ECE 2017

16BMD0016
Ritobrita De

Assessment 5:

1. Create the open loop transfer function G(s) = (2s2+5s+1)/(s2+2s+3)

Code:

```
clc;
clear all;
num = [2 5 1];
den = [1 2 3];
G = tf(num,den);
```

Output:

```
G =

  2 s^2 + 5 s + 1
  ---------------
   s^2 + 2 s + 3

Continuous-time transfer function.
```

2. Create the closed loop transfer function where G(s) is the plant and H(s) is the controller:
G(s) = (2s2+5s+1)/(s2+2s+3) and H(s)=5(s+2)/(s+10)

a. Express G(s) as a function using the command 'tf'.

Code:

```
clc;
clear all;
num = [2 5 1];
den = [1 2 3];
G = tf(num,den);
n = [0 5 10];
d = [0 1 10];
H = tf(n,d);
p = pole(H);
[z,gain] = zero(H);
Hg = zpk(z,p,gain);
pzmap(H);
T = feedback(G,H);
```

Output:

```
G =

  2 s^2 + 5 s + 1
  ---------------
   s^2 + 2 s + 3

Continuous-time transfer function.

>> H

H =

  5 s + 10
  --------
   s + 10

Continuous-time transfer function.

T =

  2 s^3 + 25 s^2 + 51 s + 10
  --------------------------
  11 s^3 + 57 s^2 + 78 s + 40

Continuous-time transfer function.
```

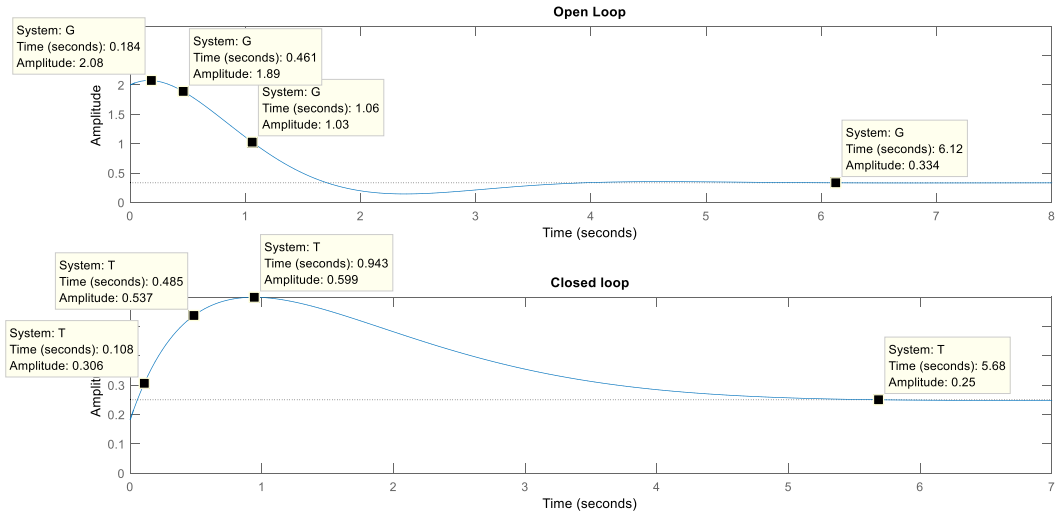
2. Plot the step response of the open loop and closed loop transfer functions and calculate the: i. Delay time ii. Peak time iii. Rise time iv. Settling time

Code:

```
clc;
clear all;
num = [2 5 1];
den = [1 2 3];
G = tf(num,den);
n = [0 5 10];
d = [0 1 10];
H = tf(n,d);
p = pole(H);
[z,gain] = zero(H);
Hg = zpk(z,p,gain);
pzmap(H);
T = feedback(G,H);
figure(2)
```

```
subplot(2,1,1)
step(G)
title('Open Loop');
subplot(2,1,2)
step(T);
title('Closed loop');
```

Output:



Observation Table:

	OPEN LOOP	CLOSED LOOP
DELAY TIME	1.06 sec	0.102 sec
PEAK TIME	0.184 sec	0.943 sec
RISE TIME	0.47 sec	0.490 sec
SETTLING TIME	6.12 sec	5.71 sec

4. Plot the impulse response of the open loop and closed loop transfer functions and calculate the: i. Peak time ii. Settling times

Code:

```
clc;
clear all;
num = [2 5 1];
den = [1 2 3];
G = tf(num,den);
n = [0 5 10];
d = [0 1 10];
H = tf(n,d);
p = pole(H);
[z,gain] = zero(H);
Hg = zpk(z,p,gain);
pzmap(H);
T = feedback(G,H);
figure(2)
```

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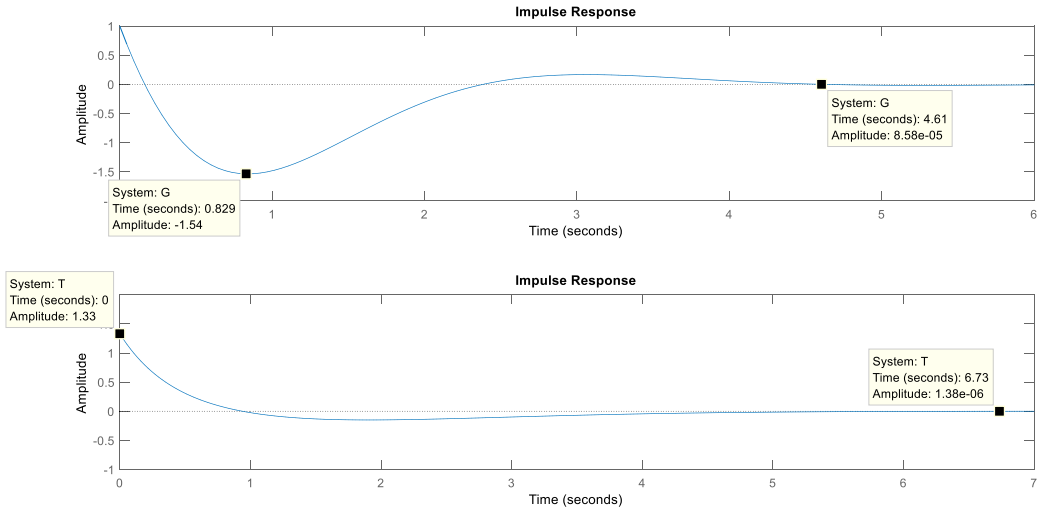
```
subplot(2,1,1)
step(G)
title('Open Loop');
subplot(2,1,2)
step(T);
title('Closed loop');
X = stepinfo(G);
Y = stepinfo(T);
figure(3)
subplot(2,1,1)
impulse(G);
subplot(2,1,2)
impulse(T);
```

Output:



Observation Table:

	OPEN LOOP	CLOSED LOOP
PEAK TIME	0.829 sec	0.00 sec
SETTLING TIME	4.61 sec	6.734 sec