CONTROL SYSTEM LAB REPORTS

LAB 01

SUBMITTED BY

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LAB TASK 1

Create a transfer function object in MATLAB of system:

$$G(s) = \frac{2 - s}{s^4 + 3s^2 + 4s - 9}$$

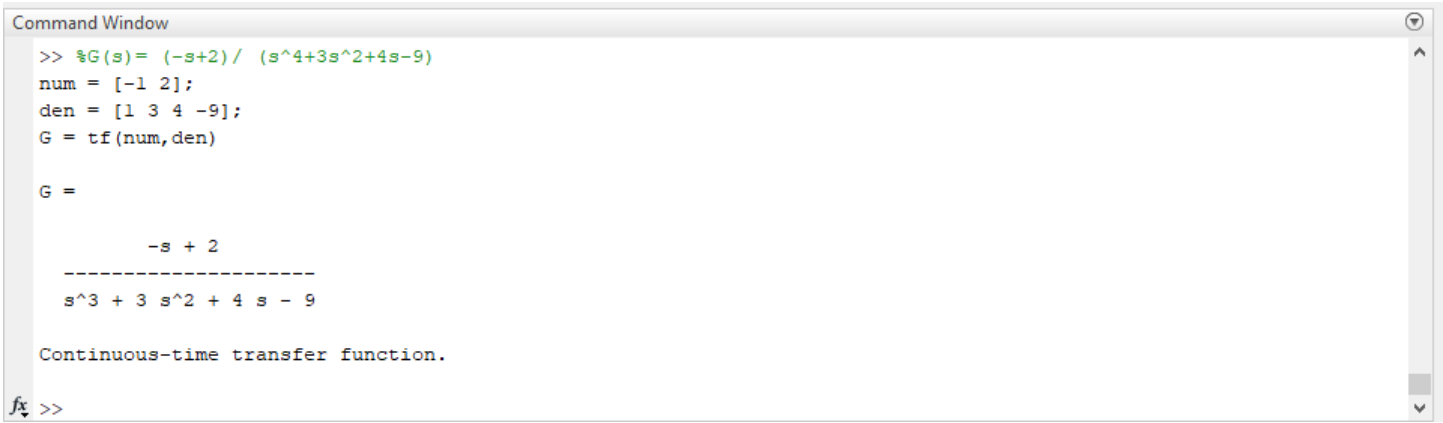
$$H(s) = \frac{s^2 + 4s - 9}{s^4 + 8s^2 - 4s}$$

$$G(s) = \frac{(s-5)(s-10)}{(s-2)(s-2 \pm 4i)}$$

1). MATLAB CODE:

```
%G(s)= (-s+2)/ (s^4+3s^2+4s-9)
num = [-1 2];
den = [1 3 4 -9];
G = tf(num,den)
```

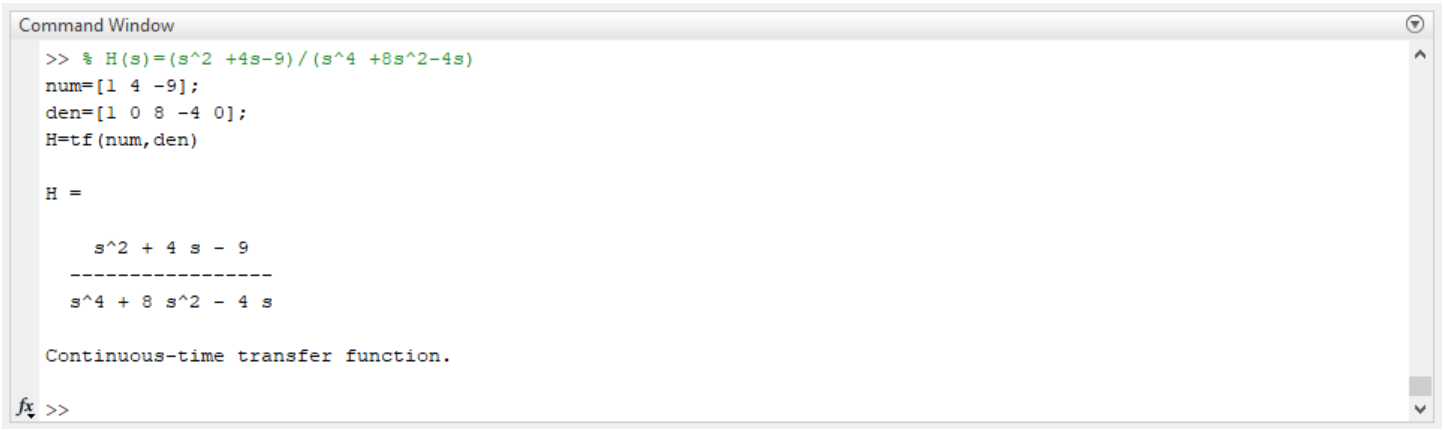
MATLAB RESULT:



