

H.W-4-----2024-2025 ///// CONTROL SYSTEM-2
SOLVE ALL QUESTIONS: CHOSE A SUTIALE ANSWER.

1. What is the primary purpose of compensation in control systems?

- A) To increase the system's complexity
- B) To stabilize a system and improve performance
- C) To decrease the bandwidth of the system
- D) To limit feedback control actions

2. Which type of compensation utilizes changes made to the output before it is disturbed by external factors?

- A) Cascade Compensation
- B) Feedback Compensation
- C) Feed-Forward Compensation
- D) Passive Compensation

3. Which controller is classified as a type of active compensation?

- A) Phase-lead Controller
- B) Phase-lag Controller
- C) PID Controller
- D) Phase lag-lead Controller

4. What is a key feature of a Proportional-Derivative (PD) controller?

- A) It introduces a pole at zero
- B) It does not affect system type
- C) It eliminates steady-state errors
- D) It decreases system bandwidth

5. Which controller improves steady-state performance by increasing the system type?

- A) PD Controller
- B) PID Controller
- C) Phase-lag Controller
- D) Phase-lead Controller

6. In the context of passive compensation controllers, which configuration typically aims to improve transient response without affecting steady-state performance?

- A) Phase-lead Controller
- B) Phase-lag Controller
- C) Feed-Forward Compensation
- D) Passive Compensation

7. What are the effects of employing a phase-lag controller in a control system?

- A) Increases system stability
- B) Reduces noise significantly
- C) Improves the rise time of the response
- D) Eliminates steady-state error in first-order systems

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8. How do active compensators generally compare to passive compensators?

- A) Active compensators are simpler to design
- B) Active compensators respond slower to disturbances
- C) Active compensators provide greater control over system dynamics**
- D) Active compensators are always less expensive

9. What is the primary purpose of using root-locus design in control systems?

- A) To determine the system's steady-state error
- B) To adjust system gain for satisfactory closed-loop behavior
- C) To define the transfer function of a system
- D) To find the time constant of a system

10. Which type of controller combines proportional gain with the integral of the error?

- A) PD Controller
- B) PI Controller**
- C) PID Controller
- D) Phase-Lag Controller

11. In a phase-lead compensator, what is the relationship between the zero and pole?

- A) The zero is greater than the pole**
- B) The zero is less than the pole
- C) The zero and pole are equal
- D) The pole is located at the origin

12. When designing a PD compensator, which of the following is typically the goal?

- A) To increase the steady-state error
- B) To improve the transient response of the system**
- C) To completely eliminate overshoot
- D) To decrease the system's gain

13. How do phase-lag compensators primarily affect the root-locus plot?

- A) They shift the root-locus to the right
- B) They reduce the overshoot of the system
- C) They add positive phase to the system
- D) They have no effect on the root-locus plot

14. What is a key characteristic of a PID controller?

- A) It uses only proportional control
- B) It improves stability without affecting response time
- C) It combines proportional, integral, and derivative actions**
- D) It has no impact on steady-state error

15. Which command in MATLAB is used to plot the root locus of a system?

- A) step()
- B) rlocus()
- C) plot()
- D) tf()

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16. In the design of a compensator, what does the angular criterion help determine?

- A) The speed of the response
- B) The location of poles on the real axis
- C) The positions of zeros and poles in the s-plane
- D) The steady-state error of the system

17. What does the term "breakaway point" refer to in root-locus design?

- A) The point at which the response changes from stable to unstable
- B) The location on the root locus where multiple trajectories diverge
- C) The point indicating no response to input changes
- D) The point of maximum overshoot in a step response.

18. What is the effect of increasing the controller gain in a P-controller?

- A) Increases error
- B) Increases system stability
- C) Improves transient response at the risk of overshoot
- D) No effect on the system response

19. What is the function of a compensator in the context of root-locus design?

- A) To simplify the transfer function of a system
- B) To reshape the root-locus plot for desired performance
- C) To measure system frequency response
- D) To enhance system noise immunity

20. What effect does a PD controller have on overshoot in transient response?

- A) It increases overshoot
- B) It eliminates overshoot entirely
- C) It can reduce overshoot
- D) It has no effect on overshoot

21. For a control system using a PID controller, which action is responsible for eliminating steady-state error?

- A) Proportional action
- B) Derivative action
- C) Integral action
- D) None of the above

22. When designing a phase-lead compensator, what must you consider regarding the placement of the compensator pole?

- A) It must be placed at the origin
- B) It should be far from the zero to avoid instability
- C) It should satisfy the angle criterion
- D) It must be equal to the zero for stabilit

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23. What is the purpose of the graphical root-locus design method?

