Control & Automation Engineering Department

KON309E Microcontroller Systems - Experiment 8

Aim: Implementation of P and PI type controllers.

Preliminaries:

1. Construct the circuit given in Figure 1, where

   $C_1 = 220\mu F$

   $C_2 = 100\mu F$

   $R_1 = 10K\Omega$

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2. Obtain the transfer function of the system.

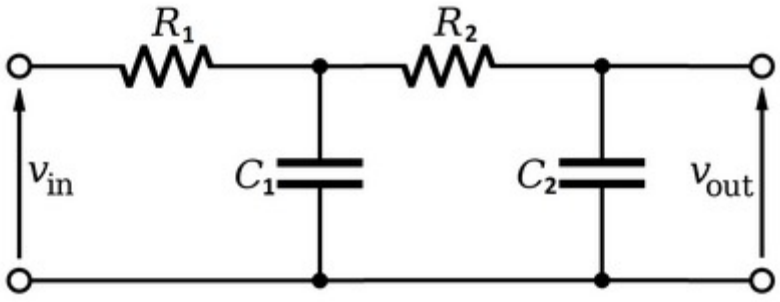

Figure 1: Circuit diagram of the system to be controlled

Yüksüz kalma problemi

In this experiment, participants are expected to achieve tasks given below.

1. Implement the control system using one of the presented methods in the lecture notes (differential equation solution via ODE solvers or direct digital implementation via difference equation).
2. Choose a proper sampling time.
3. Simulate the system first (Hardware-in-the-Loop).
4. Use a button to give the reference to the system. When button is pressed, reference of 1V will be given to the system. When the button is pressed again, the reference will be 0V. You can think of it as an ON/OFF button. Use external interrupt for button pressed event.
5. Send the output of the system to MATLAB via UART and visualize the data using the code given previously.
6. Control the system with a P type controller (You can take $K = 2.5$).
7. Control the system with a PI type controller (You can take $K_P = 2.8$ and $K_I = 0.8$).
8. Do the same for the actual system.
9. Read the output of the actual system from an analog input pin.
10. Give the control signal to the system using PWM.

Please consider the following steps when preparing your reports.

1. Describe the experiment **in your own words** and explain what you learned.
2. Add your codes as screen shots.
   - Don't forget to comment your codes **in your own words** explaining how each line of code works.
3. Explain how you implemented the control system for both simulation and the actual system.
4. Explain why the PI controller is needed for this system.
5. Explain the constraints regarding the control signal.
6. Compare the simulation and the actual system.
7. Include the MATLAB graphics (use plot() function of MATLAB to plot all data).
8. Add a photo of your whole circuit.
9. Take a video of your system while running, upload it on YouTube, Drive, etc. and include the link on your report.