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Responsi Praktik

Soal 1

$$G(s) = \frac{1}{1000s^3 + 300s^2 + 30s + 1}$$

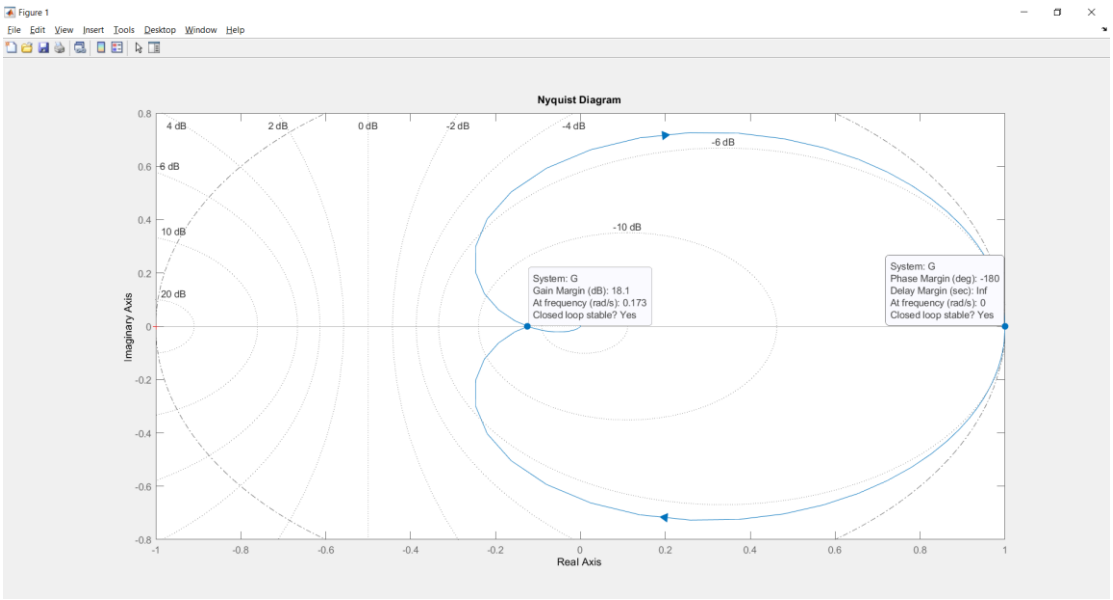
a. Amati kestabilan kritis melalui grafik Nyquist!

Script

```
G = tf([1],[1000 300 30 1])
figure(1)
nyquist(G)
```

Command window

```
G =

                1
  ----------------------------
  1000 s^3 + 300 s^2 + 30 s + 1

Continuous-time transfer function.
```



b. Tentukan periode dari kestabilan kritis sistem tersebut!

