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[https://colab.research.google.com/drive/1z_SzBktRodbM73HfhmX6TAxlel_Wfm1e?](https://colab.research.google.com/drive/1z_SzBktRodbM73HfhmX6TAxlel_Wfm1e?usp=sharing)

[usp=sharing https://github.com/gabrielkheisa/sisken/blob/main/Sisken_Tugas_5.ipynb](https://github.com/gabrielkheisa/sisken/blob/main/Sisken_Tugas_5.ipynb)

```
!pip install slycot
!pip install control
```

```
↳ Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/
Requirement already satisfied: slycot in /usr/local/lib/python3.7/dist-packages (0.5
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/
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Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-packages (
Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-packages (from
Requirement already satisfied: cycycler>=0.10 in /usr/local/lib/python3.7/dist-packages
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-pac
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-pac
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (fr
```

+ Code

+ Text

```
%matplotlib inline

import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import control.matlab as control

# Variabel motor DC
J = 0.01
b = 0.1
K = 0.01
R = 1
L = 0.5

Kd = [1,3,5,7,9] # Ganti Kd
Kp = 1

t = 5
motor = control.tf([K],[J*L, (J*R+b*L), K*K])
print(motor)

C1 = control.tf([Kd[0], Kp, 0],[0, 1, 0])
C3 = control.tf([Kd[1], Kp, 0],[0, 1, 0])
C5 = control.tf([Kd[2], Kp, 0],[0, 1, 0])
C7 = control.tf([Kd[3], Kp, 0],[0, 1, 0])
C9 = control.tf([Kd[4], Kp, 0],[0, 1, 0])

complete1 = control.feedback(motor*C1, 1)
complete3 = control.feedback(motor*C3, 1)
complete5 = control.feedback(motor*C5, 1)
```

```

complete7 = control.feedback(motor*C7, 1)
complete9 = control.feedback(motor*C9, 1)

# Fungsi step info
def step_info(t,yout):
    try:
        print("% overshoot : ",(yout.max()/yout[-1]-1)*100,'%')
    except:
        print("% overshoot : -%")
    try:
        print("Rise time : ",t[next(i for i in range(0,len(yout)-1) if yout[i]>yout[-1]*.90)
    except:
        print("Rise time : -")
    try:
        print("%Settling time : ",t[next(len(yout)-i for i in range(2,len(yout)-1) if abs(yo
    except:
        print("%Settling time : -%")

```

$$\begin{array}{c}
 0.01 \\
 \hline
 0.005 \text{ s}^2 + 0.06 \text{ s} + 0.0001
 \end{array}$$

Kd = 1

```

# Step
y,t = control.step(complete1)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step Response')

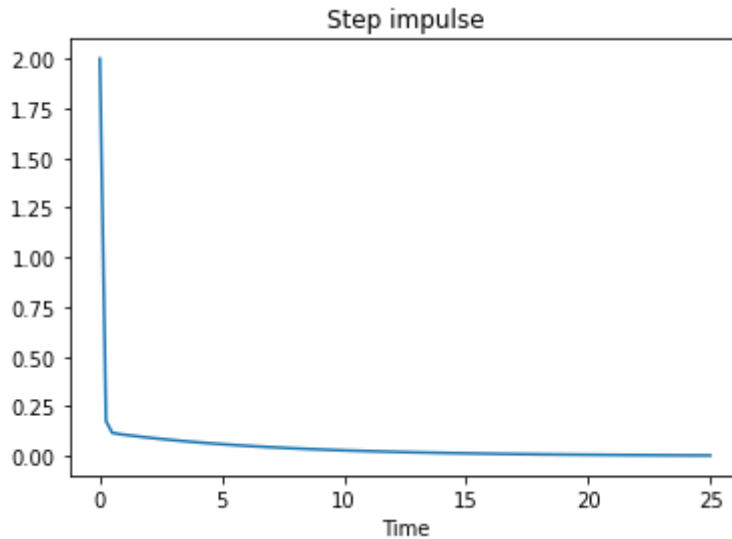
step_info(t,y)

```

% overshoot : 0.0 %

```
# impulse
y,t = control.impulse(complete1)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step impulse')
```

