Exam1

This is a preview of the published version of the quiz

Started: Jan 9 at 6:23pm

Quiz Instructions

This exam is open book, open notes, you may use any online/hardback textbooks you like. You may use calculators and matlab, but may not collaborate with other people. All multiple choice answers should be within 5% of correct value.

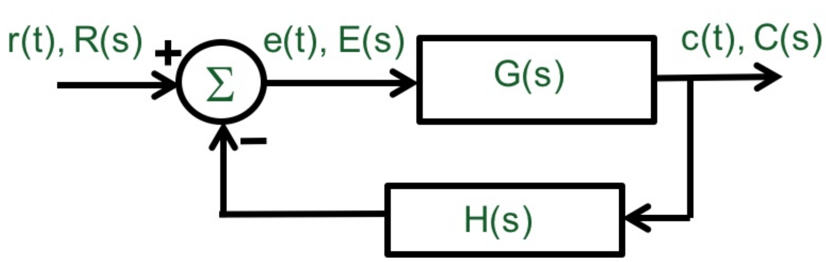
Unless stated otherwise in the question, use 3 decimal precision in fill-in-the blank questions, such as "132.312" or "58.023" for example. Do not give numerical fill-in-the-blank answers as fractions such as "4/5," give answer as decimal "0.800" form. Also, canvas might force you to enter a leading "0" for numbers less than one, such as "0.113" and entries such as ".113" might be disallowed.

As always, make sure that you are in a location with good internet connectivity during the exam. It is not a bad idea to practice tethering through your cellphone as a backup to your regular internet access. Make sure your browser is compatible with canvas.

I may monitor my email **tpweldon@uncc.edu (mailto:tpweldon@uncc.edu)** during the exam/quiz, in case of some major urgent issue during the exam. Because the exam/quiz is online, most issues will have to wait until after the exam/quiz is completed, so do not expect any reply to any email, and **proceed on** with the exam/quiz even if you send an email.

Question 1

5 pts



For the continuous-time system above with H(s)=1/(s+2) and G(s)=5/(s+3), the closed-loop transfer function is $G_{CL}(s)$=C(s)/R(s)=

- $\frac{5(s+10)}{(s+5)(s+11)}$
- $\frac{5s+2}{s^2+6s+11}$
- $\frac{5(s+10)}{s^2+5s+12}$
- None above
- $\frac{5s+10}{s^2+5s+11}$

Question 2

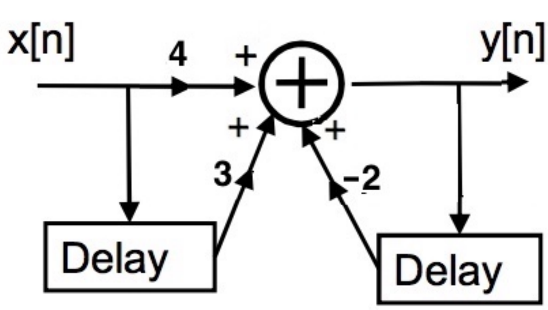
5 pts

If $X\left(s\right)=\frac{3}{s(s+4)}$ then, x(t)=

- (4/3)(1-e^{-4t})u(t)
- None above
- 3(1-e^{-4t})u(t)
- (3/4)(1-$e^{-t/4}$) u(t)
- 4 (1-e^{-3t}) u(t)/3

Question 3

5 pts



For the LTI system above with impulse response h[n], the z-transform of h[n] is H(z)=Y(z)/X(z)=

- ◯ (2z+1)/(4z-3)
- ◯ None above
- ◯ (4z+3)/(z+2)
- ◯ (3z+4)/(z-2)
- ◯ (2z+1)/(3z+4)

Question 4

5 pts

The z-transform of $x[n]=(3/4)^{n-1}$ u[n-1] is

- ◯ 0.75/(z-4/3); |z|>4/3
- ◯ 4z/(3z-9/4); |z|>3/4
- ◯ 1/(z-3/4); |z|>3/4
- ◯ None above
- ◯ 0.75z/(z-3/4); |z|>3/4

Question 5

5 pts

In a 10 sample/s system with $X^*(s) = 1/(5 + e^{s/5})$ the z-transform (ignoring ROC) is X(z) =

- ◯ none above
- ◯

- $\frac{1}{z^2+5}$
- ○ $\frac{z^2}{z^2+0.5}$
- ○ $\frac{5z}{z^2+5}$
- ○ $\frac{1}{z^{-2}+5}$