Script

```
Kcr = db2mag(18.1)
Pcr = 2*pi/0.173
```

Command window

```
Kcr =

    8.0353


Pcr =

   36.3190
```

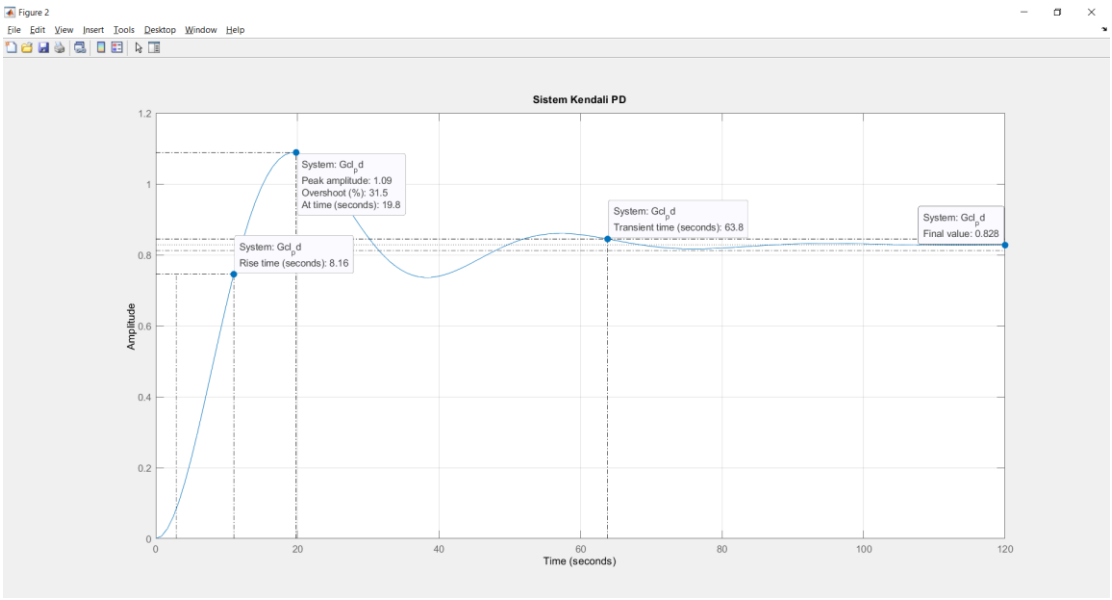
c. Dengan metode kedua, rancang sistem kendali PD dan amati responsnya!

Script

```
s = tf('s');
Kp_pd = 0.6*Kcr
Td_pd = 0.125*Pcr
Gc_pd = Kp_pd*(1+Td_pd*s)
Gcl_pd = feedback(Gc_pd*G,1)
figure(2)
step(Gcl_pd)
title('Sistem Kendali PD')
```

Command window

```
Kp_pd =

    4.8212


Td_pd =

    4.5399


Gc_pd =

  21.89 s + 4.821

Continuous-time transfer function.


Gcl_pd =

            21.89 s + 4.821
  -------------------------------------
  1000 s^3 + 300 s^2 + 51.89 s + 5.821

Continuous-time transfer function.
```



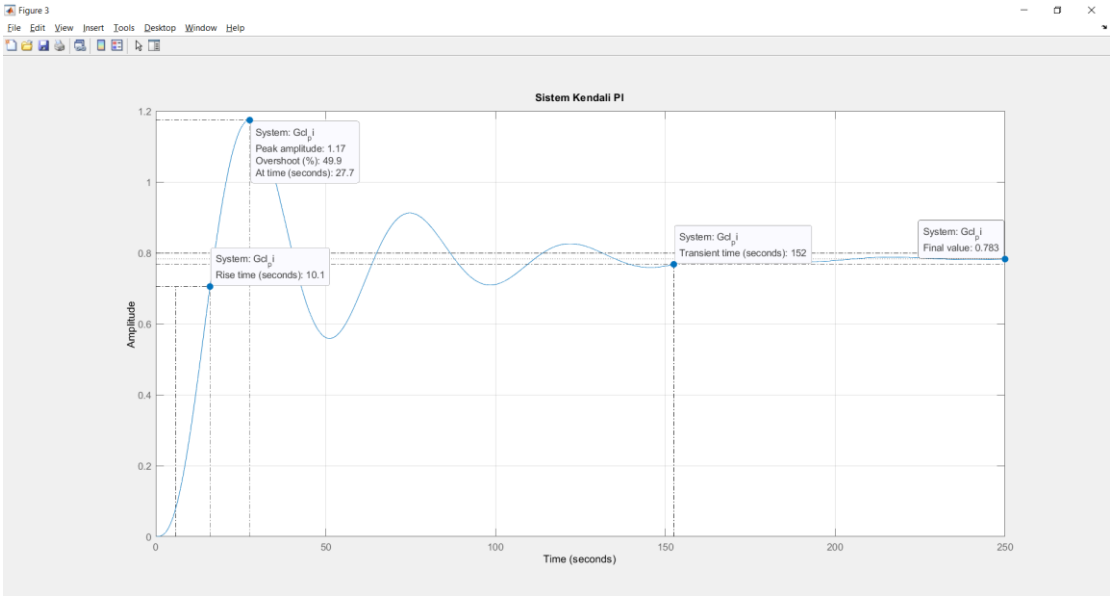
d. Dengan metode kedua, rancang sistem kendali PI dan amati responsnya!

