Continuing Education Course #060
Converting Feedback Systems
from Analog to Digital Control

1. Interest in digital control for analog systems is due to the digital control 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 represented in the frequency domain using:
- a. Bode plots,
- b. polynomial equations,
- c. either of the above,
- d. none of the above.

3. Analog system behaviors can be compared in the frequency domain using:
- a. magnitude response,
- b. phase response,
- c. both of the above,
- d. neither of the above.

4. A single pole behavior produces a phase shift at the pole frequency of:
- a. zero degrees,
- b. 45 degrees,
- c. 90 degrees,
- d. 180 degrees.

5. A single pole behavior produces an asymptotic gain decrease below the pole frequency of:
- a. zero,
- b. 10x decrease per decade of frequency increase,
- c. 100x decrease per decade of frequency increase,
- d. none of the above.

6. A single pole behavior produces an asymptotic gain decrease above the pole frequency of:
- a. zero,
- b. 10x decrease per decade of frequency increase,
- c. 100x decrease per decade of frequency increase,
- d. none of the above.

7. The “open-loop” system behavior can be used to predict “closed loop” stability:
- a. True,
- b. False.

8. A second-order pole in an “open-loop” is unconditionally stable in a “closed loop”:
- ○ a. True,
- ○ b. False.

9. Phase shift at the “open-loop” unity-gain frequency is an important indicator of “closed-loop” system stability:
- ○ a. True,
- ○ b. False.

10. A “Pole-Zero” (PZ) compensator can be used to improve system stability:
- ○ a. True,
- ○ b. False.

11. The introduction of an Analog-to-Digital converter with “Zero-Order Hold” causes the phase margin of an analog system to:
- ○ a. get better,
- ○ b. get worse,
- ○ c. remain unchanged,
- ○ d. depends on the system.

12. A digital model of an analog system introduces:
- ○ a. discrete-time effects,
- ○ b. quantized magnitude effects,
- ○ c. both of the above,
- ○ d. none of the above.

13. Sampling an analog system produces a wide-band spectrum:
- ○ a. True,
- ○ b. False.

14. Adding a Zero-Order Hold to a sampled signal increases the amount of signal in higher frequencies:
- ○ a. True,
- ○ b. False.

15. The “Nyquist” frequency is what fraction of the sampling rate:
- ○ a. one fourth,
- ○ b. one half,
- ○ c. three quarters,
- ○ d. they are equal.

16. Sampling must be substantially higher than the Nyquist frequency to avoid aliasing:
- ○ a. True,
- ○ b. False.

17. Sampling with a Zero-Order Hold is equivalent to a delay of:
- ○ a. one quarter of the sampling period,
- ○ b. one half of the sampling period,
- ○ c. three quarters of the sampling period,
- ○ d. one sampling period.

18. Digital to Analog conversion introduces delay in a system model:
- ○ a. True,
- ○ b. False.

19. In an analog system diagram, the block with a value 1/s represents:
- ○ a. a multiplication,
- ○ b. a differentiation,
- ○ c. a division,
- ○ d. an integration.

20. A Bilinear Transform Block is used to represent:
- ○ a. a multiplication,
- ○ b. a differentiation,
- ○ c. a division,
- ○ d. an integration.

21. A discrete-time controller can be implemented using:
- ○ a. an ASIC,
- ○ b. an FPGA,
- ○ c. an MCU,
- ○ d. any of the above.

22. A digital controller behavior can be expressed using:
- ○ a. VHDL,
- ○ b. Verilog,
- ○ c. A “C” language program,
- ○ d. any of the above.

23. Wider digital words enable more accurate timing:
- ○ a. True,
- ○ b. False.

24. Wider digital words enable more accurate Signal to Noise (SNR) computation:
- ○ a. True,
- ○ b. False.

25. Both Analog to digital and digital to analog conversion produce noise:
- ○ a. True,
- ○ b. False.