Question 6

5 pts

In a in a 5 sample/s system with X(s)=4/s^2, the starred transform is $X^*(s)$ =

- ○ $\frac{0.2\ e^{s/5}}{\left(e^{s/5}-4\right)^2}$
- ○ $\frac{0.2\ e^{-4/5}}{\left(e^{-s/5}-1\right)^2}$
- ○ $\frac{0.8e^{s/5}}{\left(e^{s/5}-1\right)^2}$
- ○ $\frac{e^{s/5}}{e^{s/5}-1}$
- ○ none above

Question 7

5 pts

A continuous-time signal x(t) is sampled with period T_0=0.1 s to create discrete-time signal x[n], and the z-transform of x[n] is $X\left(z\right)=\frac{2}{3z-1};\quad \left|z\right|>\frac{1}{3}$. Then, the starred transform of x(t) is $X^*\left(s\right)$ =

- ○ $\frac{2}{3e^{-s/10}-1}$
- ○

$\frac{2e^{-s/10}}{3e^{-s/10} - e^{-1/10}}$

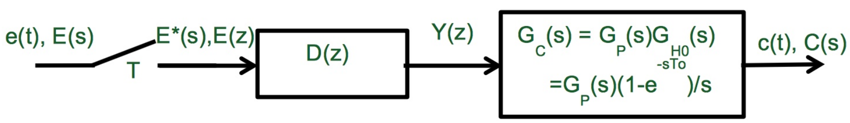
○ $\frac{2e^{s/10}}{3 - e^{s/10}}$

○ $\frac{2}{3e^{s/10} - 1}$

○ None above

Question 8

5 pts



In the system above, let T=0.1 s, D(z)=1-1/z, $G_P(s)=4/(s+4)$, $G_{H0}(s)= (1-e^{-sT})/s$.

For the system above, the pulse transfer function is G(z)=C(z)/E(z)=

○ $(1-1/z)(1-e^{-2/5})/(z-e^{-2/5})$

○ $(2/5)(1-e^{-5/2})/(z-e^{-5/2})$

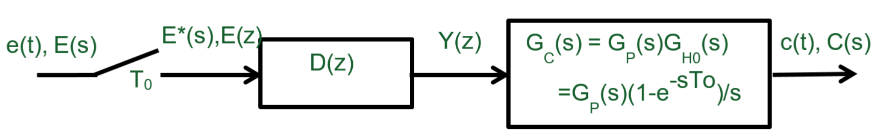
○ $(4/10)(1+e^{-2/5})/(z+e^{-2/5})$

○ $(1+1/z)(1+e^{-4/5})/(z-e^{-4/5})$

○ None above

Question 9

5 pts



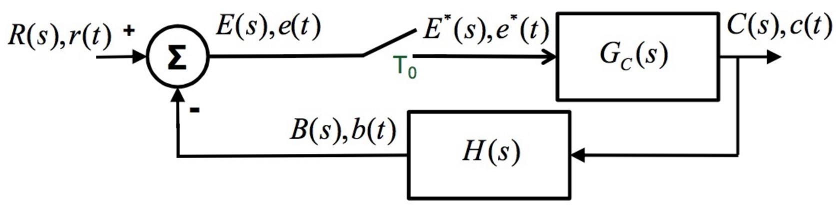
For the system above, $D(z) = 1-0.5z^{-1}$, $G_P(s)=3/s$, $G_{H0}(s)=(1+e^{-sT_o})/s$, $T_0=1/10$

In the open-loop system above, the starred transform of the output is C*(s)=

- $\left(\frac{4}{5}\right) \frac{e^{s/10}-2}{e^{s/10}\left(e^{s/5}-1\right)} E^*(s)$
- $\left(\frac{4}{5}\right) \frac{2e^{s/10}+1}{e^{s/5}\left(e^{s/10}-1\right)} E^*(s)$
- $\left(\frac{3}{20}\right) \frac{2e^{s/10}-1}{e^{s/10}\left(e^{s/10}-1\right)} E^*(s)$
- none of the answers

Question 10

5 pts



In the system above, let:

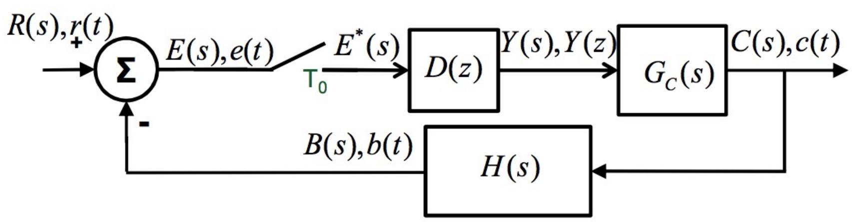
$H(s)=1/10$, $G_C(s)=G_P(s)G_{H0}(s)$, $G_P(s)=15$, $G_{H0}(s)=(1-e^{-sT})/s$.

