Unit 11 - Week 7: Quantitative feedback theory (Part 1/2)

Week 7 Assessment

The due date for submitting this assignment has passed. **Due on 2018-09-19, 23:59 IST.**
As per our records you have not submitted this assignment.

1) It is required that the response of a plant P(s) varies within a specified limit when the parameters of the plant change. A 2-DOF control system with a controller $C(s) = \frac{K_c(s+z_c)}{(s+p_c)}$ and a Pre-filter F(s) is designed in order to minimise the effect off variation in plant properties on the position of a given dominant closed-loop pole, p. *1 point*

- While C(s) adds z_c close to p and provides adequate gain K_c in order to minimise the variation in the dynamic response, F(s) ensures that z_c does not cancel p.
- While C(s) adds z_c far away from p and provides adequate gain K_c inorder to minimise the variation in the dynamic response, F(s) ensures that z_c does not cancel p.
- While C(s) adds p_c close to p and provides adequate gain K_c in order to minimise the variation in the dynamic response, F(s) ensures that z_c does not cancel p
- While C(s) adds z_c close to p and provides adequate gain K_c in order to minimise the variation in the dynamic response, F(s) ensures that p_c does not modify p

No, the answer is incorrect.
Score: 0

Accepted Answers:
While C(s) adds z_c close to p and provides adequate gain K_c in order to minimise the variation in the dynamic response, F(s) ensures that z_c does not cancel p.

2) The transfer function of a plant is given as $P(s) = \frac{K_p}{(s+p_1)(s+p_2)(s+p)}$. Although the nominal gain of the plant is K_p it varies between $0.25K_p$ and $4K_p$. Similarly, the open loop pole at p varies from 0.25p to 4p. A 2-DOF control system with a controller C(s) and Pre-filter F(s) is designed such that the variation in the dominant closed loop pole at $P_{cl}^0 = -\alpha \pm j\beta$ is less than 0.2p due to variation in plant parameters. Also, the closed loop system should be capable of tracking a DC reference signal. Identify the appropriate transfer function of the controller C(s) from below: *1 point*

- $C(s) = \frac{K_c(s+z_c)(s+\bar{z}_c)}{(s+p_c)^2}$
- $C(s) = \frac{K_c(s+p_1)(s+z_c)(s+\bar{z}_c)}{s(s+p_c)^2}$
-

$$C(s) = \frac{K_c(s+p_c)}{s(s+p_c)^2}$$

$$C(s) = \frac{K_c(s+z_c)(s+\bar{z}_c)}{s(s+p_c)^2}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$C(s) = \frac{K_c(s+p_1)(s+z_c)(s+\bar{z}_c)}{s(s+p_c)^2}$$

3) What is the issue associated with Bode plot as a tool to design a controller if, apart from reference tracking, one also desire to reject both the input and output disturbances in case of an uncertain plant. ***1 point***

- There will be bundle of bode plots for an uncertain plant and deciding on which one to choose for designing a controller to meet the performance specifications would be problematic.
- The phase plots of the Bode plot will be inaccurate.
- Magnitude Bode plots will not be straight lines
- Bode plots cannot be employed to reject disturbances.

No, the answer is incorrect.
Score: 0

Accepted Answers:
There will be bundle of bode plots for an uncertain plant and deciding on which one to choose for designing a controller to meet the performance specifications would be problematic.

4) What are the advantages of the Nichols plot over Nyquist plot when it comes to feedback control? ***1 point***

- Multiplying the controller transfer function with the plant's transfer function does not change either the shape or orientation of the region within which an uncertain plant's transfer function assumes values.
- It is easier to define gain and phase margin in Nichols plot
- The shape of Nichols plot of an open loop transfer function is less complex compared to its Nyquist plot.
- The Nichols plot provides more information about performance than the Nyquist plot.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Multiplying the controller transfer function with the plant's transfer function does not change either the shape or orientation of the region within which an uncertain plant's transfer function assumes values.

5) The transfer function of a plant is given as $P(s) = \frac{K_p}{s(s+1)(s/2+1)}$. Identify the Nichols plot of the given plant when K_p =1: ***1 point***

No, the answer is incorrect.
Score: 0

Accepted Answers:

6) For the plant given in previous question (Q5), identify the Nichols plot of the given plant when K_p=10: ***1 point***

No, the answer is incorrect.
Score: 0

Accepted Answers:

7) Figure shows the plot of input disturbance rejection bound and stability bound of a plant at a particular frequency 'ω_0' on the Nichols plot. Identify the region (shaded with lines) where loop gain 'L should lie to simultaneously satisfy input disturbance rejection and stability requirement at frequency 'ω_0' — *1 point*

No, the answer is incorrect.
Score: 0

Accepted Answers:

8) The Nichols plots of three systems (i-iii) have been given below. Identify which of the three result in a stable closed-loop system. — *1 point*

- i and ii
- ii and iii
- iii and i
- i, ii and iii

No, the answer is incorrect.
Score: 0

Accepted Answers:
iii and i

9) In order to depict closed-loop stability of a feedback control system, which of the following entity is conventionally specified in the Nichols plot? — *1 point*

- Maximum value of the transmission function (T_{max})
- Gain Margin
- Phase Margin
- Magnitude of loop gain at the phase cross-over frequency

No, the answer is incorrect.
Score: 0

Accepted Answers:
Maximum value of the transmission function (T_{max})

10)In order to plot the stability bounds what all frequencies should be considered? — *1 point*

- Frequencies within the gain cross-over frequency of the open loop transfer function
- All frequencies within which performance specifications will have to be met
- Frequencies higher than ones at which performance specifications will have to be met
- Both b and c.

No, the answer is incorrect.
Score: 0

Accepted Answers:

Both b and c.

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