Text(0.5, 1.0, 'Step impulse')



```
# pole
try:
    y,t = control.pole(complete1)
    plt.plot(t,y)
    plt.xlabel('Time')
    plt.title('Step impulse')
except ValueError:
    print("Bilangan imajiner")
```

Bilangan imajiner

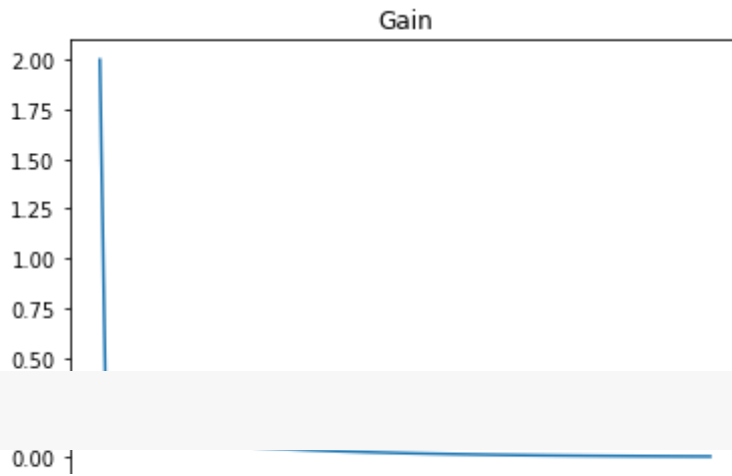
```
# Gain
kp = 1
ti = 1

H = control.tf(complete1)
print(H)

plt.plot(t,y)
plt.xlabel('Time')
plt.title('Gain')
```

$$\frac{0.01 s^2 + 0.01 s}{0.005 s^3 + 0.07 s^2 + 0.0101 s}$$

Text(0.5, 1.0, 'Gain')

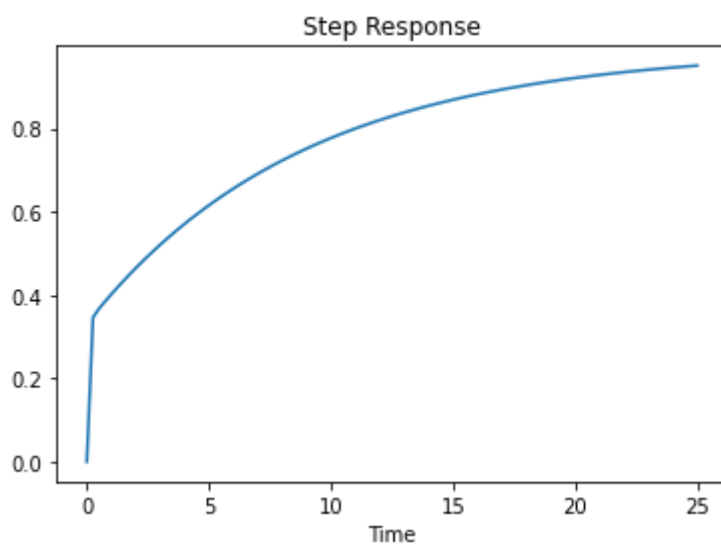


$K_d = 3$

```
# Step
y,t = control.step(complete3)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step Response')
```

```
step_info(t,y)
```

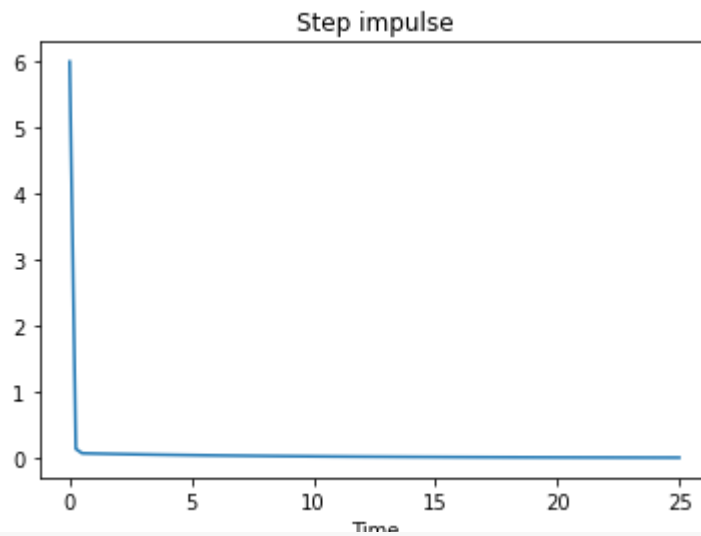
```
% overshoot : 0.0 %
Rise time : 14.141414141414142
%Settling time : -%
```



```
# impulse
y,t = control.impulse(complete3)
plt.plot(t,y)
```

```
plt.xlabel('Time')
plt.title('Step impulse')
```

```
Text(0.5, 1.0, 'Step impulse')
```



```
# pole
try:
    y,t = control.pole(complete3)
    plt.plot(t,y)
    plt.xlabel('Time')
    plt.title('Step impulse')
except ValueError:
    print("Bilangan imajiner")
```