The closed-loop **continuous-time step response** is

- 3 u(t)
- 6 u(t)
- 1.6 u(t)
- None above

Question 11

5 pts



If the characteristic equation for the system above is

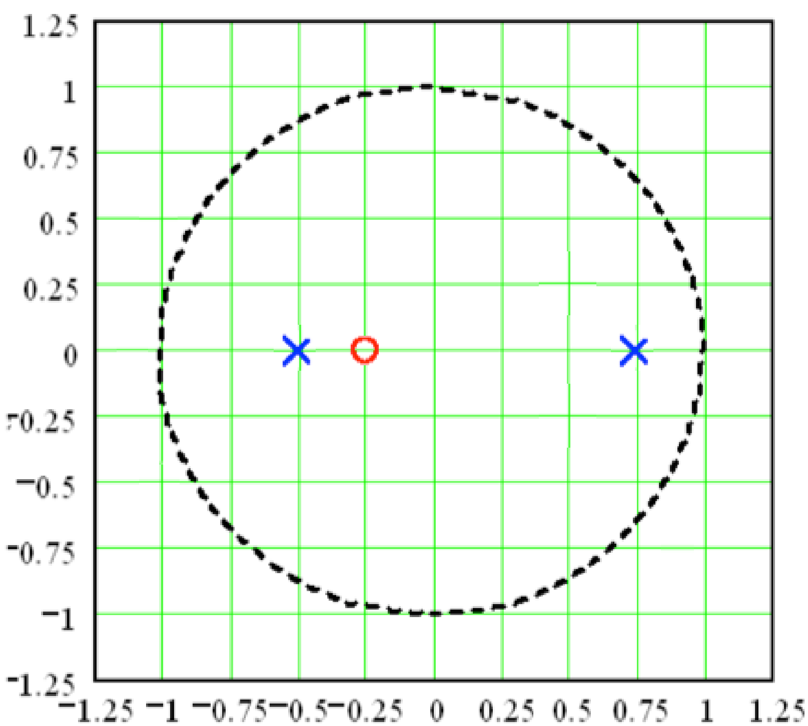
$z^2 + z - 5/16=0$,

then the closed-loop pulse transfer function $G_{CL}(z)=C(z)/R(z)$ is stable.

- ◯ True
- ◯ False

Question 12

5 pts



The causal LTI system with closed-loop pulse transfer function $G_{CL}(z)$ having the pole/zero plot above is BIBO stable.

- True
- False

Question 13

5 pts

For a system with variable gain K>0, the closed-loop response

$G_{CL}(z) = \frac{C(z)}{R(z)} = \frac{\frac{K}{2z+4}}{1-\frac{K}{2z+4}}$ is stable for

- none of the answers
- 2<K<4
- 2<K<6
- 0<K<2

Question 14

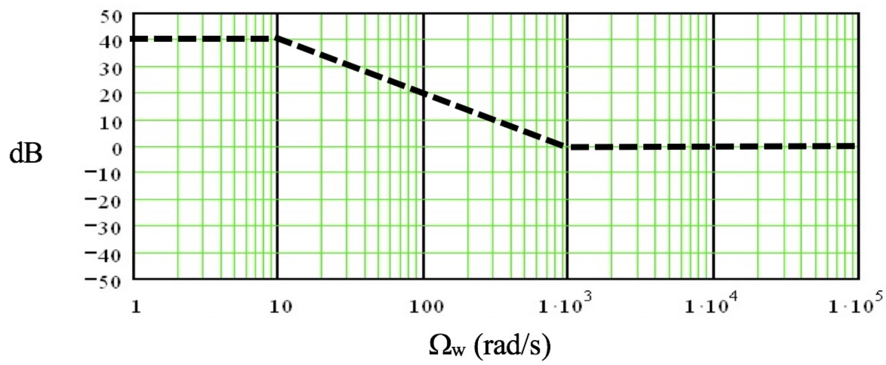
5 pts

The w-transform of 1/(3z-4) in a 5 sample/s system is

- $\frac{5-2w}{14w-5}$
- $\frac{4-3w}{21w-4}$
- none of the answers
- $\frac{10-w}{7w-10}$

