

HVA 240  
 PRINCIPLES OF PROCESS CONTROL  
 Assignment 7  
 17 October 2007

Solve the following problems on a separate sheet of paper. In the case of problems requiring computation, show the steps in your work to obtain your answer. Remember to reference the source of your data.

- 1) During class, you did a lab emphasizing the performance characteristics of cascade control. As part of that lab, you were provided a handout that showed a shell and tube heat exchanger operating under TC-FC control along with the functional block diagram. Using this as a starting point, draw a control schematic that places the exchanger under TC-PC control.
  
- 2) Using the software you purchased for this course, *Controller Tuning 101*, investigate the impact of gain, integral, and derivative settings on system response. Follow the instructions below. When commenting on your results, pay special attention to wave shape, settling time, and the degree of offset at any point in time.
  - a. Program Setup  
 Controller = Derivative on Error  
 Interacting Algorithm  
 (ie: Deselect noninteracting algorithm)  
 Time Scale = 1x  
 Calc Steps = 1000
  
  - b. Controller Setup  
 (Consider this your "Base Case")  
 SP = 70%  
 Kc = 1  
 Ti = 0  
 Td = 0
  
  - c. Process Setup  
 Kp = 1  
 Td = .5  
 td1 = .5  
 td2 = .2  
 Integrator = No  
 Filter (Tf) = 0  
 Load Change = 0
  
  - d. Investigate Gain Changes
    - i. Clear by clicking on Reset
    - ii. Run Base Case
    - iii. Increase Kc by 50% to 1.5 & run
    - iv. Decrease Kc by 50% to 0.666 & run
    - v. Comment
  
  - e. Investigate Integral Changes
    - i. Clear by clicking on Reset
    - ii. Run Base Case  
 (Derivative and integral should be zero)
    - iii. Set Ti to 1 and run
    - iv. Double Ti to 2 and run
    - v. Halve Ti to 0.5 and run
    - vi. Comment
  
  - f. Investigate Derivative Changes
    - i. Clear by clicking on Reset
    - ii. Run Base Case  
 (Derivative and integral should be zero)
    - iii. Set Td to 0.25 and run
    - iv. Double Td to 0.5 and run
    - v. Halve Td to 0.125 and run
    - vi. Comment
  
  - g. Investigate Derivative Plus Integral
    - i. Clear by clicking on Reset
    - ii. Run Base Case  
 (Derivative and integral should be zero)
    - iii. Set Ti to 1 and Td to 0.25 and run
    - iv. Double Td to 0.5 and run
    - v. Halve Td to 0.125 and run
  
    - Reset if desired, then:
      - vi. Set Ti to 2 and Td to 0.25 and run
      - vii. Double Td to 0.5 and run
      - viii. Halve Td to 0.125 and run
  
    - Reset if desired, then:
      - ix. Set Ti to .5 and Td to 0.25 and run
      - x. Double Td to 0.5 and run
      - xi. Halve Td to 0.125 and run
      - xii. Comment