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Control system

transfer function

$$TF = \frac{L[o/p]}{L[I/p]}$$

$$TF = \frac{K(s+z_1)(s+z_2)\cdots}{s^n(s+p_1)(s+p_2)\cdots}$$

eg:→

$$G(s) = \frac{100}{(s+2)}$$

pole ⇒ $s = -2$

zero → $s = \infty$

$$\frac{100}{\infty + 2} = \frac{100}{\infty} = 0$$

eg :->

$$G(s) = \left\{ \frac{100(s+1)}{s(s+2)} \right\}$$

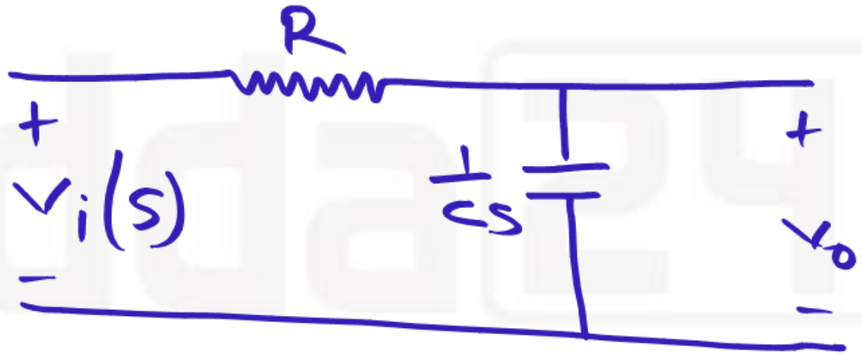
poles = 0, -2

zero = -1, ∞

$$G(s) = \frac{100(s+1)}{s(s+2)(s+3)}$$

No. of zeroes at ∞ = 2

Transfer function :→



$$TF = \frac{V_o(s)}{V_i(s)}$$