Question 15

5 pts



For the w-transform of the digital lag filter with |D(w)| shown above, D(w) =

- None above
- 100(w+1000)/(w+10)
- 0.1(w+10)/(w+1000)
- (w+1000)/(w+10)
- 0.3(w+1000)/(w+10)

Question 16

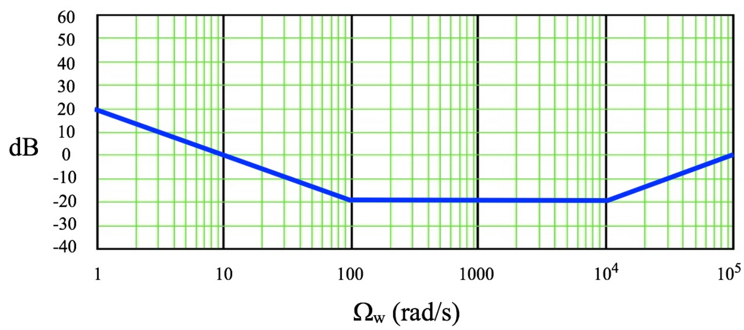
5 pts

For a lag compensator with $D\left(w\right)=4\frac{1+\frac{w}{16}}{1+\frac{w}{2}}$ in a system with sample period T_s=1/4 s, the corresponding discrete-time compensator is D(z) =

- none of the answers
- (10z -2)/(z + 3)
- (8z + 4)/(6z - 3)
- (6z + 2)/(5z - 3)

Question 17

5 pts

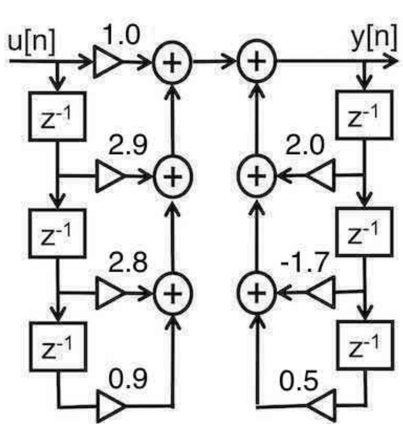


For the w-transform of the PID controller with |D(w)| shown above, to within +/- 20% the differentiator coefficient is K_D=

- None above
- 10^{-5}
- 0.1
- 10
- 1,000

Question 18

5 pts

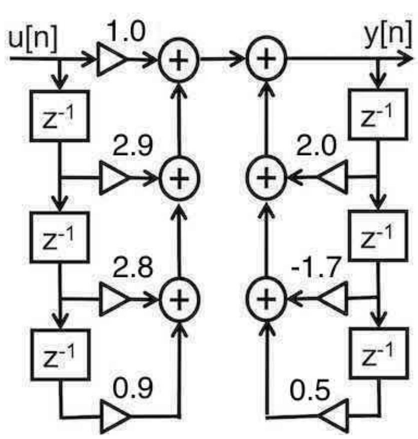


For the digital system above with sample period To=0.001 s, controllable form state-variable matrix A=

- $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.5 & 1.7 & -2 \end{bmatrix}$
- $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 2 & -1.7 & 0.5 \end{bmatrix}$
- none of the answers
- $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0.5 & -1.7 & 2 \end{bmatrix}$
- $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0.9 & 2.8 & 2.8 \end{bmatrix}$

Question 19

5 pts



For the digital system above with sample period To=0.001 s, the controllability matrix is

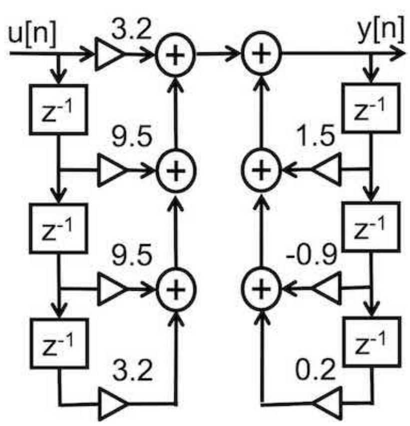
-

$$\begin{bmatrix} 0 & 0 & 0.5 \\ 0 & 1 & 1 \\ 1 & 0.9 & 1.9 \end{bmatrix}$$

- ○ $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 2 \\ 1 & 2 & 2.3 \end{bmatrix}$
- ○ $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 2 \\ 1 & 1.7 & -1.1 \end{bmatrix}$
- ○ none of the answers
- ○ $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 1 \\ -2.9 & -2.8 & -0.9 \end{bmatrix}$

Question 20

5 pts



For the digital system above with sample period To=0.001 s, the system is controllable.