- A) To determine the frequency response of a system
- B) To select points in the s-plane for closed-loop poles
- C) To linearize nonlinear systems
- D) To derive the state-space representation

24. During root-locus design, what does the term "dominant poles" refer to?

- A) Poles that contribute most significantly to the system's behavior
- B) Poles found on the imaginary axis
- C) The poles that have negligible impact on system dynamics
- D) Poles that are located in the right half of the s-plane

25. How would you describe the behavior of a system with a gain that is too high?

- A) It leads to faster response times
- B) It enhances stability
- C) It can cause instability
- D) It has no effect on the system response

26. In a PID controller, adjusting which parameter first is recommended to achieve quick response?

- A) Integral gain (K_I)
- B) Derivative gain (K_D)
- C) Proportional gain (K_P)
- D) All gains should be set simultaneously

27. What does the integral action of a PID controller primarily address

- A) Transient response
- B) Overshoot
- C) Steady-state error
- D) Damping of oscillations

28. What is the role of the angle criterion in root-locus design?

- A) To determine system type
- B) To calculate the magnitude of gain
- C) To establish the phase contribution of poles and zeros
- D) To plot the root locus on a graph

29. With regard to the filtering capacity the lead compensator and lag compensator are respectively:

- A) Low pass and high pass filter
- B) High pass and low pass filter
- C) Both high pass filter
- D) Both low pass filter

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30. What is the effect of phase lag compensation on the performance of a servo system?

- A) For a given relative stability, the velocity constant is increased
- B) For a given relative stability, the velocity constant is decreased
- C) The bandwidth of the system is increased
- D) The time response is made faster

31. A composite R-C network yielded the following transfer function when calculated from its components:

$T(s) = \frac{1+21s+20s^2}{1+11s+10s^2}$. This network can be used as which one of the following?

- A) Phase lead compensator
- B) Phase lag compensator
- C) Lag lead compensator
- D) None of the mentioned

32. The open loop transfer function of a plant is given as, $G(s) = 1/s^2 - 1$. If the plant is operated in unity feedback configuration, then the lead compensator that can stabilize the control system is:

- A) $10(s-1)/(s+2)$
- B) $10(s+4)/(s+2)$
- C) $10(s+2)/(s+1)$
- D) $10(s+2)/(s+1)$

33. What does a Bode plot represent?

- A) Time-domain response of a system
- B) Frequency response of a system
- C) Stability of a system
- D) Root locus of a system

34. Which axes are used in a Bode plot?

- A) Linear scale for magnitude and phase, log scale for frequency
- B) Log scale for magnitude and frequency, linear scale for phase
- C) Log scale for both magnitude and frequency
- D) Linear scale for both magnitude and phase

35. What is the formula to convert gain G into decibels (dB)?

- A) $\text{dB} = 10 \log_{10} G$
- B) $\text{dB} = 20 \log_{10} G$
- C) $\text{dB} = 10G$
- D) $\text{dB} = 20G$

36. What is the phase margin in a Bode plot?

- A) The distance from the 0 dB point to the gain crossover frequency
- B) The distance from -180 degrees to the phase at the gain crossover frequency
- C) The difference between gain margin and phase angle
- D) The maximum phase that can be achieved before instability

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37. How can high-order transfer functions be effectively plotted using Bode plots?

- A) By plotting each term separately and adding them graphically
- B) By calculating numeric values at discrete points
- C) By fitting a polynomial curve
- D) By converting them to state-space form

38. What type of response does a Bode plot specifically analyze?

- A) Step response
- B) Transient response
- C) Steady-state response
- D) Frequency response

39. Which of the following parameters does a Bode plot not directly provide information about?

- A) Gain crossover frequency
- B) Time constant
- C) Phase crossover frequency
- D) Stability margins

40. In Bode plots, how is a first-order system represented in terms of its slope on the magnitude plot?

- A) 10 dB/decade
- B) 20 dB/decade
- C) 30 dB/decade
- D) 40 dB/decade

41. When is a Bode plot considered to indicate a stable system?

- A) When the gain margin is greater than 1
- B) When the phase margin is positive
- C) When the output does not vary
- D) When the magnitude plot approaches infinity

42. What is the corner frequency in a Bode plot?

- A) The frequency at which the gain is maximum
- B) The frequency at which the phase shift is -90 degrees
- C) The frequency at which the slope of the magnitude plot changes
- D) The frequency at which the gain crosses 0 dB

43. In a Bode plot, what effect does adding a zero at the origin have on the magnitude plot?

- A) No effect
- B) Increases slope by 20 dB/decade
- C) Decreases slope by 20 dB/decade
- D) Flattens the slope

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- 44. According to the principle of log-scales, if the ratio between two points is same, then the two points get _____ equally.**
A) United
B) Separated
C) Multiplexed
D) Mixed
- 45. What does the term 'gain margin' refer to in a Bode plot?**
A) The frequency response beyond the cutoff frequency
B) The maximum gain that a system can tolerate before becoming unstable
C) The slope of the magnitude plot at the bandwidth
D) The average gain over all frequencies
- 46. How does a second-order system appear on a Bode plot?**
A) As a constant value
B) With a slope that changes at two distinct frequencies
C) With a single continuous line
D) As two separate straight lines
- 47. in a bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th order all-pole system?**
A) -80dB/decade
B) -40 dB/decade
C) 40 dB/decade
D) 80 dB/decade
- 48. In a Bode plot, what does the slope of the magnitude plot indicate?**
A) The system's bandwidth
B) The stability margins
C) The order of the system
D) The damping ratio of the system
- 49. The system is said to be marginally stable, if gain margin is:**
A) 0
B) 1
C) $+\infty$
D) None of the above
- 50. At which frequency does the magnitude of the system becomes zero dB?**
A) Resonant frequency
B) Cut-off frequency
C) Gain crossover frequency
D) Phase crossover frequenc

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