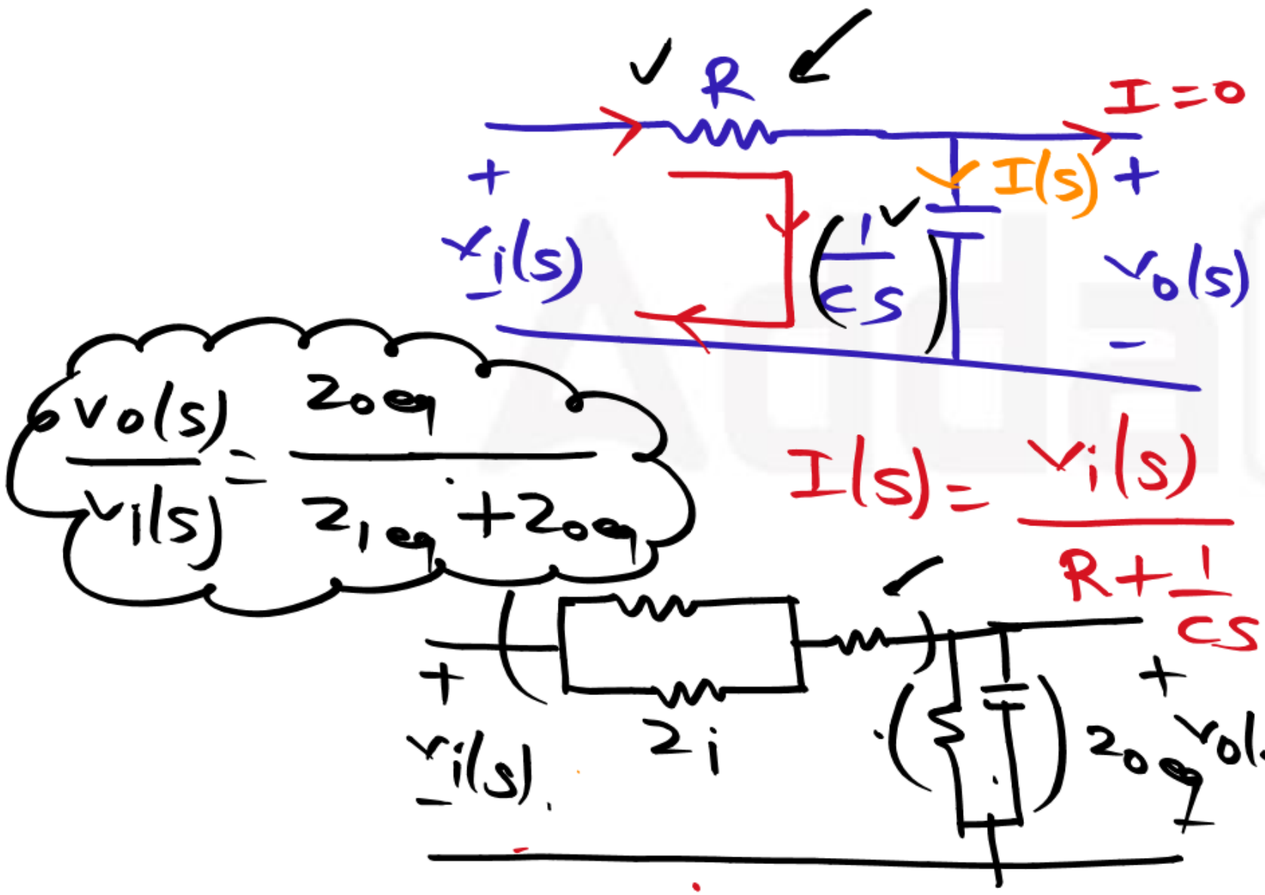
$$I = c\frac{dv}{dt}$$

$$I(s) = cs \cdot V(s) \Rightarrow \boxed{V(s) = \frac{1}{cs} \cdot I(s)}$$

$R \rightarrow R$

$c \rightarrow \frac{1}{cs}$

$L \rightarrow sL$



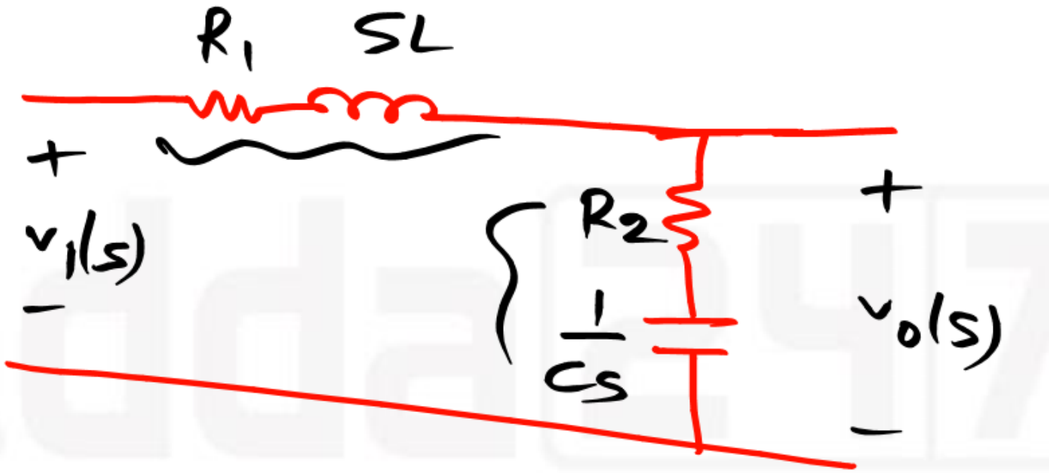
$$V_o(s) = \frac{1}{cs} \times I(s)$$

$$I(s) = \frac{V_i(s)}{R + \frac{1}{cs}}$$

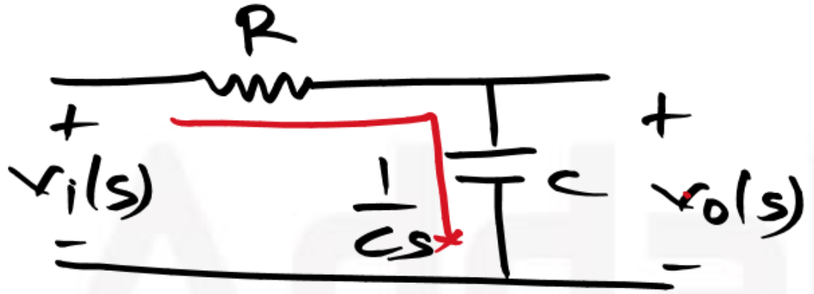
$$V_o(s) = \frac{1}{cs} \times \frac{V_i(s)}{R + \frac{1}{cs}}$$

$$\Rightarrow \boxed{\frac{V_o(s)}{V_i(s)} = \frac{\left(\frac{1}{cs}\right)}{R + \frac{1}{cs}}}$$

eg:



