FYS 4420 PiD Controller Task List

September 10, 2015

TIPS AND RECOMMENDATIONS:

1. **IMPORTANT:** Before starting with the lab exercises double check and make sure that all the wiring is connected, the power supply that powers the Peltier element is switched on and that the thermistor is in firm contact with the copper sample casing.
2. **IMPORTANT:** if the code is interuppted (CONTROL + C) or did not properly execute run *reset_pid* .
3. Feel free to modify the sample code given at the beginning of the lab exercise but as a suggestion you might want to keep the original intact and for each modification to save it with a different name.
4. Save the results of each task with a separate name to prevent overwriting of already existing data.

TASKS:

1. Explanation of the experimental setup
2. Explanation of the MATLAB code.
3. Plain temperature measurements. The code should be ran for approximately 20 min. The code is initaially set to run 2000 samples. The number of samples defines the length of the experiment. Make sure to adjust the number of samples so that the experiment runs approximately 20 minutes. After the measurements are performed comment on the variation in measured temperature.
4. Modify the code so that it performs step-excitation. Perform the step-excitation measurements and save the results. This is probably the most time consuming experiment. Typically it takes 2.5h before the response curve reaches saturation.

5. Modify the code to perform pulse-excitation. The length of the pulse can be abitrarily chosen (typically in the interval of 10-20 seconds). Perform the excitation and measure the response. Save the results.

6. Use the results from Task 4 and Task 5 along with your theoretical knowledge on step and pulse-excitation to get H_0, T_1 and T_2.

7. Use H_0, T_1 and T_2 to find P and I.

8. Implement the values for P and I and prepare the code to do PI-control of the sample.

9. Run the code and perform PI-control of the system. The current T_{ref} is set to 28° C, but feel free to experiment with a bit lower or higher value of T_{ref}. Save the results.

10. Run another PI-controller experiment for the given value of T_{ref} and then increase the reference temperature (f.ex. after 200-250 samples) to a new reference temperature, $T_{ref} \rightarrow T_{ref} + \Delta T$. Save the results.

11. Repeat Task 10 using 10 times longer sampling interval and comment on the results.

12. Set $K_I = 0$ and keep K_p as is. Run the PI-controller with a step reference like in Task 10 and verify that the response has an asymptotic deviation between T_{ref} and T. Comment the results with respect to the theoretical findings.

13. It is easy to make a system unstable by increasing the corrective feedback. Set K_p to 100 and run the PI-controller. Comment on the results.