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Continuing Education Course #292
Proportional, Integral, and Derivative
Controller Design - Part 2

1. The PID controller is the sum what three terms?
- a. proportional, integral, 2nd order derivative
- b. proportional, integral, derivative
- c. proportional, double integrator, derivative

2. Increasing a PID proportional K_P gain will?
- a. decrease overshoot
- b. increase overshoot
- c. have no effect

3. The integral gain K_I in the standard PID gain form is related to the equivalent gain in the standard PID time form as?
- a. $K_I = K_P * T_I$
- b. $K_I = K_P * (T_I)^2$
- c. $K_I = K_P/T_I$

4. The derivative gain K_D in the standard PID gain form is related to the equivalent gain in the standard PID time form as?
- a. $K_D = K_P/T_D$
- b. $K_D = K_P * T_D$
- c. $K_D = K_P * (T_D)^2$

5. The noise issue with the derivative can be mitigated by implementing it as a?
- a. 2nd order derivative
- b. high pass filter
- c. low pass filter

6. The Smith Predictor is used most often when plant delays are?
- a. short
- b. long
- c. unknown

7. The advantage of the Smith Predictor is?
- a. removes impact of delay on closed loop system poles thereby maintaining loop stability with a nominal controller but delay still remains in forward path
- b. shortens the plant delay

8. The Smith Predictor?

○ a. requires a model of the plant with delay and integrates with a nominal controller
○ b. does not require a plant model
○ c. requires a special nominal control structure but no plant model

9. The frequency response in the sample data domain can be analyzed using the?
○ a. Laplace transform
○ b. Z-transform
○ c. S-transform

10. For as one to one conversion of a transfer function block in continuous control loop diagram to a sample-data representation each physical block must connect through?
○ a. a summing junction
○ b. a scaling factor
○ c. a sampler

11. A sampler can be represented mathematically by a?
○ a. low pass filter
○ b. high pass filter
○ c. zero order hold

12. A method for converting continuous functions to sample-data format is the?
○ a. S-transform
○ b. Laplace transform
○ c. Bilinear transform with frequency pre-warping

13. The advantage of the incremental PID controller is?
○ a. magnitude of the control terms are larger
○ b. magnitude of the control terms are smaller
○ c. there is none

14. When designing a digital control loop; due to sampling key effects to bear in mind are?
○ a. sample rate limits bandwidth to < half the sampling frequency per the Nyquist theorem
○ b. sampling causes phase delay; roughly the time delay relative to the system bandwidth
○ c. Both

15. In the section 4 Home Heating System example, the response of the system to two types of controllers was analyzed which were?
○ a. proportional only (P-only) and proportional plus derivative (PD)
○ b. proportional plus derivative (PD) and proportional plus integral plus derivative (PID)
○ c. proportional only (P-only) and proportional plus integral (PI)

16. In the Home Heating System example, continuous time and sampled data time results are very similar due to the relatively high sample rate with the only difference comparing Bode plots is?
○ a. continuous time has significantly more low frequency gain
○ b. the phase response now falls off as frequency approaches the sampling frequency of 100 Hz
○ c. the phase response now increases as frequency approaches the sampling frequency of 100 Hz Explanation: continuous time and sampled data time results are very similar due to the relatively high sample rate with the only difference the phase response now falls off as frequency approaches the sampling frequency of 100 Hz (page 24)

17. The motion control example in section 5 examines the continuous and sample data response for a _____ control loop?

○ a. rate
○ b. position
○ c. acceleration

18. When comparing the stability margins in the continuous s-domain and sampled z-domain for the first motion control example with position feedback only, the net result was _____ margin due to sampling.
○ a. an increase in phase and decrease in gain
○ b. an decrease in both phase and gain
○ c. an increase in both phase and gain

19. The PID structure can be implemented within?
○ a. adaptive controllers
○ b. fuzzy logic controllers
○ c. both

20. Indirect Adaptive Control Architectures use?
○ a. a standard control loop feedback structure, with adjustable parameters, coupled with an identification algorithm of the plant parameters used in a standard controller with adjustable parameters
○ b. a adaptive parameter update algorithm to calculate the control parameters directly
○ c. both

21. Direct Adaptive Control Architectures use?
○ a. a standard control loop feedback structure, with adjustable parameters, coupled with an identification algorithm of the plant parameters used in a standard controller with adjustable parameters
○ b. a adaptive parameter update algorithm to calculate the control parameters directly
○ c. both

22. The model reference adaptive controller (MRAC) described in the course is?
○ a. a indirect adaptive control architecture
○ b. a direct adaptive control architecture
○ c. hybrid

23. A PID cascaded with the FLC as illustrated in this course uses?
○ a. the FLC operating on the individual PID output terms
○ b. the PID operating on the FLC output
○ c. the FLC operating on the single summed PID output

24. Fuzzy Logic Control is implemented in how many steps?
○ a. 2
○ b. 4
○ c. 3

25. The first step in the FLC implementation is termed?
○ a. fuzzification
○ b. intialization
○ c. defuzzification