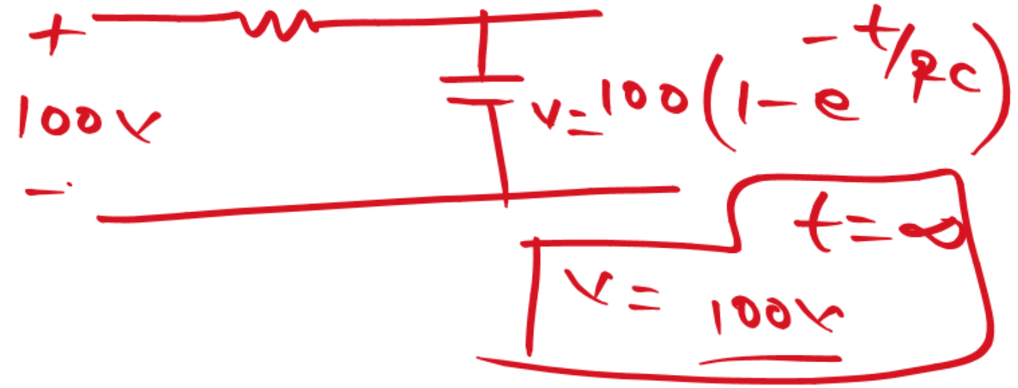
$$\frac{V_o(s)}{V_i(s)} = \frac{R_2 + \frac{1}{Cs}}{R_1 + SL + R_2 + \frac{1}{Cs}}$$



$\tau = RC$

$$\frac{V_o(s)}{V_i(s)} = \frac{\frac{1}{Cs}}{R+\frac{1}{Cs}} = \frac{\frac{1}{Cs}}{\frac{RCs+1}{Cs}} = \left(\frac{1}{RCs+1}\right)$$

time constant →



$$e^{-\infty} = \frac{1}{e^{\infty}} = \frac{1}{\infty} = 0$$

$v_c(t) = 100(1 - e^{-t/RC})$ ↙

$e = 2.71$

5. $t = \infty$, $v_c(t) = 100V$

1. $t = 0$, $v_c(t) = 0V$

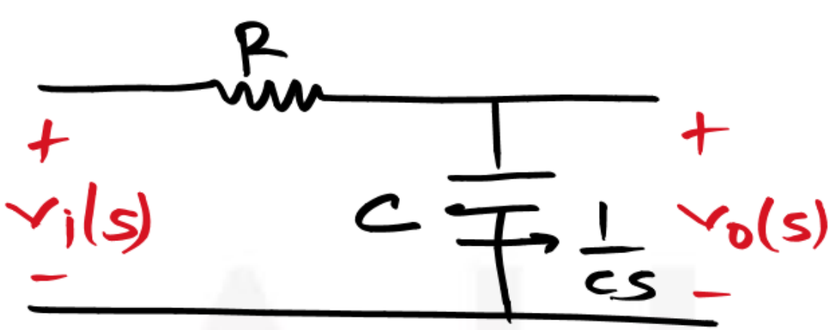
63.2% / 1

→ 2. $t = RC$, $v_c(t) = 100\left(1 - e^{-1}\right) = 100 \times .632 = 63.2V$

Settling time →

3. $t = 4RC$, $v_c(t) = 100\left(1 - e^{-4}\right) = 100 \times .98 = 98V$

4. $t = 5RC$, $v_c(t) = 99V$



$s = \sigma + j\omega$

Q.

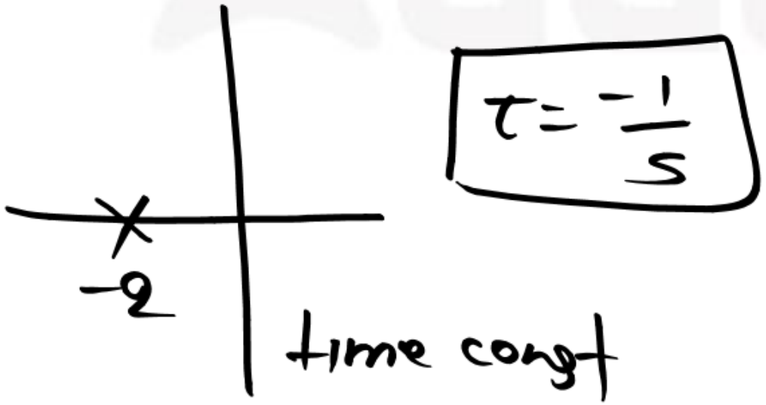
$$\frac{V_o(s)}{V_i(s)} = \frac{1}{s \cdot RC + 1} = \frac{1}{s\tau + 1}$$