Bilangan imajiner

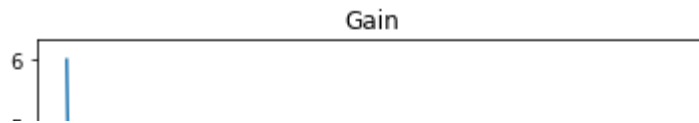
```
# Gain
kp = 1
ti = 1

H = control.tf(complete3)
print(H)

plt.plot(t,y)
plt.xlabel('Time')
plt.title('Gain')
```

$$\frac{0.03 s^2 + 0.01 s}{0.005 s^3 + 0.09 s^2 + 0.0101 s}$$

Text(0.5, 1.0, 'Gain')

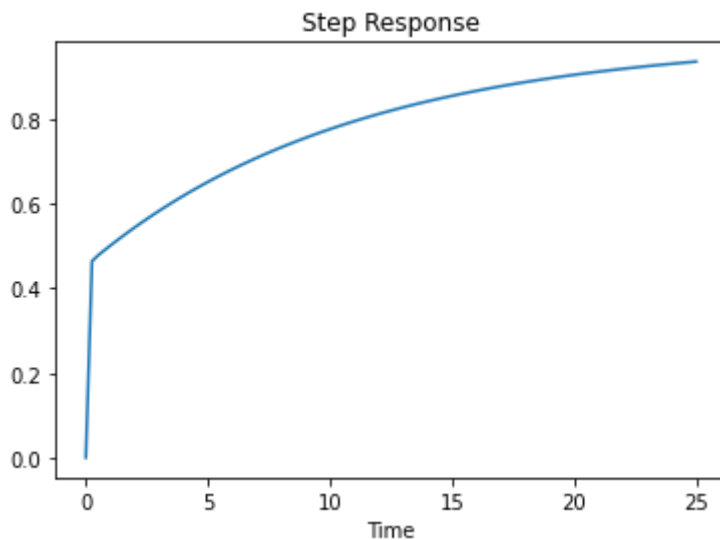


Kd = 5

```
# Step
y,t = control.step(complete5)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step Response')
```

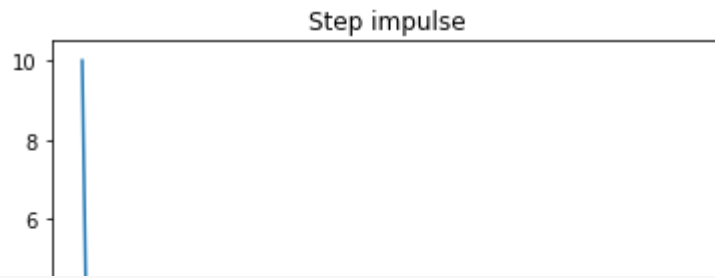
```
step_info(t,y)
```

```
% overshoot : 0.0 %
Rise time : 14.141414141414142
%Settling time : -%
```



```
# impulse
y,t = control.impulse(complete5)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step impulse')
```

```
Text(0.5, 1.0, 'Step impulse')
```



```
# pole
try:
    y,t = control.pole(complete5)
    plt.plot(t,y)
    plt.xlabel('Time')
    plt.title('Step impulse')
except ValueError:
    print("Bilangan imajiner")
```

