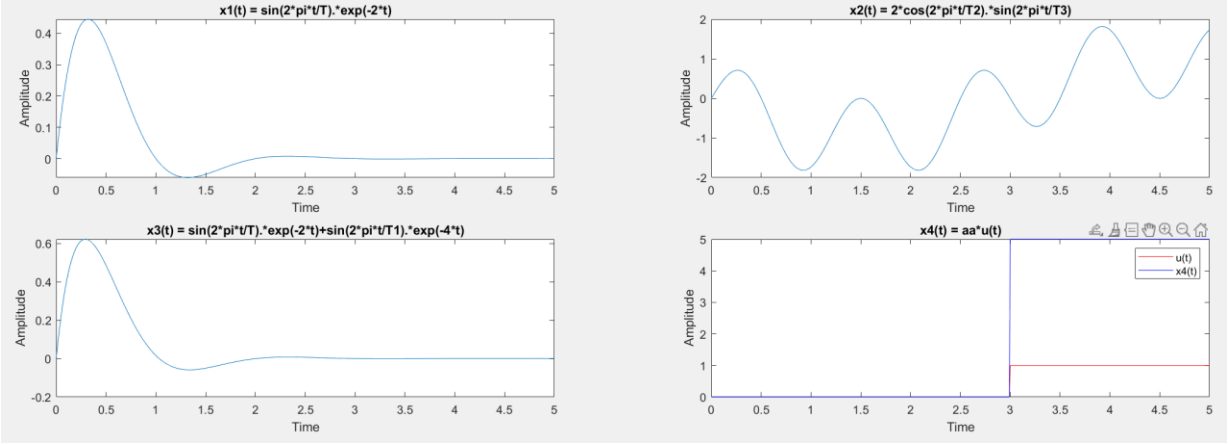
a. x1(t) = sin(2*pi*t/T).*exp(-2*t)

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)');
```


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