- ○ True
- ○ False

Question 21

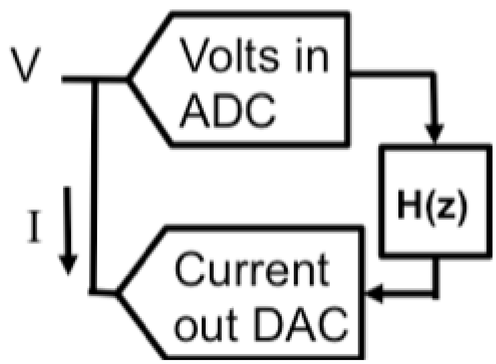
5 pts

A state-variable system with observability matrix $\begin{bmatrix} -1 & 1 \\ 2 & -2 \end{bmatrix}$ is observable.

- ◯ True
- ◯ False

Question 22

5 pts

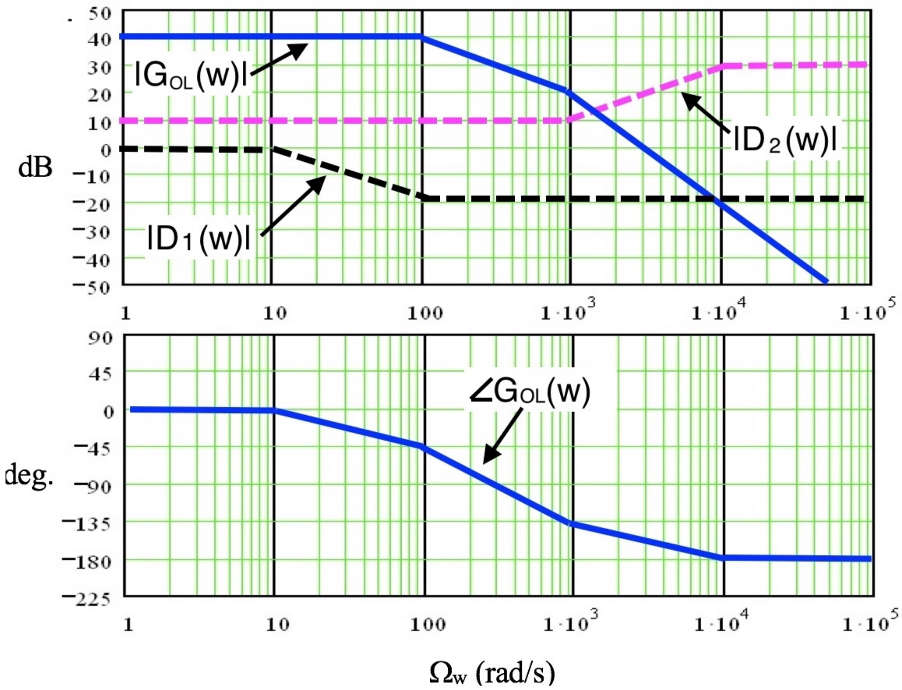


If H(z)= -20(1 - z^{-1}) and $T_0=10^{-3}$ s for the system above, and for the direction of DAC current as shown, the input capacitance in seen at the point V is

