ME 422 – Mechanical Control Systems

Lab 5

Divide up into two groups with your lab partners. Half of the lab teams will do Part 1 first, then Part 2. The other half will do Part 2 first, then Part 1. You have 1.5 hours for each part.

Part 1 – Motomatic with velocity and position feedback

Set up the Motomatic in closed-loop position control with the position to be plotted on an oscilloscope. Set the step knob to put in 180° of knob input. Set the scope up to trigger for an input step. Set the scale so that the signal captured takes up a lot of the oscilloscope screen.

1. Set R_F = 5 kΩ. Run a step input. Capture the step response into Excel.
2. Turn R_F up to 10 kΩ. Run a step input. Capture the step response into the same Excel file.
3. Turn R_F up to 20 kΩ. Run a step input. Capture the step response into the same Excel file.
4. Hook up the velocity feedback loop. Perform 1-3 again. Capture the responses.

Here we want to compare the outputs with and without the velocity feedback. (You may use your previous Simulink model and compare each run with what it predicts, though this is not required. For the simulation make sure you have the generator gain (volts/rpm). Also assume the power amp max voltage is 30 volts.)

Turn in three annotated plots. Each plot should have two curves on it – a) position control without velocity feedback and b) position control with velocity.

Part 2 – Single-tank controller

Set up the two-tank controller as a single-tank level controller. Get the tank running at steady-state, mid-range in open loop. Now set it up with the proper controls—i.e. to give no steady-state error for a step input. Have the unit running at this steady-state, mid-range with the controller active. Introduce a disturbance by closing the tank outlet valve about 10%. Record the result. Does the unit return to its original steady-state level? After it has come again to steady state, open the valve back up and see how the system responds.

Print out your Simulink controller and the response to the disturbance inputs. Record flow rates for before and after the step disturbances.