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Courses » Control System Design

Announcements **Course** Ask a Question Progress FAQ

Unit 8 - Week 4: Bode-plot and root-locus based control design

Course outline

Week-4 Assessment

The due date for submitting this assignment has passed. **Due on 2018-09-05, 23:59 IST.**
As per our records you have not submitted this assignment.

Week-4 Assessment

1) For the unity feedback control system shown below, it is desired to achieve a phase margin of at least 40°. Which of the following controllers C(s) would be appropriate to achieve the desired specifications? (Hint: Pls. consider solving this problem by plotting the Bode plot of the open loop transfer function C(s)P(s). The procedure to draw the bode plot in MATLAB is given in the attachment "Bode plot tutorial") ***2 points***

- $C(s) = \frac{s/0.1+1}{100s+1}$
- $C(s) = \frac{s/0.2+1}{100s+1}$
- $C(s) = \frac{s/0.4+1}{100s+1}$
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
$C(s) = \frac{s/0.1+1}{100s+1}$

2) Consider a plant whose transfer function is given by $P(s) = \frac{10}{(s/10+1)(s/50+1)}$. Although the nominal gain of the plant is 10, this could change by a factor of 2, i.e., it could drift to any value between 5 and 20. The plant experiences an output disturbance d(t)=sin (10 t). A unity feedback control system is employed to track a DC reference perfectly and to reject the disturbance by at least 98%, regardless of the plant gain. Which of the following controllers C(s) would be appropriate to achieve this desired performance and also ensures the stability of the closed loop system? (Hint: Pls. consider solving this problem by plotting the Bode plot of the open loop transfer function C(s)P(s). The procedure to draw the bode plot in MATLAB is given in the attachment "Bode plot tutorial") ***2 points***

- C(s)=200/s
- C(s)=200(s/30+1)/s
- C(s)=200(s/100+1)/s

- Control system design using root-locus
- Quiz : Week-4 Assessment

Week 5: Control of systems with some known parameters, Introduction to 2-degree of freedom control

Week 6: 2-Degree of freedom control design for robustness

Week 7: Quantitative feedback theory (Part 1/2)

Week 8 : Quantitative feedback theory (Part 2/2)

Lecture Notes(Week 1 - 8)

Week 9: Fundamental properties of feedback systems

Week 10 :Nonminimum phase system

Week 11: Unstable systems

Week 12 Describing functions

Assignment solutions

- C(s)=5(s/30+1)/s

No, the answer is incorrect.
Score: 0

Accepted Answers:
C(s)=200(s/30+1)/s

3) In the block diagram shown below, the plant transfer function is given to be $P(s) = \frac{20}{(s/50+1)(s/500+1)(s/1000+1)}$ and the control system is affected by input disturbance. Identify the controller C(s) which rejects a sinusoidal input disturbance d(t) = sin (0.5 t) by at least 98% and also ensures the stability of the closed loop system. (Hint: Pls. consider solving this problem by plotting the Bode plot of the open loop transfer function C(s)P(s). The procedure to draw the bode plot in MATLAB is given in the attachment "Bode plot tutorial") ***2 points***

- $C(s) = \frac{25}{s}$
- $C(s) = \frac{25(s/150+1)}{s}$
- $C(s) = \frac{50}{2s+1}$
- $C(s) = \frac{50(s+1)}{2s+1}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$C(s) = \frac{25(s/150+1)}{s}$

4) Consider a unity feedback control system as shown below. If C(s)=K/s, where K=10, which of the following control actions will have to be undertaken to simultaneously decrease the rise time and increase the phase margin? ***1 point***

- Increase the controller gain K suitably and add a controller pole near the origin
- Increase the controller gain K suitably and add a controller zero near gain cross-over frequency
- Add a controller zero at 300 rad/s
- Increase the controller gain K suitably and add a controller zero at 300 rad/s

No, the answer is incorrect.
Score: 0

Accepted Answers:
Increase the controller gain K suitably and add a controller zero near gain cross-over frequency

5) If the plant transfer function $P(s) = \frac{50}{s(0.1s+1)}$ has gain crossover frequency $\omega_{gc} = 21.3\ rad/s$ and phase margin $PM = 25.2°$. Suppose a lead compensator $C(s) = \frac{s/z+1}{s/p+1}$ is used to improve the PM of the open loop transfer function C(s)P(s) to at least 40° without significantly affecting the ω_{gc}. The location of the zero 'z' & pole 'p' of the lead compensator that achieve this specification are ***1 point***

- z=1, p=100
- z=10, p=100

- z=30, p=300
- z=5, p=500

No, the answer is incorrect.
Score: 0

Accepted Answers:
z=30, p=300

6) From the plots given below, identify the root locus of the open loop transfer function $C(s)P(s) = \frac{(s+10)}{s(s+5)(s+20)}$. *1 point*

No, the answer is incorrect.
Score: 0

Accepted Answers:

7) For an open loop transfer function $C(s)P(s) = \frac{K}{s(s+10)}$ the value of the gain K at which closed loop poles of a unity feedback system have a damping factor of $\zeta = 0.5$ is ______

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 100

1 point

8) For the unity feedback system shown below, suppose a lead compensator $C(s) = \frac{K(s+z)}{(s+800)}$ where 'K' is a constant, is employed to ensure the dominant pair of closed loop poles are at $-2 \pm j2\sqrt{3}$ then, the value of 'z' is *2 points*

- 3.62
- 7.94
- 5.28
- 10.12

No, the answer is incorrect.
Score: 0

Accepted Answers:
7.94

9) For the controller designed in the previous question, the approximate value of the gain K which ensures the dominant closed loop poles are at $-2 \pm j2\sqrt{3}$.is *1 point*

- $K = 1.6\ X\ 10^3$
- $K = 1.2\ X\ 10^3$
- $K = 2.5\ X\ 10^3$
-

$K = 6.8\ X\ 10^3$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$K = 1.6\ X\ 10^3$

10) For the feedback system shown below, identify the controller transfer function C(s), from among the choices given below, that ensure that the damping ratio ζ and the natural frequency ω_n of the dominant closed loop poles are 0.5 & 2 rad/s, respectively. (Hint: Pls. consider solving the problem using the root locus technique). ***2 points***

- $C(s) = \frac{15(s+10)}{(s+50)}$
- $C(s) = \frac{11.2(s+1)}{(s+6)}$
- $C(s) = \frac{22.2(s+20)}{(s+42)}$
- $C(s) = \frac{15(s+10)}{(s+80)}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$C(s) = \frac{11.2(s+1)}{(s+6)}$

Previous Page End