$\tau = RC$

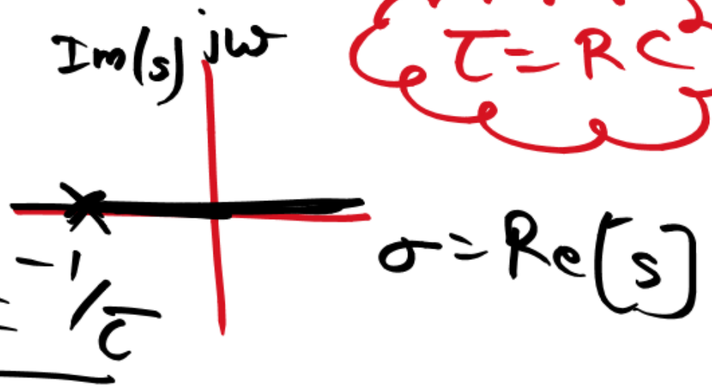
$s = -1/\tau$

$\downarrow$

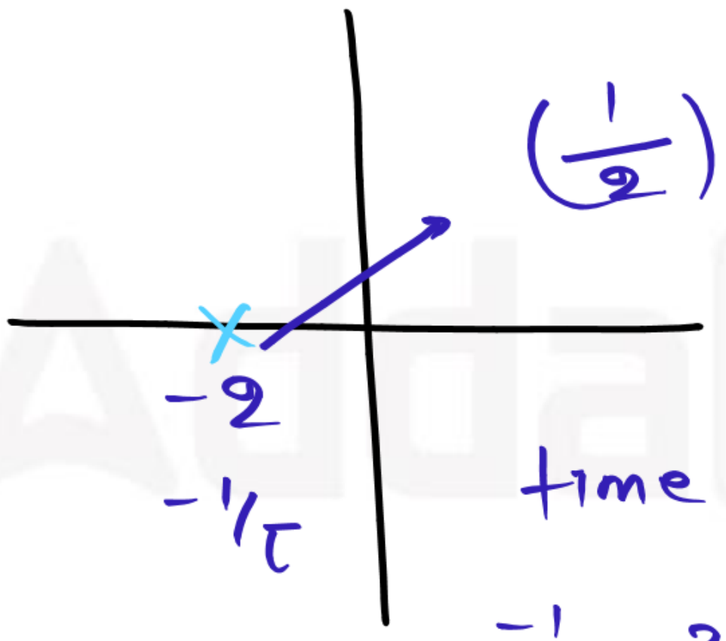
pole



$\tau = -\frac{1}{s}$



$s = -1/\tau$

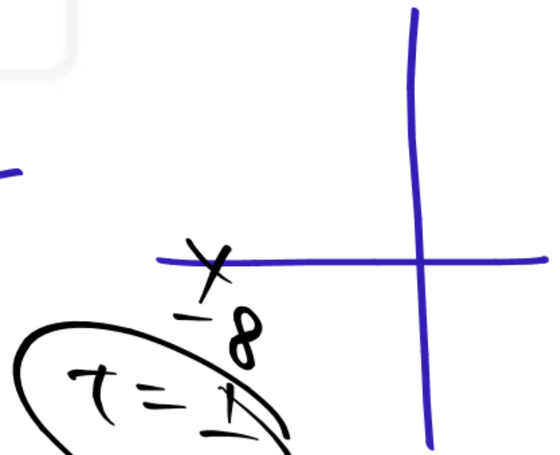


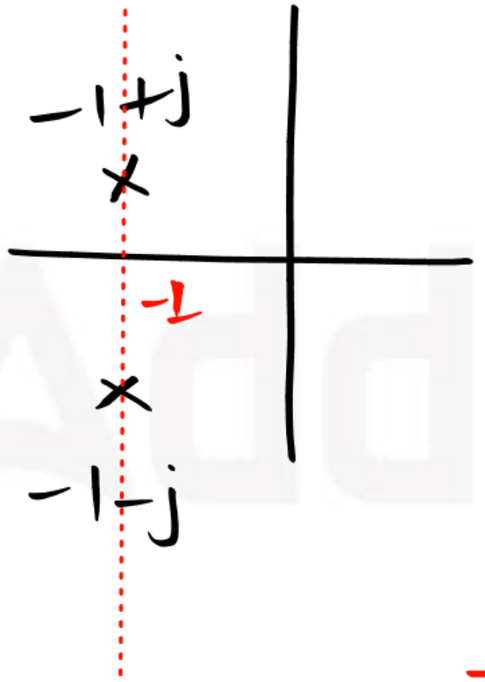
$\left(\frac{1}{2}\right) = \tau = \frac{1}{|\text{Real part of pole}|}$

time const = ?

$\frac{-1}{\tau} = -2 \Rightarrow \boxed{\tau = 0.5s}$ ←

$\tau = \left(\frac{1}{2}\right)$





$$\tau = \frac{1}{|\text{Real part of pole}|}$$

$$\tau = \frac{1}{|-1|} = 1$$

Y642

order and types of the control system

R L C

dissipates stores energy

order of the control system → No. of energy storing elements in a system.

THANKS FOR

Watching

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