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Question: For each of the transfer functions shown below, find the locati...

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For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the s-plane, and then write an expression for the general form of the step response without solving for the inverse Laplace transform. State the nature of each response (overdamped, underdamped, and so on.

6. For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the s-plane, and then write an expression for the general form of the step response without solving for the inverse Laplace transform. State the nature of each response (overdamped, underdamped, and so on). [Sections: 4.3, 4.4]

a. $T(s)=\frac{2}{s+2}$

b. $T(s)=\frac{5}{(s+3)(s+6)}$

c. $T(s)=\frac{10(s+7)}{(s+10)(s+20)}$

d. $T(s)=\frac{20}{s^2+6s+144}$

e. $T(s)=\frac{s+2}{s^2+9}$

f. $T(s)=\frac{(s+5)}{(s+10)^2}$

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Expert Answer

Anonymous answered this
583 answers

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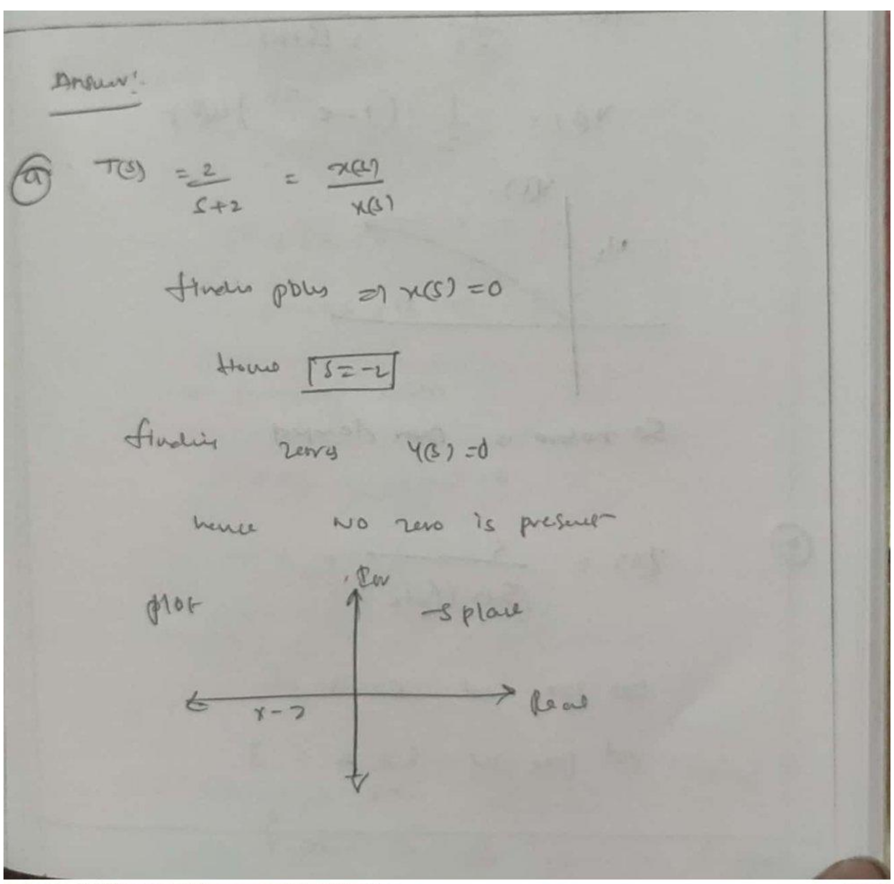


Input $u(t) \xrightarrow{LT} \frac{1}{s}$

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

$$Y(s) = \frac{1}{(s+2)} \times \frac{1}{s}$$

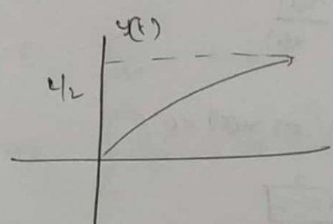
$$\boxed{Y(s) = \frac{1}{s(s+2)}}$$

Nature as

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

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

$$y(t) = \frac{1}{2}\left(1 - e^{-2t}\right)u(t)$$



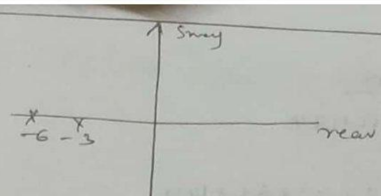
So nature is over damped

(b.)

