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Question: Q8 1. Name the performance specification for first-order system...

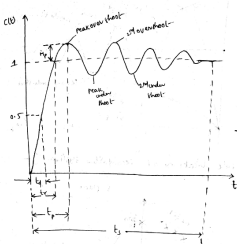
Q8

1. Name the performance specification for first-order systems.
2. What does the performance specification for a first-order system tell us?
3. In a system with an input and an output, what poles generate the steady-state response?
4. In a system with an input and an output, what poles generate the transient response?
5. The imaginary part of a pole generates what part of a response?
6. The real part of a pole generates what part of a response?
7. What is the difference between the natural frequency and the damped frequency of oscillation?
8. List five specifications for a second-order underdamped system.

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Expert Answer

Jagadeesh answered this 763 answers Was this answer helpful?



1. Delay time (t_d) :- The time required for the response to reach the 50% of its final value

$$t_d = \frac{1 + 0.7 \zeta}{\omega_n}$$

2. Risetime (t_r) :- It is time required for response rise from 10% to 90% of its final value for overdamped systems

The time taken for response to rise from 0 to 100 of its final value underdamped system

→ 5% to 95% for critically damped system

$$t_r = \frac{\pi - \phi}{\omega_d} \quad \phi = \cos^{-1}(\zeta)$$

3. Peak time (t_p) :- It is the time required for the response to reach peak of the time response

$$t_p = \frac{\pi}{\omega_d} \quad \omega_d = \omega_n \sqrt{1 - \zeta^2}$$

→ Time for peak overshoot = $\frac{\pi}{\omega_d}$

→ time for 1st undershoot = $\frac{2\pi}{\omega_d}$

→ time for 2nd overshoot = $\frac{3\pi}{\omega_d}$

4. Peak overshoot (M_p) :-

$$\text{Peak overshoot } (M_p) = c(t_p) - c(\infty)$$

$$\% \text{ peak overshoot} = \frac{c(t_p) - c(\infty)}{c(\infty)} \times 100\%$$

$$= e^{-\zeta\pi/\sqrt{1-\zeta^2}} \times 100$$

$$\% \text{ of overshoot (n) undershoot} = e^{-\zeta n\pi/\sqrt{1-\zeta^2}} \times 100$$

n = 1, 3, 5 ... overshoot

n = 2, 4, 6 ... undershoot

5) Settling time (t_s) :- It is the time taken by the response to settle within in specified error tolerance band of its final value

$$*) \pm 0\% \text{ band } t_s = 5\tau = \frac{5}{\zeta\omega_n}$$

$$*) \pm 2\% \text{ band } t_s = 4\tau = \frac{4}{\zeta\omega_n}$$

$$*) \pm 5\% \text{ band } t_s = 3\tau = \frac{3}{\zeta\omega_n}$$

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Q: 2. Time Response 1. Name the performance specification for first-order systems 2. What does the performance specification for a first-order system tell us? 3. In a system with an input and an output, what poles generate the steady-state response? 4. In a system with an input and an output, what poles generate the transient response? 5. The imaginary part of a pole generates what...

A: See answer 100% (0 ratings)

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A: See answer 100% (0 ratings)

Up next for you in Electrical Engineering

Hello, I am having trouble solving number 34. Could you please help? Thank you.

See answer

For the unit step responses shown below, find the transfer function of the system

See answer

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Q: 1. Name the performance specification for first-order systems 2. What does the performance specification for a first-order system tell us? 3. In a system with an input and an output, what poles generate the steady-state response? 4. In a system with an input and an output, what poles generate the transient response? 5. The imaginary part of a pole generates what part of a response...

A: See answer 100% (0 ratings)

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Question: Determine the Laplace transform (Y(s)) for the solution of the di...

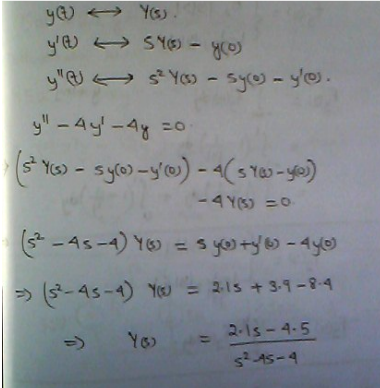
Determine the Laplace transform (Y(s)) for the solution of the differential equation given below:

$$y'' - 4y' - 4y = 0 \text{ Initial Conditions: } y(0) = 2.1, y'(0) = 3.9$$

Expert Answer

 **harsukh** answered this
 1,771 answers

Was this answer helpful?  1  0



$$\begin{aligned}
 y(t) &\leftrightarrow Y(s) \\
 y'(t) &\leftrightarrow sY(s) - y(0) \\
 y''(t) &\leftrightarrow s^2 Y(s) - sy(0) - y'(0) \\
 y'' - 4y' - 4y &= 0 \\
 (s^2 Y(s) - sy(0) - y'(0)) - 4(sY(s) - y(0)) - 4Y(s) &= 0 \\
 (s^2 - 4s - 4)Y(s) - sy(0) + y'(0) + 4y(0) &= 0 \\
 (s^2 - 4s - 4)Y(s) &= sy(0) + y'(0) - 4y(0) \\
 \Rightarrow (s^2 - 4s - 4)Y(s) &= 2.1s + 3.9 - 8.4 \\
 \Rightarrow Y(s) &= \frac{2.1s - 4.5}{s^2 - 4s - 4}
 \end{aligned}$$

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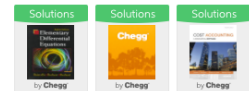
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Q: Determine the Laplace transform (Y(s)) for the solution of the differential equation given below: $y'' + 3y' + 2y = \mu 3(t)$ Initial Conditions: $y(0) = 0, y'(0) = 0$

A: [See answer](#)  100% (1 rating)

Up next for you in Advanced Math

EE235 Find the Fourier Series and Fourier Expansion (up to $n=4$) of the following: (a) $f(x) = \text{HAY} - \{3-v\}$ (b) $f(x) = -3 < x < 0$ $0 < x < 3$

EE235 Find the Fourier Series and Fourier Expansion (up to $n=4$) of the following:



[See answer](#)

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Q: 5. (20) Find the work done by the force $F = 4xyi + (2x^2 - 3xy)j$; by pushing a particle along the line segment from $(-3, -2)$ to $(1, 0)$ and the arc of the circle in the first quadrant from $(1, 0)$ to $(0, 1)$.

A: [See answer](#)

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