- ◯ 0.02 F
- ◯ -0.005 F
- ◯ -0.02 F
- ◯ 0.005
- ◯ none of the answers

Question 23

5 pts

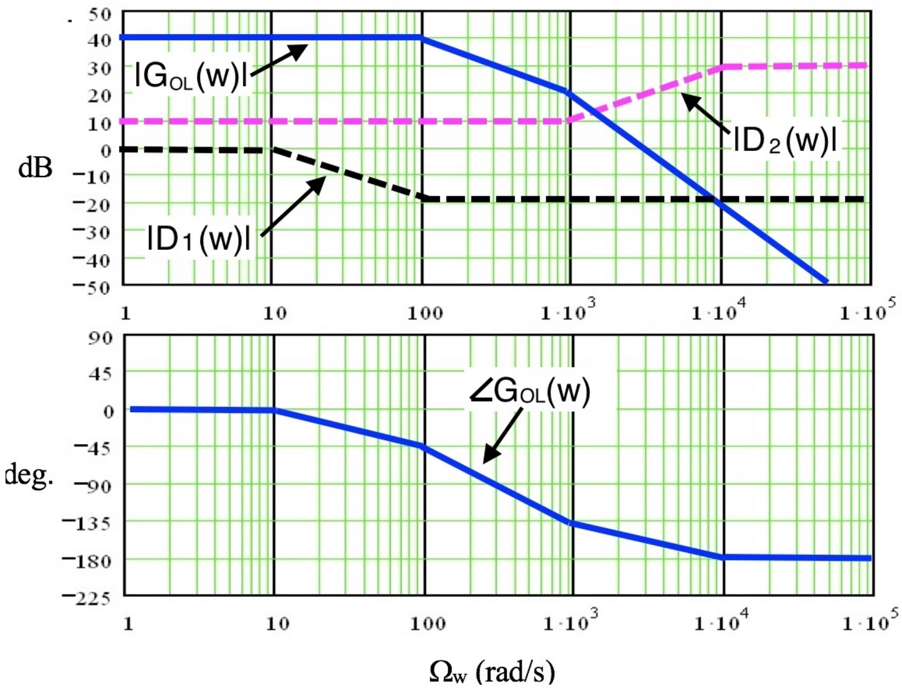


For the w-transforms shown above, the Bode plots for phase of the two compensators are not shown (you may assume the phases are the correct Bode plot phases for lag, lag-lead, PID, or lag compensators). For **uncompensated** open-loop gain $G_{OL}(w)$ shown above, using Bode plot analysis the gain margin to within +/-3 dB is

- ◯ 0 dB
- ◯ 20 dB
- ◯ 10 dB
- ◯ none of the answers

Question 24

5 pts

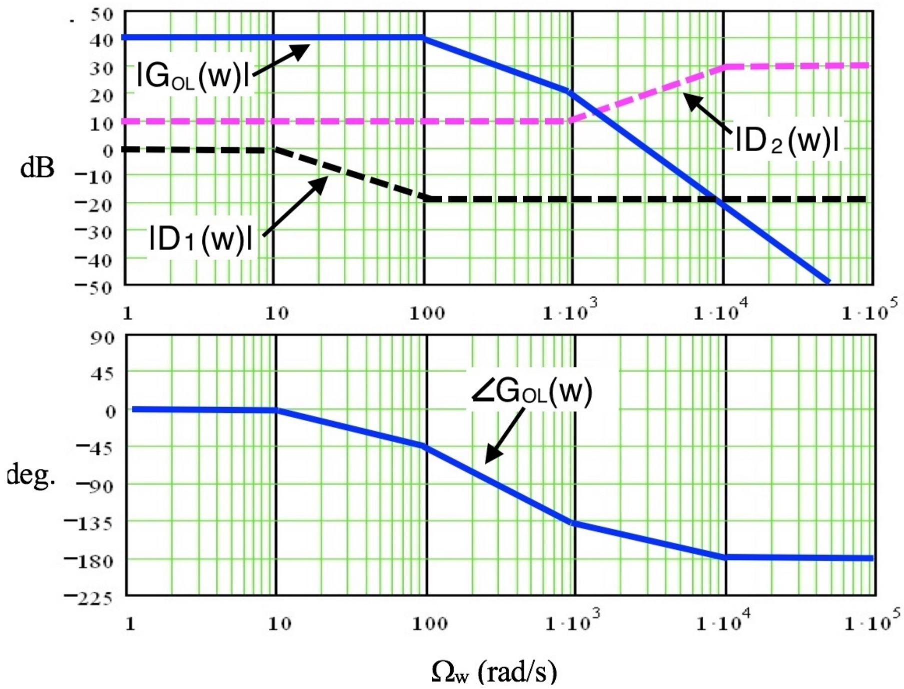


For the w-transforms shown above, the Bode plots for phase of the two compensators are not shown (you may assume the phases are the correct Bode plot phases for lag, lag-lead, PID, or lag compensators). For open-loop gain $G_{OL}(w)$ combined with compensator $D_1(w)$ shown above, the phase margin of $G_{OL}(w)D_1(w)$ to within +/-10 degrees is

