ECE 2017

16BMD0016
Ritobrita De

Assessment 6:

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'.

b. Create a ZPK model for H(s).

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.
```

3. Plot the Root Locus of the open loop and closed loop transfer functions

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)
```

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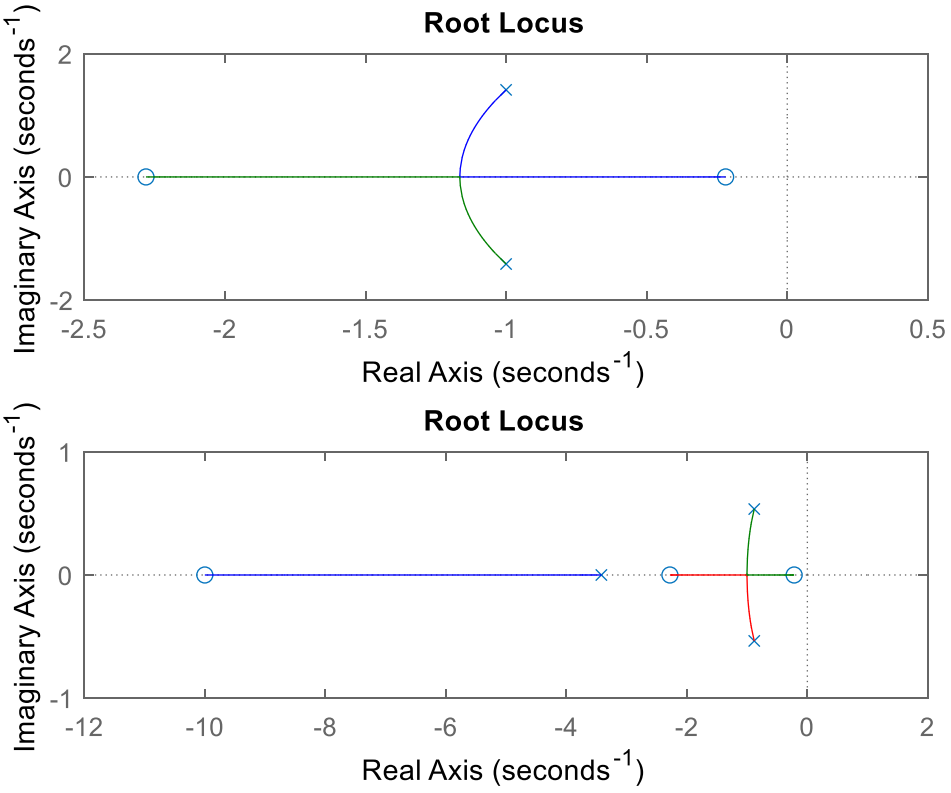
```
step(G)
title('Open Loop');
subplot(2,1,2)
step(T);
title('Closed loop');
X = stepinfo(G);
Y = stepinfo(T);
figure(3)
subplot(2,1,1)
impulse(G);
subplot(2,1,2)
impulse(T);
figure(4)
subplot(2,1,1)
rlocus(G)
subplot(2,1,2)
rlocus(T)
```

Output:



4. Plot the Bode Plot of the open loop and closed loop transfer functions

Code:

```
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');
X = stepinfo(G);
Y = stepinfo(T);
figure(3)
subplot(2,1,1)
impulse(G);
subplot(2,1,2)
impulse(T);
figure(4)
subplot(2,1,1)
rlocus(G)
subplot(2,1,2)
rlocus(T)
figure(3)
subplot(2,1,1)
bode(G);
subplot(2,1,2)
bode(T);
```

Output: