EE2227 Control Systems

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GATE-2019, EE Section
Problem no.13

Gate Problems

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13) The output response of a system is denoted as y(t), and its Laplace transform is given by

$$Y(s) = \frac{10}{s(s^2 + s + 100(2)^{0.5})}$$

The steady state value of y(t) is

a) $100(2)^{0.5}$

$b)\dfrac{1}{10(2)^{0.5}}$

$c)10(2)^{0.5}$

$d)\dfrac{1}{100(2)^{0.5}}$

Gate Problems

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The final value theorem states that

$$\lim_{t \to \infty} y(t) = \lim_{s \to 0} sY(s)$$

This is valid only when sY(s) has poles that lie in the negative half of the real side.

Gate Problems

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If the quadratic equation $ax^2 + bx + c$ has complex roots then the real part of those roots will be -b/2a
Hence, verified that the roots of $s^2 + s + 100(2)^{0.5}$ have a negative real part which is -0.5. So, Final value theorem is applicable.

Solution:(b)

Steady state value of y(t) =

$$\lim_{t\to\infty} y(t) = \lim_{s\to 0} sY(s) = \lim_{s\to 0} \frac{10s}{s(s^2 + s + 100(2)^{0.5})}$$

$$= \frac{10}{100(2)^{0.5}} = \frac{1}{10(2)^{0.5}}$$

Thank You!