2. MATLAB CODE:

```
    % H(s)=(s^2 +4s-9)/(s^4 +8s^2-4s)
num=[1 4 -9];
den=[1 0 8 -4 0];
H=tf(num,den)
```

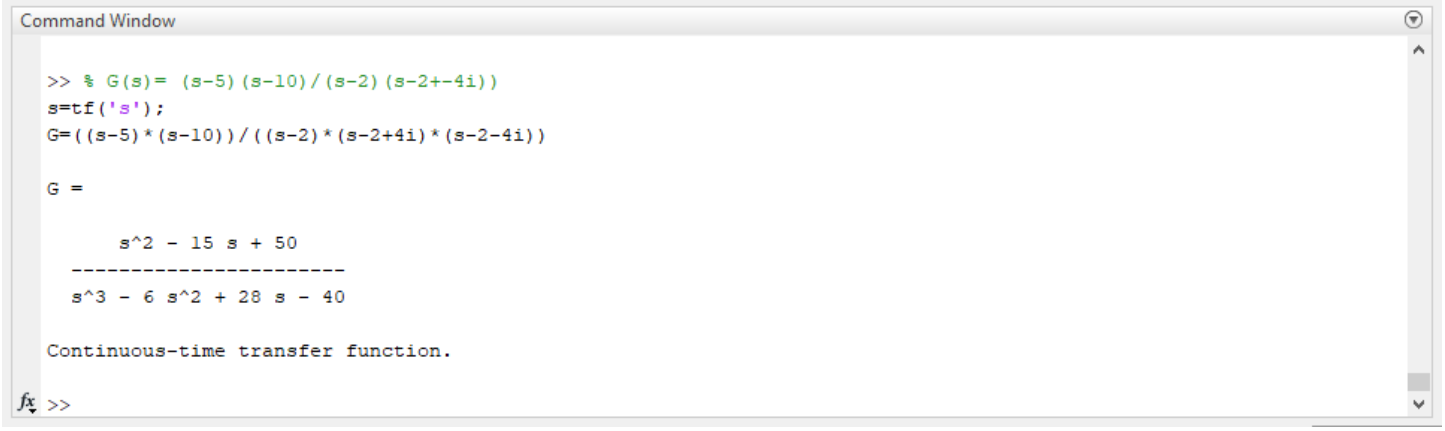
MATLAB RESULT:



3. MATLAB CODE:

```
    % G(s)= (s-5)(s-10)/(s-2)(s-2+-4i))
s=tf('s');
G=((s-5)*(s-10))/((s-2)*(s-2+4i)*(s-2-4i))
```

MATLAB RESULT:



LAB TASK 2

Consider the rational fraction: Identify the poles and zero of system.

