Christian Johnson

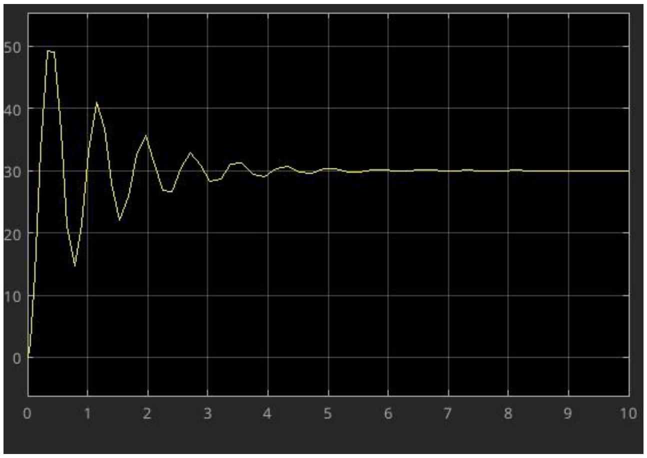
Riley Thorburn

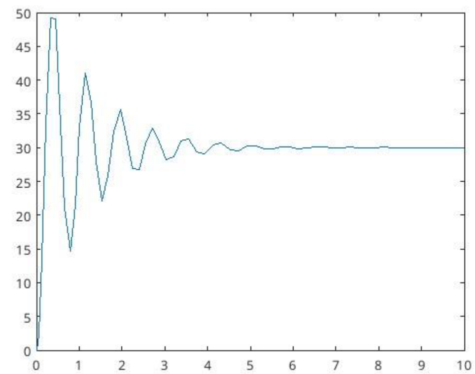
30JAN2024

Automatic Control Systems: Lab 1 Part 1

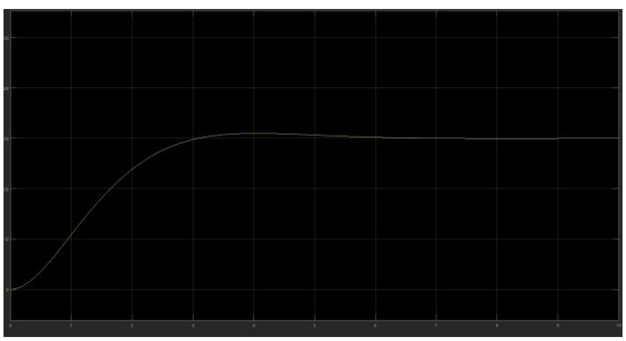
This lab focused primarily on correcting antenna angles. Typically, when an antenna's position is disturbed, it has trouble correcting itself to return to its original position. We attempt to solve this problem using the system outlined in the lab document, which will take the current position as input and correct it to match the desired position. After the Simulink model was initially created, we replaced a power amplifier with a given transfer function - which changed the way in which the system corrected the antenna's position. During this lab, we covered topics that we had not been introduced to. One of these, integral to this exercise, involved using Matlab to create a block diagram for a system, and thereby simulate its effect. Similarly, we covered strategies for using several Matlab commands to analyze that system to verify our results mathematically. We learned how to apply specific transfer functions to a model to adjust the system's output; additionally, we covered how to analyze the scope output of a system to see how it will change its input into a more desirable output. One of the more specific things in the Matlab Simulink that we learned was how to run the scope model; this showed us the response of the system, with the y-axis showing the angle in degrees and the x-axis showing the time. While trying to verify the answer using the control system toolbox, one of the helpful functions that we previously did not know about was, *zpk*. It is a function that converts zero-pole-gain models. The other useful function was *ilaplace* and *laplace*, which finds the inverse Laplace and Laplace transform respectively. Another fun lesson we learned during this lab was changing the background color of your diagram model. We changed ours to blue and pink!

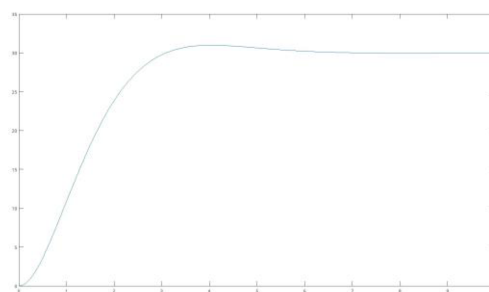
Initial System, Scope and Workspace output:



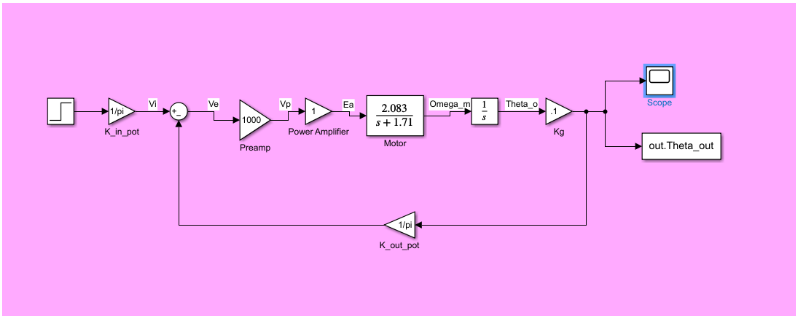


System #2, Scope and Workspace output:

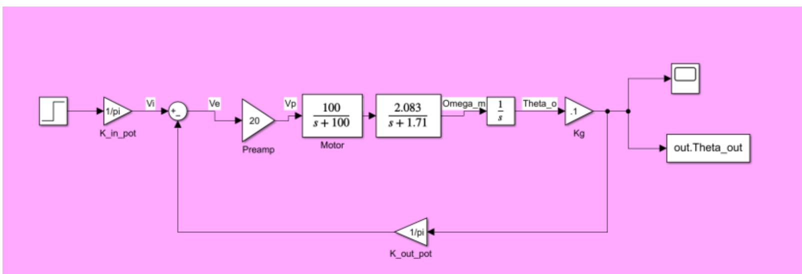




Block Diagram (Part1)



Block Diagram (After amplifier change)



Worked out Solution:

$$g = \frac{0.2083}{s(s+1.71)} = \frac{\Theta_o(s)}{E_a(s)} \qquad \left.\begin{array}{l} \cancel{E_a} \\ E_a = 1/s \end{array}\right\} \Theta_o = \frac{\frac{0.2083}{s(s+1.71)}}{1/s} = \frac{0.2083}{(s+1.71)}$$

$$\mathcal{L}^{-1}(\Theta(s)) = \cancel{\mathcal{L}^{-1}\left(\frac{0.2083}{s(s+1.71)}\right)} = \mathcal{L}^{-1}\left(\frac{0.2083}{s+1.71}\right) = 0.2083\left(e^{-1.71t}\right)$$