MATLAB/Simulink Session 2

Part 3

State Space

```
% x' = Ax + Bu
% y = Cx + Du
A = [-1.5 -2; 1 0];
B = [0.5;0];
C = [0 1];
D = 0;

s_space = ss(A, B, C, D)
```

```
s_space =

  A =
         x1    x2
   x1  -1.5    -2
   x2     1     0

  B =
        u1
   x1  0.5
   x2    0

  C =
       x1  x2
   y1   0   1

  D =
       u1
   y1   0

Continuous-time state-space model.
```

State Space to Trasfer Function

```
[n, d] = ss2tf(A,B,C,D)
```

```
n = 1×3
         0         0    0.5000
d = 1×3
    1.0000    1.5000    2.0000
```

```
G = tf(n, d)
```

```
G =

        0.5
  ---------------
  s^2 + 1.5 s + 2

Continuous-time transfer function.
```

Transfer Function to State Space

```
[n, d] = tfdata(G)
```

```
n = 1×1 cell array
    {[0 0 0.5000]}
d = 1×1 cell array
    {[1 1.5000 2.0000]}
```

```
[A, B, C, D] = tf2ss(n{1}, d{1})
```

```
A = 2×2
   -1.5000   -2.0000
    1.0000         0
B = 2×1
     1
     0
C = 1×2
         0    0.5000
D = 0
```

```
% C*((sI - A)^-1)*B + D
s = tf('s')
```

```
s =

  s

Continuous-time transfer function.
```

```
G = C * inv(s*eye(2) - A)*B + D
```

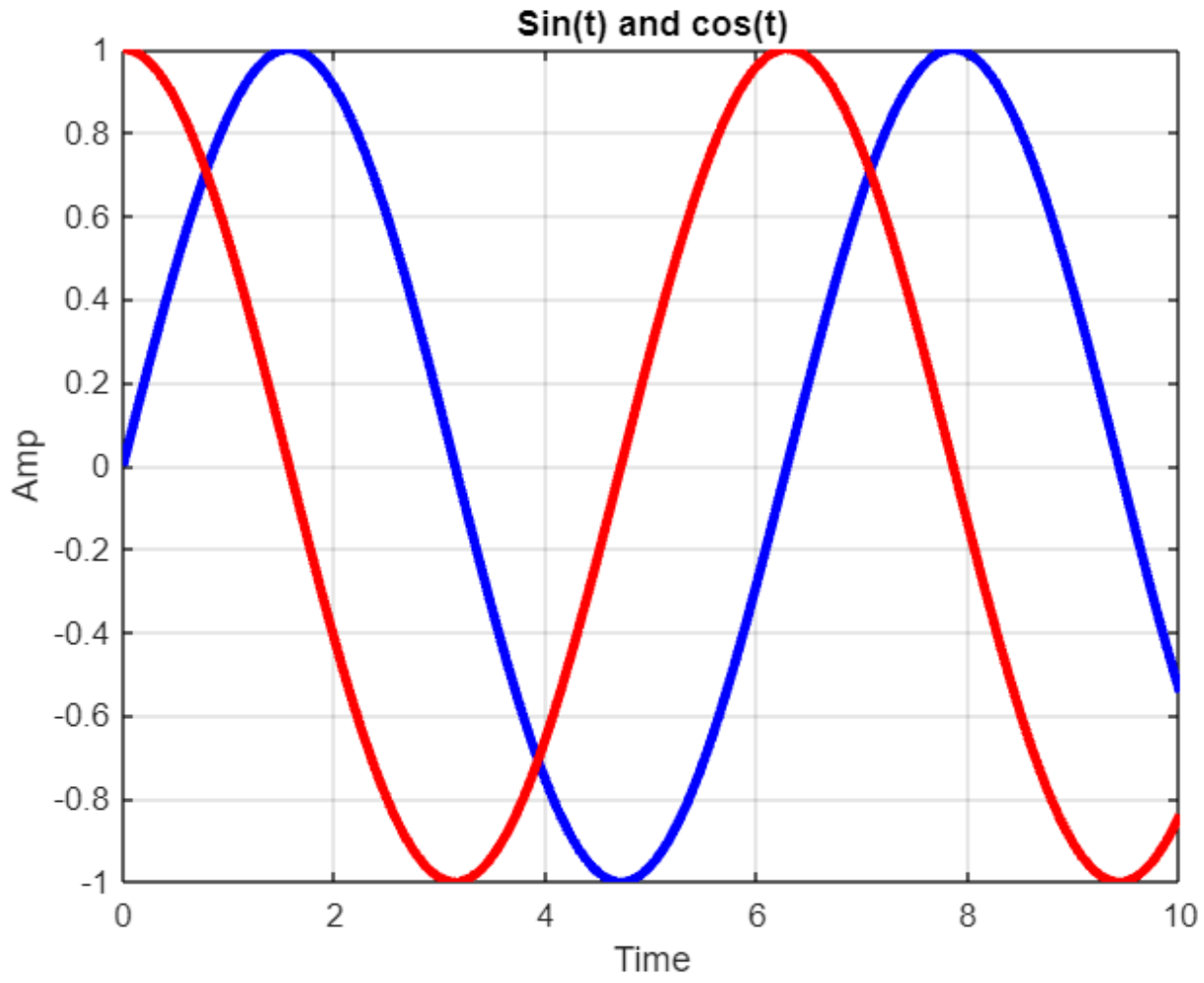
```
G =

       0.5
  ---------------
  s^2 + 1.5 s + 2

Continuous-time transfer function.
```

Plots

```
% plots
t = 0:0.01:10;
x = sin(t);
y = cos(t);
plot(t, x, 'b', t, y, 'r', 'LineWidth', 3)
title('Sin(t) and cos(t)')
xlabel('Time')
ylabel('Amp')
grid on
```




```
% subplots
t = 0:0.01:10;
x = sin(t);
y = cos(t);

figure(1);
subplot(211);
plot(t, x)
title('Sin(t)')
xlabel('Time')
ylabel('Amp')
grid on
legend('sin(t)')
subplot(212);
plot(t, y)
title('cos(t)')
xlabel('Time')
ylabel('Amp')
grid on
```

```
legend('cos(t)')
```