$$G_1 = \frac{2}{s^2+3s+2}.$$

$$G_2 = \frac{s^2+3s+2}{(s+2)^3}$$

$$G_3 = \frac{1}{s^2+s+1}.$$

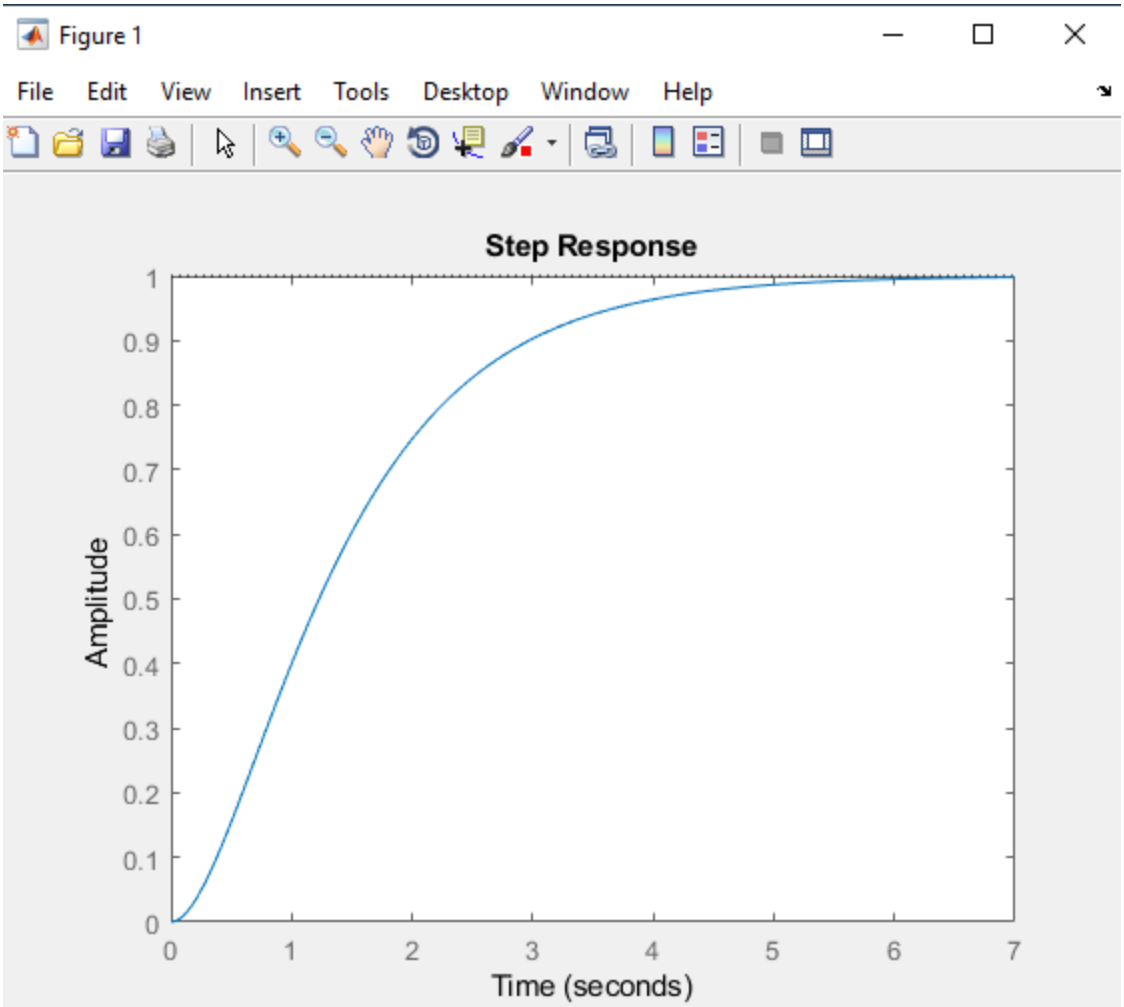
Comment on unit step response.

MATLAB CODE:

```
%G1= 2/(s^2 +3*s+2)
num=[2];
den=[1 3 2];
G1=tf(num,den)
p1=pole(G1)
z1=zero(G1)
step(G1)
```

MATLAB RESULT:

```
Command Window
  G1 =

          2
    -------------
    s^2 + 3 s + 2

  Continuous-time transfer function.


  p1 =

      -2
      -1


  z1 =

    0×1 empty double column vector
```



MATLAB CODE:

```
    % G2=(s^2+3s+2)/(s+2)^3
s=tf('s')
G2=(s^2+3*s+2)/(s+2)^3
p2=pole(G2)
z2=zero(G2)
step(G2)
```