Bilangan imajiner

```
# Gain
kp = 1
ti = 1

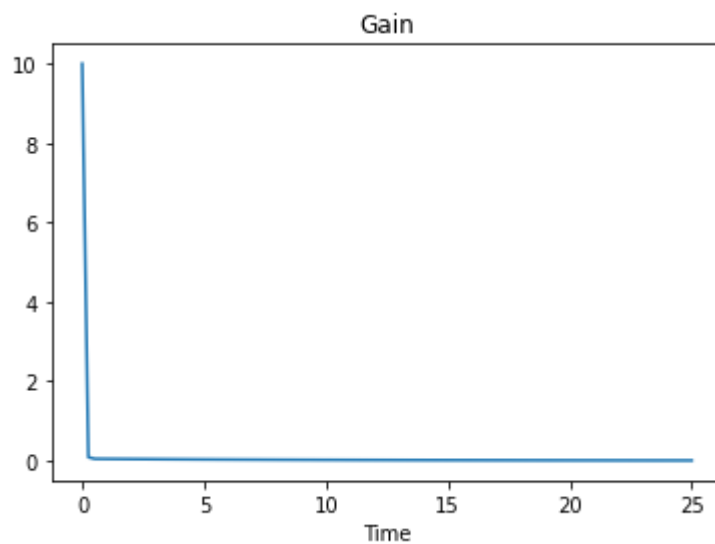
H = control.tf(complete5)
print(H)

plt.plot(t,y)
plt.xlabel('Time')
plt.title('Gain')
```

$0.05 s^2 + 0.01 s$

 $0.005 s^3 + 0.11 s^2 + 0.0101 s$

```
Text(0.5, 1.0, 'Gain')
```

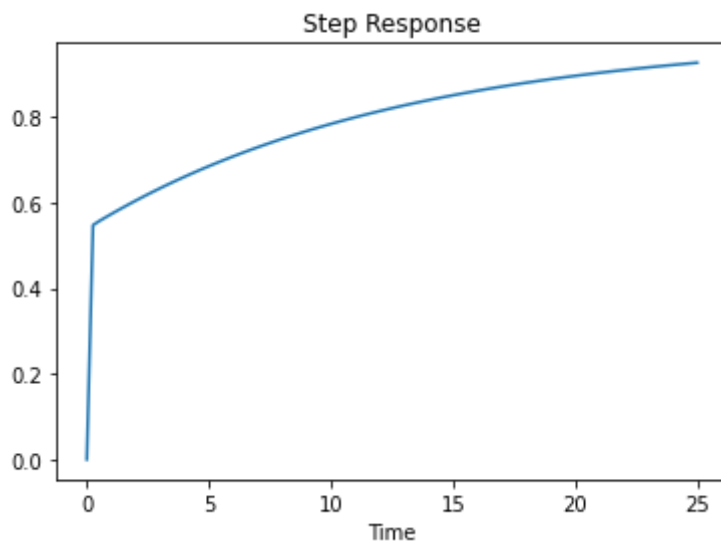


$K_d = 7$

```
# Step
y,t = control.step(complete7)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step Response')

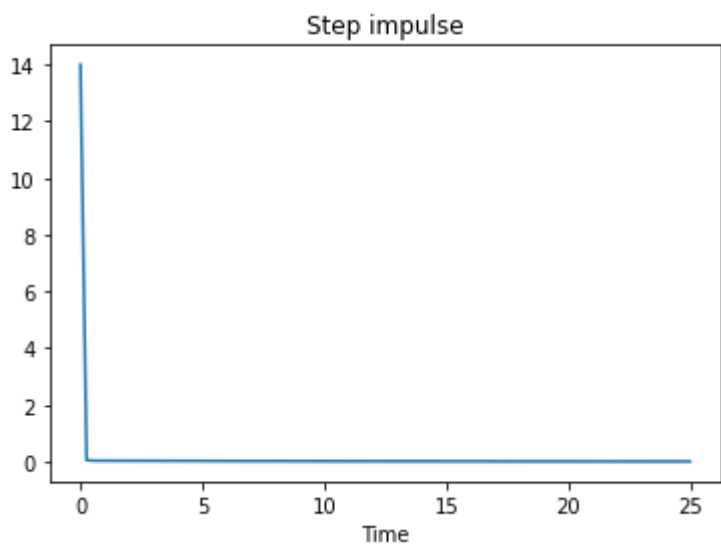
step_info(t,y)
```

```
% overshoot : 0.0 %
Rise time : 13.636363636363637
%Settling time : -%
```



```
# impulse
y,t = control.impulse(complete7)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step impulse')
```

```
Text(0.5, 1.0, 'Step impulse')
```




```
# pole
try:
    y,t = control.pole(complete7)
    plt.plot(t,y)
    plt.xlabel('Time')
    plt.title('Step impulse')
except ValueError:
    print("Bilangan imajiner")
```

