Continuing Education Course #059
Digital Control of Second
and Higher Order Systems

1. Interest in digital control for analog systems is due to the digital controller with:
- a. no temperature effects,
- b. inexpensive embedded digital controllers,
- c. no long-term component drift,
- d. all of the above.

2. Analog systems can be modeled in the frequency domain using:
- a. cascaded first and second-order blocks,
- b. a high-order rational polynomial ,
- c. either of the above,
- d. none of the above.

3. Analog system behaviors can be compared in the time domain using:
- a. step responses behaviors,
- b. impulse response behaviors,
- c. both of the above,
- d. neither of the above.

4. Digital system model behaviors can be compared in the time domain using:
- a. step responses behaviors,
- b. impulse response behaviors,
- c. both of the above,
- d. neither of the above.

5. Digital and analog system model behaviors can be compared in the time domain using:
- a. step responses behaviors,
- b. impulse response behaviors,
- c. both of the above,
- d. neither of the above.

6. The “time-shift” operator “q” is used to represent systems with a Zero-Order Hold:
- a. True,
- b. False.

7. A single analog pole in the frequency domain transforms to a single digital pole in the “q” time domain:
- a. True,
- b. False.

8. A second-order analog pole in the frequency domain transforms to a second-order digital pole in the “q” time domain:

- a. True,
- b. False.

9. The “q” time-shift operator can be used to represent both forward and backward time shifts in the time domain:

- a. True,
- b. False.

10. Deadbeat control requires the digital model to:

- a. be constructed with a cascade with first-order poles first,
- b. be constructed with a cascade with first-order poles last,
- c. be constructed with a single polynomial denominator,
- d. any of the above.

11. The digital model provides the present output value in terms of:

- a. prior input values,
- b. prior output values,
- c. both of the above,
- d. none of the above.

12. The digital model “one-step-ahead” predictor provides output value in terms of:

- a. prior and present input values,
- b. prior and present output values,
- c. both of the above,
- d. none of the above.

13. The digital model “two-step-ahead” predictor provides output value in terms of:

- a. prior and present input values,
- b. prior and present output values,
- c. the “one-step-ahead” values,
- d. all of the above.

14. The “q” time-shift operator can be used to produce predictors for as many steps ahead as are required:

- a. True,
- b. False.

15. Predictors are used for future error estimation:

- a. True,
- b. False.

16. Present and future inputs are applied to force a future error estimate to zero error:

- a. True,
- b. False.

17. How many error prediction values are required to calculate the first derivative of error:

- a. one,
- b. two,
- c. three,
- d. four.

18. How many error prediction values are required to calculate the second derivative of error:

- ○ a. one,
- ○ b. two,
- ○ c. three,
- ○ d. four.

19. How many controller output values are required to force a zero-error condition in the future:
- ○ a. one,
- ○ b. two,
- ○ c. three,
- ○ d. four.

20. How many controller output values are required to force a zero-error condition and a zero first derivative of error in the future:
- ○ a. one,
- ○ b. two,
- ○ c. three,
- ○ d. four.

21. How many controller output values are required to force a zero-error condition and a zero first and second derivative of error in the future:
- ○ a. one,
- ○ b. two,
- ○ c. three,
- ○ d. four.

22. It is not possible to force higher derivatives of error than the second to zero:
- ○ a. True,
- ○ b. False.

23. Sampling with a longer period generally requires more control effort:
- ○ a. True,
- ○ b. False.

24. Sampling with a longer period generally produces more “ringing”:
- ○ a. True,
- ○ b. False.

25. Controlling the digital model produces the same step response result as controlling the analog model:
- ○ a. True,
- ○ b. False.