$$T(s) = \frac{5}{(s+3)(s+6)}$$

One pole at $s = -3$

2nd pole at $s = -6$



Step responses

$$T(s) = \frac{Y(s)}{X(s)} = \frac{5}{(s+3)(s+6)} X(s)$$

$$Y(s) = \frac{s}{(s+3)(s+6)} \times \frac{1}{s}$$

→ System charteristics Equation

$$(s+3)(s+6) = 0$$

$$s^2 + 6s - 3s + 18 = 0$$

$$s^2 + 9s + 18 = 0$$

on comparing with

$$s^2 + 2\xi\omega_n s + \omega_n^2 = 0$$

$$\omega^2 = 18$$

$$\omega_n = \sqrt{18} = 4.2426$$

$$2\xi\omega_n = 9$$

$$\xi = \frac{9}{2\omega_n} = \frac{9}{2 \times 4.2426} = 1.0606$$

$\xi > 1$ is So System over damped.

(d)

$$T(s) = \frac{20}{s^2 + 6s + 144}$$

Denominator $q(s) = s^2 + 6s + 144$

Roots of denominator $q(s)$ is

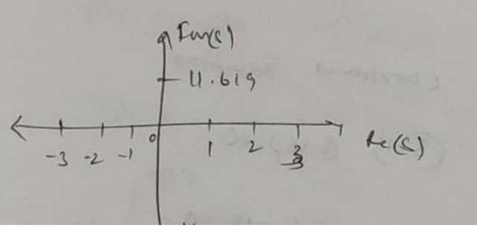
$$s = \frac{-6 \pm \sqrt{6^2 - 4(144)}}{2} = -3 \pm j11.619$$

$$s_1 = -3 + 11.619i$$

$$s_2 = -3 + 11.619i$$

Numerator $n(s) = 20$

∴ No zeros the transfer function



=) we know that when poles of system are in the form of

$$S = \sigma_d \pm j\omega_d \quad -②$$

It is under damped system

general form of its step response

$$c(t) = k_1 + Ae^{-\sigma_d t}\cos(\omega_d t - \phi)$$

By comparing Equation ① and ②

$\sigma_x = 3 \quad \omega_x = 11.619$

$$c(t) = k_1 + Ae^{-3t}\cos(11.619t - \phi)$$

ⓔ

$$T(s) = \frac{s+2}{s^2+9}$$

$s^2 + 9 = 0$

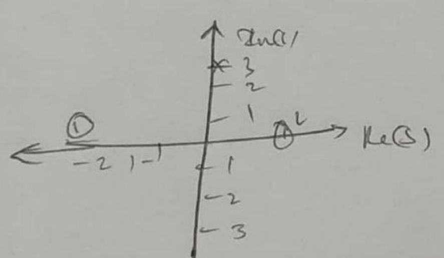
$s = \pm 3i$

$s_1 = 3i \quad s_2 = -3i$

Numerator $n(s) = s+2$

$s + 2 = 0$

$s = -2$ is the zero of system



Note!

we know the poles of the system are in the form of

$$S = \pm j\omega \quad -④$$

It is under damped system

$c(t) = k_1 + A\cos(\omega_1 t - \phi)$

by comparing Equation (3) and (4).

$\omega_1 = 3$

$c(t) = k_1 + A\cos(3t - \phi)$

As per chegg guide lines we have to solve only 4 sub part I did (a), (b), (d), (e) hope u understand

pls pls upvote thank you.

pls pls pls like upvote hope u like it thank you

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Q: Problem 3.0 For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the s-plane, and then write an expression for the general form of the step response without solving for the inverse Laplace transform. State the nature of each response (overdamped, underdamped, and so on). a. T(s) = s + 2 b. T(s) -

A: See answer 100% (1 rating)

Q: Q6 For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the s-plane, and then write an expression for the general form of the step response without solving for the inverse Laplace transform. State the nature of each response (overdamped, underdamped, and so on) 10(s +7) c. T(s)- T +10)(s +20) 20 s2+6s+144 s+2 (s + 10

A: See answer

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form of the step response with details.

For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the *s*-plane, and then write an expression for the general form of the step response without solving for the inverse Laplace transform. State the nature of each response (overdamped, underdamped, and so on). [Sections: 4.3, 4.4]

$T(s) = \frac{5}{\ldots}$ a. $T(s) = \frac{s+2}{\ldots}$

See answer

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Q: Please explain how to find the general form of the step response with details.

A: See answer 100% (1 rating)

Q: Problem 3.0 For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the s-plane, and then write an expression for the general form of the step response without solving for the inverse Laplace transform. State the nature of each response (overdamped, underdamped, and so on). a. T(s) = s + 2 b. T(s) -

A: See answer 100% (1 rating)

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