Bilangan imajiner

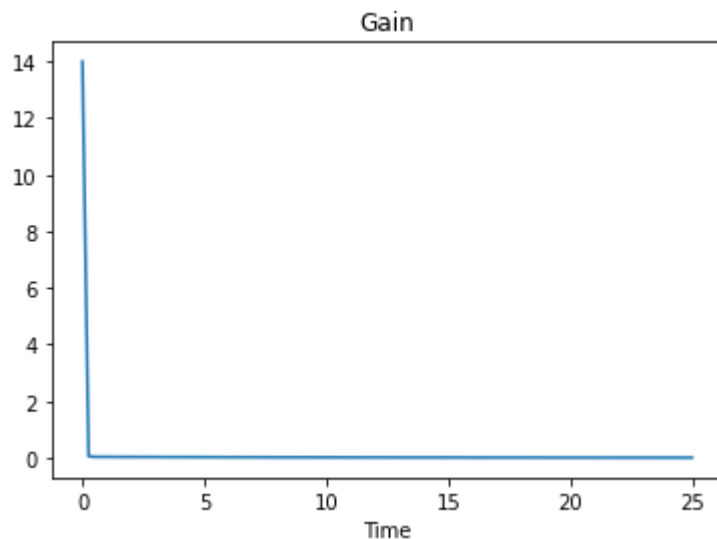
```
# Gain
kp = 1
ti = 1

H = control.tf(complete7)
print(H)

plt.plot(t,y)
plt.xlabel('Time')
plt.title('Gain')
```

$$\frac{0.07 s^2 + 0.01 s}{0.005 s^3 + 0.13 s^2 + 0.0101 s}$$

 Text(0.5, 1.0, 'Gain')



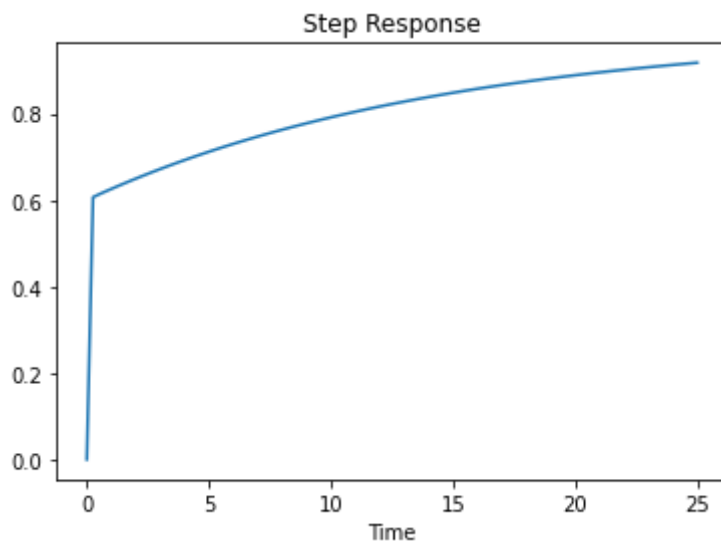
Kd = 9

```
# Step
y,t = control.step(complete9)
plt.plot(t,y)
```

```
plt.xlabel('Time')
plt.title('Step Response')
```

