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Unit 17 - Week 11: Unstable systems

Week 11 Assignment

The due date for submitting this assignment has passed. **Due on 2018-10-17, 23:59 IST.**
As per our records you have not submitted this assignment.

1) The loop-gain of a system is given as $L(s) = \dfrac{(s+1)}{(s-1)} L_{MP}(s)$ where $L_{MP}(s)$ is a minimum-phase system. Identify the Nyquist plot of the system from below which ensures that the closed-loop system is stable. ***1 point***

- ○
- ○
- ○
- ○

No, the answer is incorrect.
Score: 0

Accepted Answers:

2) Nyquist plot is a better tool than Bode plot for checking the stability of a closed-loop system because ***1 point***

- ○ Bode plot does not provide phase information at large frequencies.
- ○ Bode plot cannot be obtained for an open-loop system that has multiple phase cross-over frequencies.
- ○ Bode plot cannot be obtained for an open-loop system that has multiple gain cross-over frequencies.
- ○ It is ambiguous to obtain gain margin and phase margin for an open-loop system with multiple phase cross-over and gain cross-over frequencies using Bode plot.

No, the answer is incorrect.
Score: 0

Accepted Answers:
It is ambiguous to obtain gain margin and phase margin for an open-loop system with multiple phase cross-over and gain cross-over frequencies using Bode plot.

3) For the system specified in question 1, determine the approximate lower limit of the gain cross-over frequency ω_{gc} provided that the slope of magnitude plot of $L_{MP}(s)$ is -20dB/decade near ω_{gc} and it is also required that the system should have a phase margin of 40^o. ***1 point***

- ○ 1.21
- ○ 2.14
- ○ 3.26
- ○ 4.65

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

- Fundamental properties of unstable systems
- Consequences of actuator bandwidth limitations while controlling unstable systems
- Week 11: Lecture notes
- Quiz : Week 11 Assignment

Week 12 Describing functions

Assignment solutions

No, the answer is incorrect.
Score: 0

Accepted Answers:
2.14

4) For the system specified in question 1, determine the approximate phase cross-over frequency ω_{pcl} provided that the slope of magnitude plot of $L_{MP}(s)$ is -20dB/decade between ω_{pcl} and ω_{gc} *1 point*

- 0.5
- 1
- 1.1
- 0.6

No, the answer is incorrect.
Score: 0

Accepted Answers:
1

5) The loop gain of a non-minimum phase system is given as $L_{NMP}(s) = \frac{a-s}{a+s}\frac{s+b}{s-b}L_{MP}(s)$ where $L_{MP}(s)$ represents transfer function of a minimum phase system. Identify the condition from below for which the system may not have positive gain and phase margins: *1 point*

- $a = b$
- $a << b$
- $a \neq b$
- $a >> b$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$a << b$

6) A certain loop gain L(s) has a following transfer function: *1 point*

$$L(s) = \frac{(s+1)}{s(s-2)}$$

Obtain the value of the Bode sensitivity integral $\int_0^\infty ln|S(j\omega)|d\omega$ where S is the sensitivity and is defined as:

$$S = 1/(1 + L(j\omega))$$

- 2π
- π
- 0
- 3π

No, the answer is incorrect.
Score: 0

Accepted Answers:
2π

7) For an unstable loop gain with a single pole on the right half-plane, why can't the sensitivity dirt be distributed as an infinitesimally thin layer at all frequencies beyond the frequency of interest? *1 point*

- Because that would result in reduced Phase and Gain margins
- Because loop shape can't be controlled beyond the bandwidth of the actuator employed to actuate the plant
- Because this would increase the sensitivity substantially within the frequency of interest

Because this would decrease the sensitivity substantially within the frequency of interest

No, the answer is incorrect.
Score: 0

Accepted Answers:
Because loop shape can't be controlled beyond the bandwidth of the actuator employed to actuate the plant

8) A certain plant with a right half plane pole at $a=4$ is actuated by a system whose bandwidth is Ω_a=40 rad/s. Suppose that the sensitivity dirt has been reduced for frequencies between 0 and ω_o by an amount A=5 (i.e., $\int_0^{\omega_o} ln|S(j\omega)|d\omega = -A$). The approximate amount of dirt that will have to be spread between frequencies between ω_o and Ω_a (i.e., $\int_{\omega_o}^{\Omega_a} ln|S(j\omega)|d\omega$) is (assuming $\int_{\Omega_a}^{\infty} ln|S(j\omega)|d\omega \approx 0$). *1 po*

- 20.5
- 19.98
- 17.56
- 18.35

No, the answer is incorrect.
Score: 0

Accepted Answers:
17.56

9) For question 8, calculate approximately the minimum value of the magnitude of sensitivity $|S_{min}|$ that has been spread between ω_o and Ω_a. ***0 points***

- 2.05
- 2.98
- 1.56
- 1.79

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.79

10) For the obtained value of sensitivity $|S_{min}|$ in question 9, calculate the maximum achievable gain margin (GM_{max}) and phase margin (PM_{max}). ***0 points***

- GM_{max}= 6.5 dB; PM_{max}= 38.44^0
- GM_{max}= 8.1 dB; PM_{max}= 40.44^0
- GM_{max}=7.1 dB ; PM_{max}= 32.44^0
- GM_{max}= 9.1 dB; PM_{max}= 42.44^0

No, the answer is incorrect.
Score: 0

Accepted Answers:
GM_{max}=7.1 dB ; PM_{max}= 32.44^0

Previous Page End