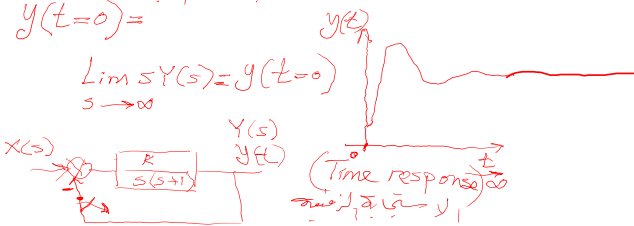




Initial Value Theorem

لإيجاد قيمة الـ (0/p) كى إشارة عند الزمن [t=0] من معادله، لتحويله إلى الزمن مباشرة.



$$Y(s) = \frac{s+2}{(s+1)^2 + 5}$$

Final Value Theorem

لإيجاد قيمة الـ (p/0) كى إشارة عند الزمن (at steady state) أى عندما ينعقد النظام

$$y(t=\infty) = \lim_{s \rightarrow p} sY(s)$$

$$= \lim_{s \rightarrow p} s \frac{(s+2)}{(s+1)^2 + 5}$$

Example

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 12y(t) = 3(t)$$

↑ step function

- Find ① $y(t=0)$
- ② $y(t=\infty)$

$$\mathcal{L}\left[\frac{d^2y}{dt^2}\right] = s^2Y(s) ; \mathcal{L}\left[5\frac{dy}{dt}\right] = 5sY(s)$$

$$\mathcal{L}[12y(t)] = 12Y(s) ;$$

$$\mathcal{L}[3] = \frac{3}{s}$$

$$s^2Y(s) + 5sY(s) + 12Y(s) = \frac{3}{s}$$

$$(s^2 + 5s + 12)Y(s) = \frac{3}{s}$$

$$Y(s) = \frac{3}{s(s^2 + 5s + 12)}$$

$y(t=0) \leftarrow$ initial Value Theorem

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

$$= \lim_{s \rightarrow \infty} s \frac{3}{s(s^2 + 5s + 12)} = \frac{3}{\infty}$$

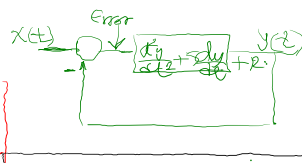
$$y(t=0) = 0$$

$y(t=\infty) = y$ at steady state

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

$$= \lim_{s \rightarrow 0} s \frac{3}{s(s^2 + 5s + 12)}$$

$$= \frac{3}{12} = 0.25$$



steady state Error
 $= y(t=\infty) - X(t)$
 o/p at steady - i/p

$$\mathcal{L}(\cos 3t) = \frac{s}{s^2 + 9}$$

$$3 \rightarrow \frac{3}{s} \quad X(t) = e^{-st} \quad \mathcal{L}[e^{-st}] = \frac{1}{s+3}$$

$$\delta(t) \rightarrow 1 \quad \frac{dy}{dt} + 5\frac{dy}{dt} + 12y = \cos 3t$$