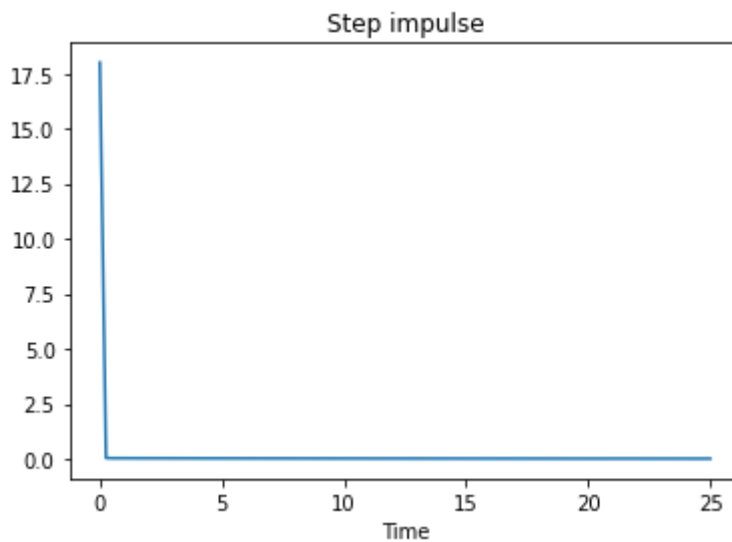
```
step_info(t,y)
```

```
% overshoot : 0.0 %
Rise time : 12.878787878787879
%Settling time : -%
```



```
# impulse
y,t = control.impulse(complete9)
plt.plot(t,y)
plt.xlabel('Time')
plt.title('Step impulse')
```

```
Text(0.5, 1.0, 'Step impulse')
```



```
# pole
try:
    y,t = control.pole(complete9)
    plt.plot(t,y)
    plt.xlabel('Time')
    plt.title('Step impulse')
except ValueError:
    print("Bilangan imajiner")
```

Bilangan imajiner

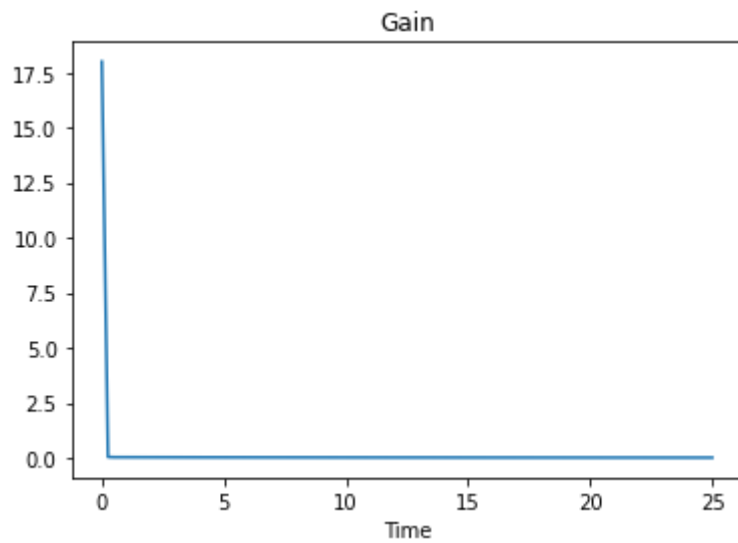
```
# Gain
kp = 1
ti = 1

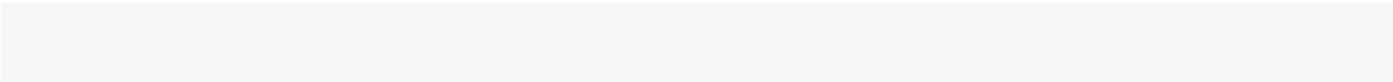
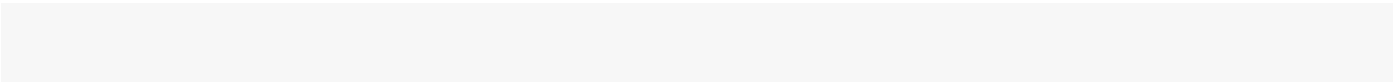
H = control.tf(complete9)
print(H)

plt.plot(t,y)
plt.xlabel('Time')
plt.title('Gain')
```

$$\frac{0.09 s^2 + 0.01 s}{0.005 s^3 + 0.15 s^2 + 0.0101 s}$$

Text(0.5, 1.0, 'Gain')





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