- ◯ 45 degrees
- ◯ 90 degrees
- ◯ none above
- ◯ 135 degrees

Question 25

5 pts

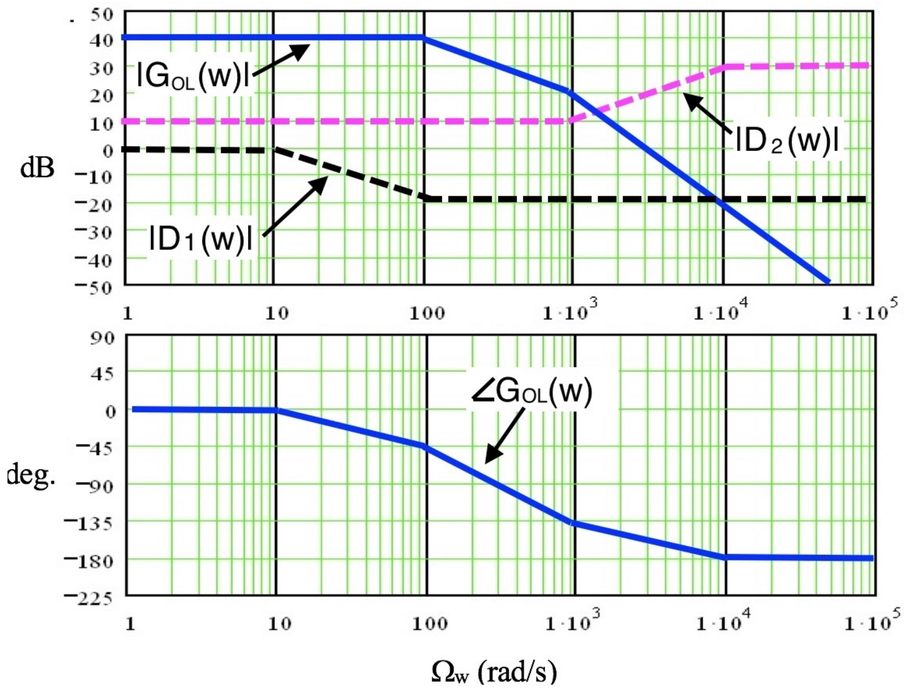


For the w-transforms shown above, the Bode plots for phase of the two compensators are not shown (you may assume the phases are the correct Bode plot phases for lag, lag-lead, PID, or lag compensators). For open-loop gain $G_{OL}(w)$ combined with compensator $D_1(w)$ shown above, the gain margin of $G_{OL}(w)D_1(w)$ to within +/-4 dB is

- ◯ None above
- ◯ 20 dB
- ◯ 60 dB
- ◯ 40 dB

Question 26

5 pts

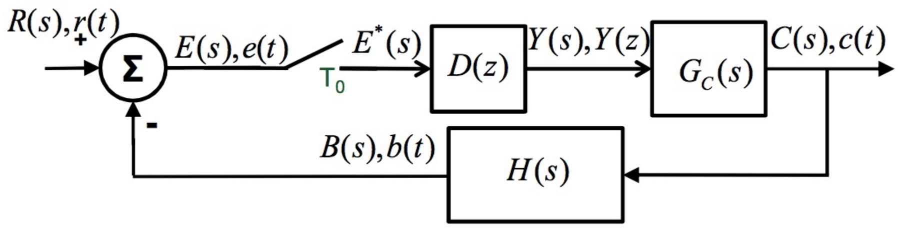


For the w-transforms shown above, the Bode plots for phase of the two compensators are not shown (you may assume the phases are the correct Bode plot phases for lag, lag-lead, PID, or lag compensators). For open-loop gain $G_{OL}(w)$, comparing the bandwidth using the two compensators, the unity-gain bandwidth of $G_{OL}(w)D_1(w)$ is larger than $G_{OL}(w)D_2(w)$.

