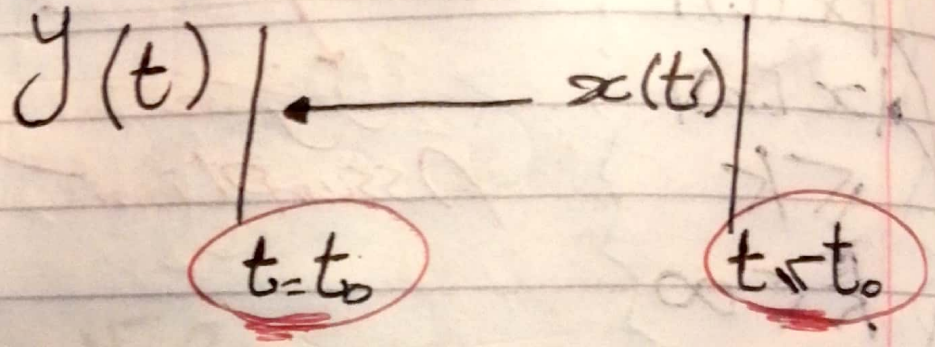
Lec.7 27/10

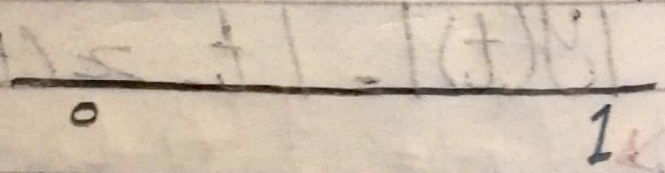
[3] Causality :- السببية



ex:- $y[n] = x[n] + 3x[n+1]$

system equation

$y[0] = x[0] + 3x[1]$



∴ the system is Not Causal.

ex: $y(t) = x(t) \cdot \cos(t+3)$

∴ the system is Memoryless.

∴ the system is Causal.

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[4] Stability :- BIBO

Complex
$|x(t)|$
$|x[n]|$
$\leq K$
$K < \infty$
$\forall t$
$\forall n$

Bound input | Bounded output

i.e.
Assumption

حاول
Trial
Check

ex:- $y(t) = t \cdot x(t)$

Let $|x(t)| \leq K, K < \infty, \forall t.$

$|y(t)| = |t \cdot x(t)|.$

Recall $|A \cdot B| = |A| \cdot |B|$

$\therefore |y(t)| = |t| \cdot |x(t)|.$

$\leq K \cdot |t|$

at $t = \pm\infty \longrightarrow |y(t)| = \infty$

$\therefore$ the system is not stable.

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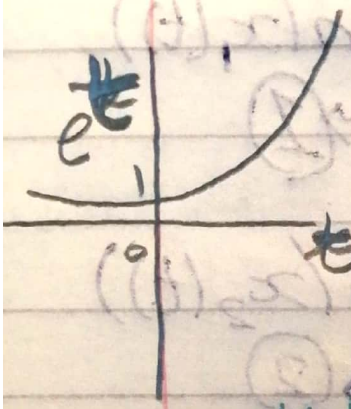
Ex:- $y(t) = e^{x(t)}$

Let $|x(t)| \leq K, K < \infty; \forall t$.



$$|y(t)| = |e^{x(t)}|$$

$$= e^{x(t)} \leq e^{|x(t)|}$$

$$\leq e^{K} < \infty$$

$e^t \leq e^{|t|}$

∴ the output is Bounded.

then the system is stable.

5] Time - Invariance:-

$y(t) \longrightarrow x(t)$

$y(t \pm t_0) \longleftarrow x(t \pm t_0)$

Time - shift for I/P

Same " " " O/P

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ex:-

$$y(t) = \sin(x(t))$$

Let $x_1(t) \xrightarrow{S} y_1(t) = \sin(x_1(t))$ → (1)

and let $x_2(t) = x_1(t-t_0) \xrightarrow{S}$

$y_2(t) = \sin(x_2(t))$ → (2)

$\therefore y_2(t) = \sin(x_1(t-t_0))$ → (2')

$y_1(t-t_0) = \sin(x_1(t-t_0))$ → (3)

$\therefore y_2(t) = y_1(t-t_0)$

∴ the system is time-Invariance

الممسوحة ضوئيا بـ CamScanner

ex:-

$$y[n] = n\,x[n]$$

Let $x_1[n] \xrightarrow{S} y_1[n] = n\,x_1[n]$ → (1)

and Let $x_2[n] = x_1[n-n_0] \xrightarrow{S} y_2[n] = n\,x_2[n]$ → (2)

$$\therefore y_2[n] = n\,x_1[n-n_0] \rightarrow (2')$$

$$y_1[n-n_0] = (n-n_0)\,x_1[n-n_0] \rightarrow (3)$$

$$\therefore y_2[n] \neq y_1[n-n_0].$$

∴ the system is not time-Invariance. //