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Lab Assignment 1

Date: 18-08-2020

**Control Theory Lab 1 dated 06-09-2021.**

**Python Code:**

import control

import matplotlib.pyplot as plt

c = 0.001

L = 40

R = 240

A = [[0,1/c], [-1/L,-R/L]]

B = [[0],[1/L]]

C = [[1, 0],[0,R]]

D = 0

sys = control.ss(A, B, C, D)

print("STATE SPACE MATRICES : \n",sys)

tf = control.ss2tf(sys)

print("Transfer Function : \n", tf)

**OUTPUT:**

STATE SPACE MATRICES :

A = [[ 0.0e+00 1.0e+03]

[-2.5e-02 -6.0e+00]]

B = [[0. ]

[0.025]]

C = [[ 1. 0.]

[ 0. 240.]]

D = [[0.]

[0.]]

Transfer Function :

Input 1 to output 1:

25

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s^2 + 6 s + 25

Input 1 to output 2:

6 s

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s^2 + 6 s + 25

# control.step\_response(tf[])

t, y = control.step\_response(tf[0,0])

plt.plot(t, y)

# plt.title("Step Response 1")

# plt.xlabel("t")

# plt.ylabel("y")

t, y = control.step\_response(tf[1,0])

plt.plot(t, y)

plt.title("Step Response 2")

plt.xlabel("t")

plt.ylabel("y")

plt.legend(["Step Response across Capacitor", "Step Response across Resistor"])

plt.show()

Output:

Chart, line chart

Description automatically generated

**Learning outcomes:**

1. Using Control Library in Python
2. Finding State space graphs using control
3. Finding step response of a SS model using control

**Conclusion:**

* We have learned how to plot State-space graphs by writing code in Spyder, solving it on paper. This lab helped to know how the Transfer function is used to get the values to plot. In this lab, we have calculated the transfer function on paper for the state space and then we have computed the coding. In this lab, we have also calculated different values of the matrix on paper
* In this lab we have also learned how to plot the step response of the state space model. In this lab we learned how the model can be converted into transfer function and then plot graph across the capacitor as well as resistor in a single graph.
* In this we have also learned to find the different values of parameters in a state-space model and the coding part as well. In this lab we learned how the model can be converted into transfer function and then plot graph across capacitor as well as resistor in a single graph. This graph helps us to know how a state-space plot is plotted with the given transfer function of an open-loop system and helps in easy visualization.