- True
- False

Question 27

5 pts



In the system above, let

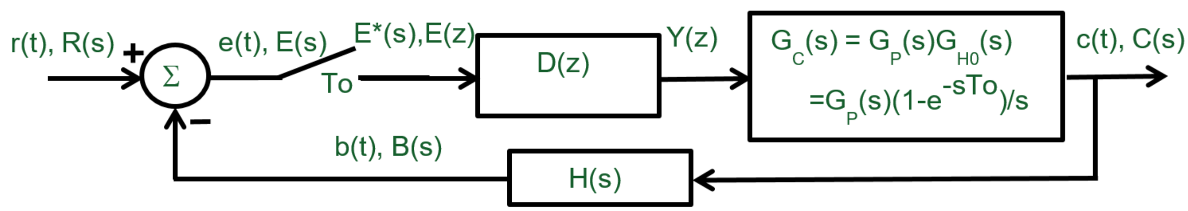
$D(z)=2-1/z$, $H(s)=1/5$, $G_C(s)=G_P(s)G_{H0}(s)$, $G_P(s)=20$, $G_{H0}(s)= (1-e^{-sT})/s$.

For the system above, the closed-loop pulse transfer function is $G_{CL}(z)=C(z)/R(z)=$

- None above
- $20(2-e^{-5To})/(z-e^{-5To})$
- 20(2z-1)/(9z-4)
- 2(z+20)/(z+8/9)
- $10(2+1/z)(1+e^{-To})/(4z-9)$
- $(20z+1)/(z^2+z+1/4)$

Question 28

5 pts



For the system above:

In the system above, let

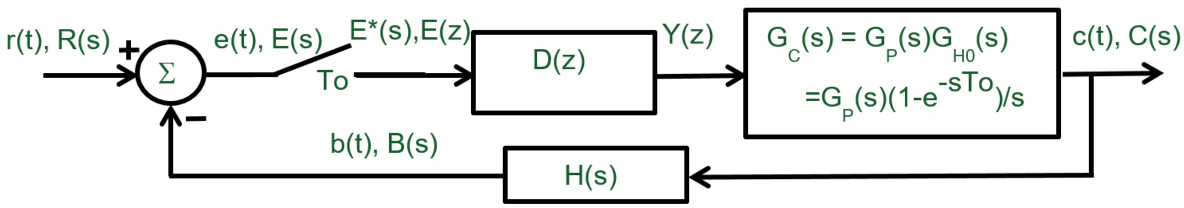
$D(z)=2-1/z$, $H(s)=1/5$, $G_C(s)=G_P(s)G_{H0}(s)$, $G_P(s)=20$, $G_{H0}(s)=(1-e^{-sT})/s$.

For the system above, the pole of the closed-loop pulse transfer function $G_{CL}(z)$ is at

- -0.25
- 0.63
- none of the answers
- 0.44

Question 29

5 pts



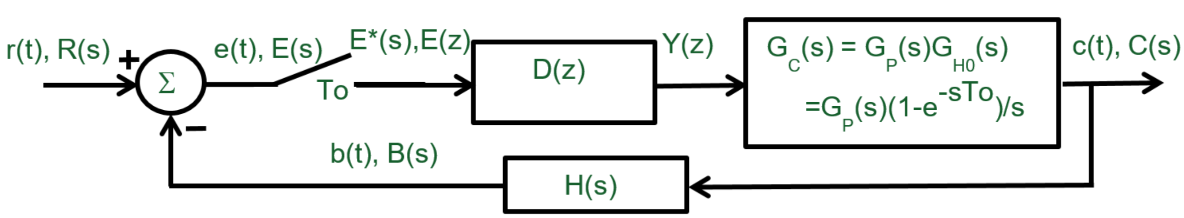
For the system above: $D(z) = 1\text{-}0.5z^{-1}$, $G_P(s)=8/s$, $G_{H0}(s)=(1+e^{-sTo})/s$, $H(s)=1/2$, $T_0=1/5$

For the system above, the closed loop pulse transfer function is $G_{CL}(z)$= C(z)/R(z) =

- ○ $\frac{z-4}{8z^2-4z-2}$
- ○ $\frac{8z-2}{7z^2+2z-6}$
- ○ $\frac{8z-4}{5z^2-z-2}$
- ○ none of the answers

Question 30

5 pts



For the system above: $D(z) = 1\text{-}0.5z^{-1}$, $G_P(s)=8/s$, $G_{H0}(s)=(1+e^{-sTo})/s$, $H(s)=1/2$, $T_0=1/5$

For the system above, the poles of the closed-loop pulse transfer function $G_{CL}(z)$ are at

- ○ none of the answers

- ◯ -0.53and 0.21
- ◯ 0.32 and 0.65
- ◯ 0.74 and -0.54

Quiz saved at 6:26pm Submit Quiz