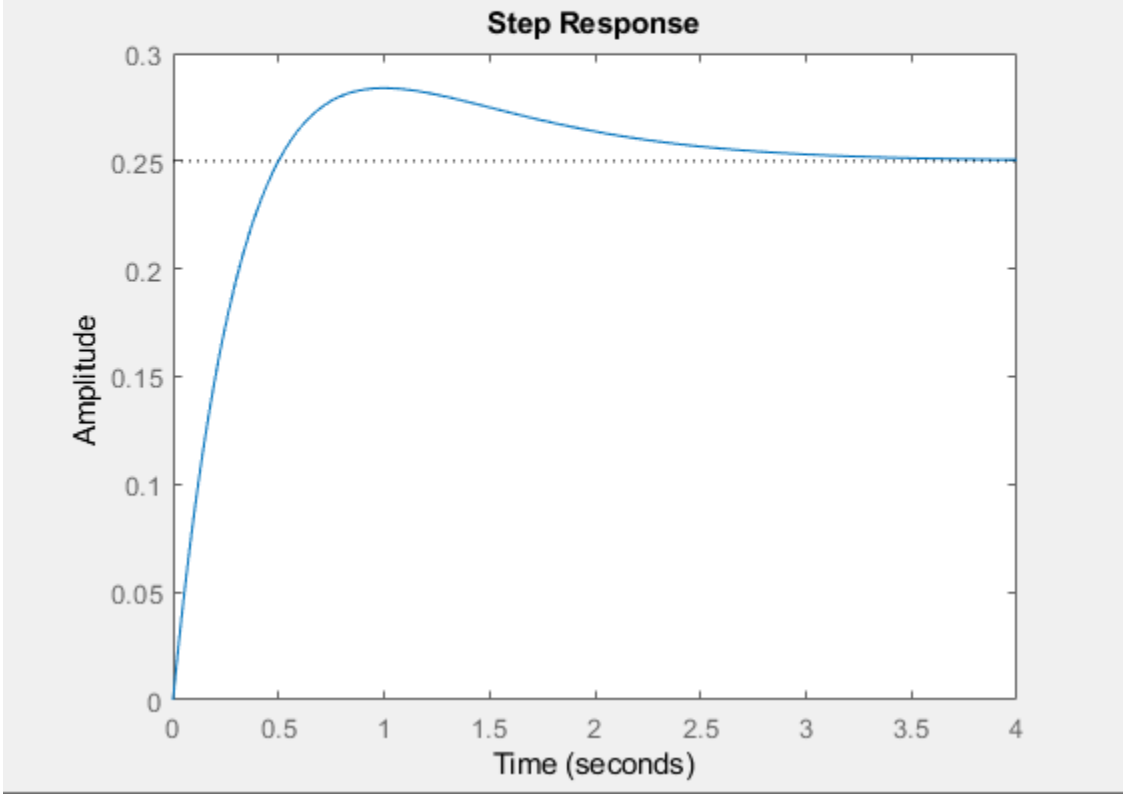
MATLAB RESULT:

Command Window

```
G2 =

      s^2 + 3 s + 2
  ----------------------
  s^3 + 6 s^2 + 12 s + 8

Continuous-time transfer function.


p2 =

  -2.0000 + 0.0000i
  -2.0000 + 0.0000i
  -2.0000 - 0.0000i


z2 =

    -2
    -1
```

Figure 1

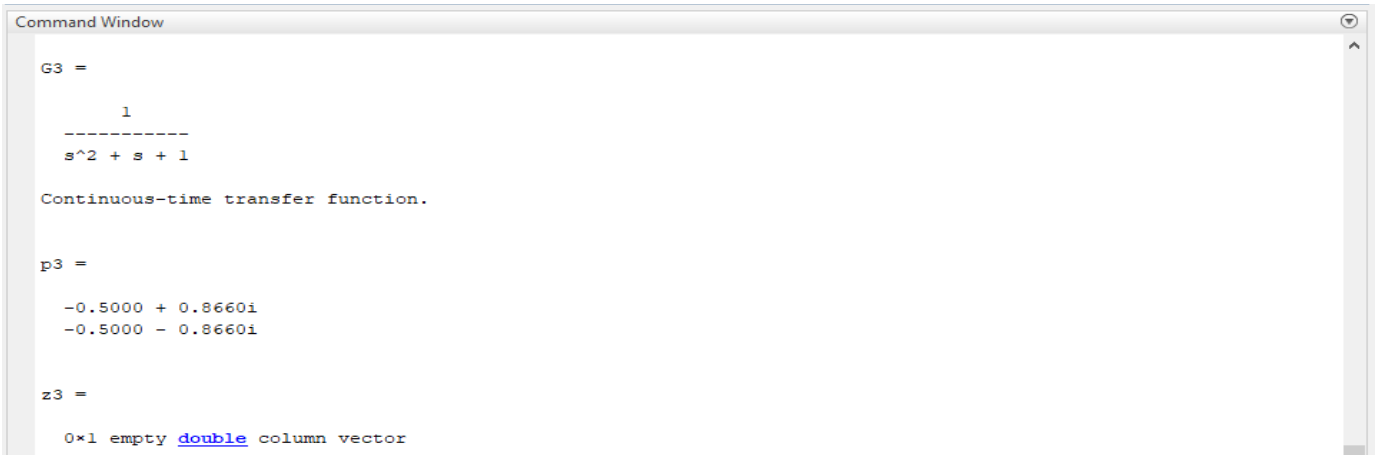
File Edit View Insert Tools Desktop Window Help



MATLAB CODE:

```
%G3=1/(s^2+s+1)
s=tf('s')
G3=1/(s^2+s+1)
p3=pole(G3)
z3=zero(G3)
step(G3)
```

MATLAB RESULT:



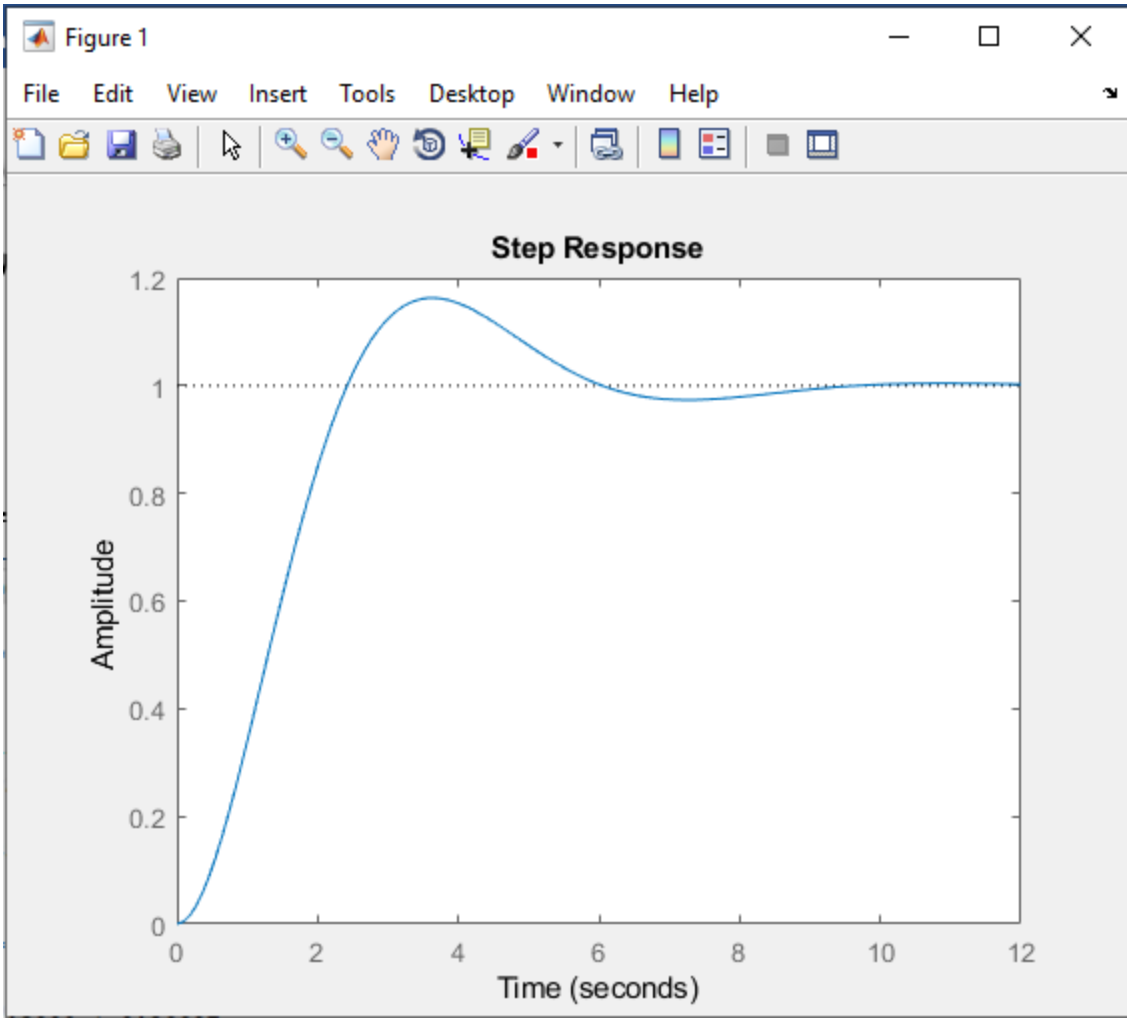


Figure 1
File Edit View Insert Tools Desktop Window Help
Step Response
Amplitude
Time (seconds)
0
0.2
0.4
0.6
0.8
1
1.2
0
2
4
6
8
10
12

LAB TASK 3

Solve below differential equation using MATLAB

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y(t) = 2e^{-t}u(t) \ , \boldsymbol{y(0) = 3, \dot{y}(0) = 0}$$

MATLAB CODE:

```
%Lab TASK 3
xt=dsolve('D2y+4*Dy+4*y=2*exp(-t)*1','y(0)=3','Dy(0)=0')
```

MATLAB RESULT:

```
>> %Lab TASK 3
xt=dsolve('D2y+4*Dy+4*y=2*exp(-t)*1','y(0)=3','Dy(0)=0')

xt =

exp(-2*t) + 2*t*exp(-t) + 4*t*exp(-2*t) - 2*exp(-t)*(t - 1)

fx >>
```