Script

```
Kp_pi = 0.45*Kcr
Ti_pi = (1/1.2)*Pcr
Gc_pi = Kp_pi*(1+(1/Ti_pi*s))
Gcl_pi = feedback(Gc_pi*G,1)
figure(3)
step(Gcl_pi)
title('Sistem Kendali PI')
```

Command window

```
Kp_pi =

    3.6159


Ti_pi =

   30.2658


Gc_pi =

  0.1195 s + 3.616

Continuous-time transfer function.


Gcl_pi =

            0.1195 s + 3.616
  -----------------------------------
  1000 s^3 + 300 s^2 + 30.12 s + 4.616

Continuous-time transfer function.
```



e. Dengan metode kedua, rancang sistem kendali PID dan amati responsnya!

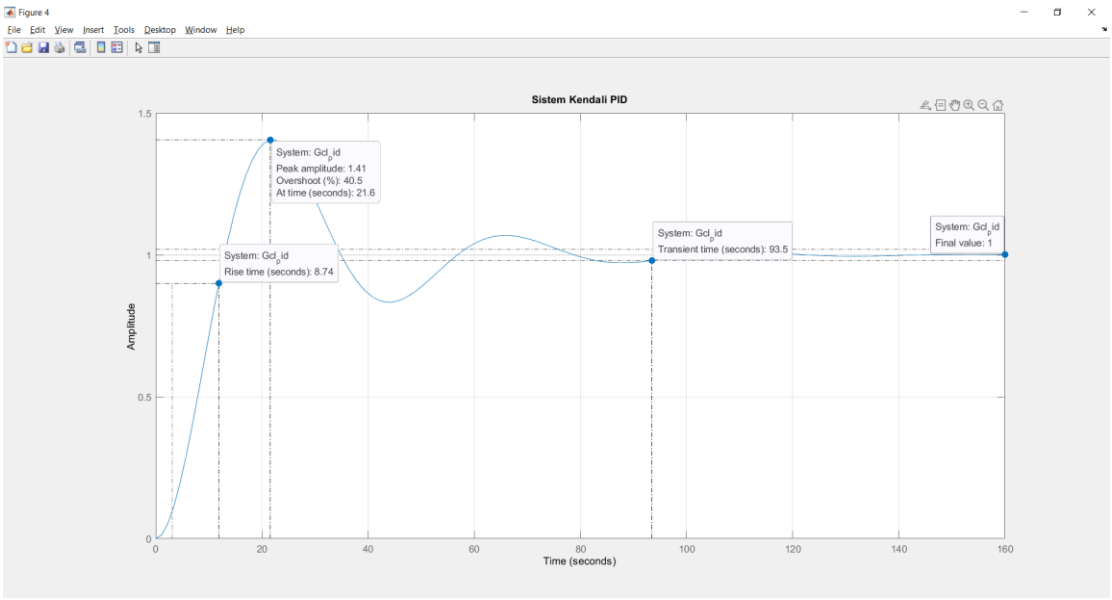
Script

```
Kp_pid = 0.6*Kcr
Ti_pid = 0.5*Pcr
Td_pid = 0.125*Pcr
Gc_pid = Kp_pid*(1+(1/(Ti_pid*s)+Td_pid*s))
Gcl_pid = feedback(Gc_pid*G,1)
figure(4)
step(Gcl_pid)
title('Sistem Kendali PID')
```

Command window

```
Kp_pid =

    4.8212


Ti_pid =

   18.1595


Td_pid =

    4.5399


Gc_pid =

  397.5 s^2 + 87.55 s + 4.821
  ---------------------------
            18.16 s

Continuous-time transfer function.


Gcl_pid =
```

```
                397.5 s^2 + 87.55 s + 4.821
  ---------------------------------------------------
  1.816e04 s^4 + 5448 s^3 + 942.2 s^2 + 105.7 s + 4.821

Continuous-time transfer function.
```



Soal 3

Suatu sistem diketahui memiliki state space sebagai berikut :

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 3 & 0 \\ 1 & 2 & 3 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

a. Tentukan kutub-kutub dari sistem tersebut.

