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Courses » Control System Design

Announcements

Course

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Unit 7 - Week 3 : Bode plots, Steps for performing control design, General controllers

Course outline

How to access the portal

Prerequisite Assignment

MATLAB Download and Introduction

MATLAB Learning Modules

Week 1: Linear System Theory, Fourier and Laplace Transforms

Week 2: Introduction to feedback control, Nyquist stability theory

Week 3 : Bode plots, Steps for performing control design, General controllers

☐ Bode plots

☐ Steps for performing control design (Part 1/2)

☒ Steps for performing control design (Part 2/2)

☒ General controllers (Part 1/3)

Week-3 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-3 Assessment

1) Obtain gain margin (GM) & phase margin (PM) for an open-loop transfer function $G(s)$ **1 point**
from the given Nyquist plot.



$$PM = 30^\circ, GM = 10 \text{ dB}$$



$$PM = 60^\circ, GM = 10 \text{ dB}$$



$$PM = -30^\circ, GM = 10 \text{ dB}$$



$$PM = -60^\circ, GM = -10 \text{ dB}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$PM = 30^\circ, GM = 10 \text{ dB}$$

2) Identify the open-loop transfer function $G(s)$ of the system whose asymptotic Bode magnitude plot is shown in figure 2. **1 point**



$$G(s) = \frac{100(s+1)}{s(\frac{s}{100}+1)}$$



$$G(s) = \frac{10(s+1)}{s(\frac{s}{100}+1)}$$



$$G(s) = \frac{10(\frac{s}{10}+1)}{s(\frac{s}{100}+1)}$$



$$G(s) = \frac{100(\frac{s}{10}+1)}{s(\frac{s}{100}+1)}$$

No, the answer is incorrect.

Score: 0

- ☒ General controllers (Part 2/3)
- ☒ General controllers (Part 3/3)
- ☐ Quiz : Week-3 Assessment

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

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

Accepted Answers:

$$G(s) = \frac{10(\frac{s}{10} + 1)}{s(\frac{s}{100} + 1)}$$

3) Figure 3 shows the asymptotic Bode magnitude plot of an open-loop transfer function $G(s)$. Find the value of gain cross-over frequency ω_{gc} in rad/s (up to 2 significant digits)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 30,32

4) If the step response of a system shows peak overshoot $M_p = 40\%$ & rise time $t_r = 5/3$ s then determine the approximate closed-loop transfer function $T(s)$ of the system

☐

$$T(s) = \frac{1}{s^2 + 0.56s + 1}$$

☐

$$T(s) = \frac{1}{s^2 + 0.14s + 1}$$

☐

$$T(s) = \frac{1}{s^2 + 0.28s + 1}$$

☐

$$T(s) = \frac{1}{s^2 + 2s + 1}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$T(s) = \frac{1}{s^2 + 0.56s + 1}$$

5) The closed-loop transfer function of a unity feedback system is given by $T(s) = \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$. Given the closed-loop bandwidth $\omega_b = 1.5$ rad/s. Find the value of ζ & ω_n from the frequency response of $T(s)$ as shown in figure 4. (Hint: $\omega_r \approx \omega_n$) 1 point

☐

$$\zeta = 0.2, \omega_n = 1 \text{ rad/s}$$

☐

$$\zeta = 0.1, \omega_n = 1 \text{ rad/s}$$

☐

$$\zeta = 0.3, \omega_n = 1 \text{ rad/s}$$

☐

$$\zeta = 0.4, \omega_n = 1 \text{ rad/s}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\zeta = 0.1, \omega_n = 1 \text{ rad/s}$$

6) From the plots given below, identify the Bode magnitude plot of the open-loop transfer function $G(s)$ which rejects sinusoidal disturbance of frequency 10 rad/s by at least 99% 1 point

☐
☐
☐


1 point



1 point



No, the answer is incorrect.

Score: 0

Accepted Answers:

7) The closed-loop control system (as shown in figure 5) is expected to track a DC reference perfectly. Which of the following arguments will have to hold for the open-loop transfer function $C(s)P(s)$? **1 point**

- ☐ $C(s)P(s)$ should have at least one pole at the origin
- ☐ $C(s)P(s)$ should have at least one zero at the origin
- ☐ $C(s)P(s)$ should have a pair of imaginary poles
- ☐ Both option a & c

No, the answer is incorrect.

Score: 0

Accepted Answers:

$C(s)P(s)$ should have at least one pole at the origin

8) The Bode magnitude plot of a transfer function $C(s)$ is shown in figure 6. Which of the following controller have such a magnitude plot? **1 point**

- ☐ Proportional controller
- ☐ Lag compensator
- ☐ Proportional integral (PI) controller
- ☐ Proportional derivative (PD) controller

No, the answer is incorrect.

Score: 0

Accepted Answers:

Proportional integral (PI) controller

9) The problem of integrator wind-up can be addressed by which of the following measures? **1 point**

- i. By re-initializing the integral action to a desired value
- ii. By increasing the set point in a suitable ramp
- iii. By preventing the integral term from accumulating above or below pre-determined bounds

- ☐ i & ii
- ☐ i & iii
- ☐ ii & iii
- ☐ All the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

All the above

10) The transfer function of a compensator is given as $C(s) = (s/a + 1)/(s/b + 1)$ where a and b are positive real numbers. The condition for this controller to act as a lead compensator is **1 point**

- ☐ $a > b$
- ☐ $ab < 1$
- ☐ $ab > 1$
- ☐ $a < b$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$a < b$$

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