Lab 2

Finding Ziegler Nichols Open Loop (ZNOL) Tuning Constants using the Fast Autotuner feature of the Temperature Control System and PID Control Using these settings

The chamber can display two sets of process dynamics that are quite different.

The first process dynamic relates the temperature of the sensor contained between the 2 cement resistor heaters and attached to them so that response will be rapid and steady state temperature high.

The second process dynamic relates to the temperature of the sensor is located away from the heater elements in the center of the chamber. The response will be much slower and result in a much lower steady temperature than that of the sensor attached to and in between the heater elements.

Purpose:

Using the built in Autotuner find the ZNOL tuning constants for the two sets of process dynamics.

Procedure:

1) Download Arduino IDE and load the code Complete Temperature Control C/C++ Code
2) Make sure 12 VDC power supply plugged in. Connecting the computer USB port to the Arduino Nano will power up the LCD Display and Nano , however the power to the heater requires the 12VDC power supply.
3) On the Arduino IDE menu, go to Tools and click on Serial Plotter. This will open up the serial plotter screen on the PC.

Note: the default setting uses the LM35R sensor contained within the 2 cement resistors.

4) Using the remote, observing the mapping diagram, and aiming the remote at the remote receiver mounted on the interface board:
5) Click on the manual key.
6) Click on 0 (zero) to create the 50% step and start the Autotuning algorithm
7) Observe the Slope indication on the LCD display.
8) After the slope has reached its peak and begins falling, click on Trans PID to transfer the ZNOL tuning constants to the PID controller.
    a. Note the Tuning Constants
        i. P _____3_____
        ii. I _____48_____
        iii. D ____12_____
9) Click on Stop ZNOL to remove the step.
10) Click on Auto to place the control system in Automatic Mode

11) Click on PID Tuning to display the ZNOL tuning constants on the LCD display.
    a. set Point should be at to 0%.
12)) Wait until the temperature drops to ambient (approximate 20 deg C) and steady state. screen on the PC
13) Adjust the Set Point Pot to 50 deg C and wait until steady steady state.
14) Adjust the set point to approximately 60 deg C. Try to do this in a step wise manner rather than incremental adjusting the Set Point.
15) Note the peak value of the temperature and the peak value of the 2nd overshoot and calculate the approximate decay ratio. Wait until the Temperature has reached steady state.

    Peak Value (deg C) _____67_____

    peak value of the 2nd overshoot (deg C) ___61_____, Decay Ratio ____(61-60)/(67-60) = 0.14

16) Wait until steady state with the temperature at 60 deg C
17) Set the Disturbance potentiometer to 50% and observe the response, noting the maximum drop in temperature and approximately how long the temperature recovers to Set Point of 60 deg C.
    a. Maximum drop in temperature (C deg) _____(58-56)= 2 C Deg_____
    b. Approximate recovery time to 60 deg C _____70 sec_____