Script

```
A = [1 0 2; 2 3 0; 1 2 3]
B = [1 ; 0; 0]
C = [0 0 0;0 0 0;0 0 0]
D = [0]

sys = ss(A,B,C,D)
figure(1)
step(sys)

lamda = eig(A)
P = pole(sys)
```

Command window

```

```

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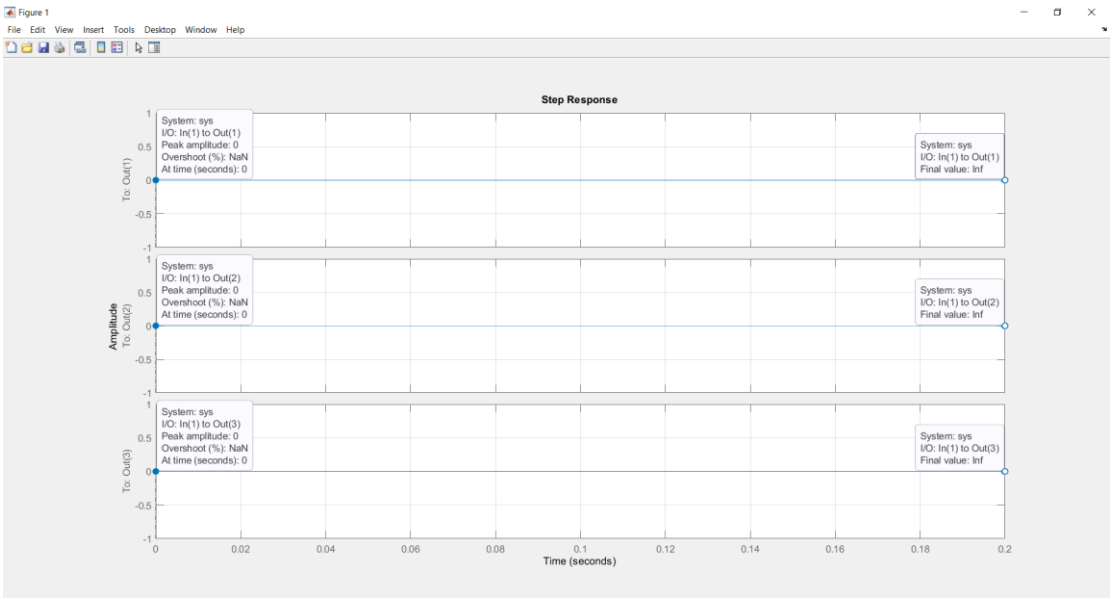

b. Tentukan matriks Q melalui persamaan pembentukan matriks.

Script

```
Q = ctrb(sys)
```

Command window

```
```

c. Tentukan apakah sistem tersebut stabil.

Script

```
isstable(sys)
```

Command window

```
```

d. Tentukan matriks umpan balik *K* sedemikian rupa sehingga sistem kalang tertutup tersebut memiliki kutub-kutub [-0.5; -0.5; -0.5]

Script

```
P = [-0.5; -0.5; -0.5]
K = place(A,B,P)

sys_fb = ss(A-B*K,B,C-D*K,D)
```

Command window

```
```

e. Rancanglah sistem setelah kutub baru ditempatkan

Script

```
figure(2)
step(sys_fb)
```

Command window

f. Amati tanggap fungsi sistem sebelum dan setelah dilakukan penempatan kutub
Script

Command window