

TE201416: SINYAL DAN SISTEM SISTEM

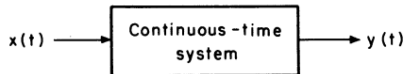


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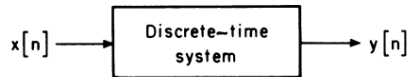
Teknik Elektro
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Balikpapan, Indonesia

Februari 26, 2020

Definisi Sistem



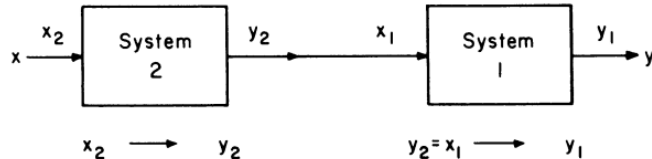
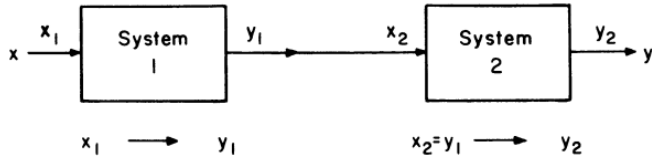
$$x(t) \longrightarrow y(t)$$



$$x[n] \longrightarrow y[n]$$

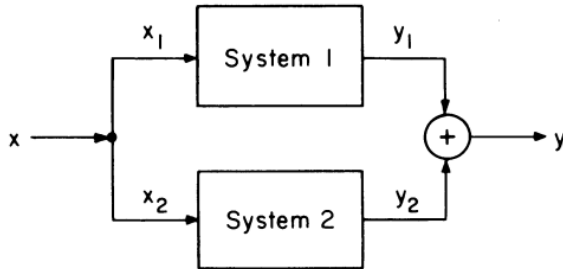
Interkoneksi Antar Sistem

Cascade



Interkoneksi Antar Sistem

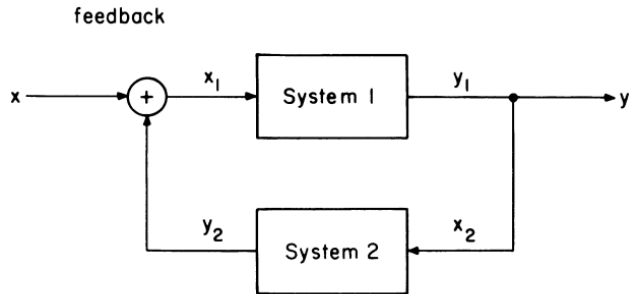
parallel



$$x_1 = x_2 = x$$

$$y = y_1 + y_2$$

Interkoneksi Antar Sistem



$$x_1 = x + y_2$$

$$y = y_1$$

$$x_2 = y_1$$

Karakteristik Sistem

MEMORYLESS

$$y(t) @ t=t_0 \leftarrow x(t) @ t=t_0$$

$$y[n] @ n=n_0 \leftarrow x[n] @ n=n_0$$

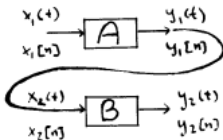
Examples

yes $y(t) = x^2(t)$ Squarer
 $y[n] = x^2[n]$

No $y(t) = \int_{-\infty}^t x^2(\tau) d\tau$

~~yes~~ No $y[n] = x[n-1]$ unit delay

INVERTIBILITY



$$x_2 = y_1$$

If \exists = Inverse of A

Then $y_2 = x_1$
Identity

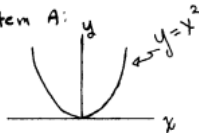
System A:

$$y_1(t) = \int_{-\infty}^t x_1(\tau) d\tau$$
 Integration

System A⁻¹;

$$y_2(t) = \frac{dx_1(t)}{dt}$$
 differentiation

System A:



Invertible? No

Memoryless? yes

Karakteristik Sistem

Causality

Output at any time depends only on input prior or equal to that time

or:

System can't anticipate "future" inputs

or:

$$x_1(t) \rightarrow y_1(t)$$

$$x_2(t) \rightarrow y_2(t)$$

If:

$$x_1(t) = x_2(t) \quad t < t_0$$

Then:

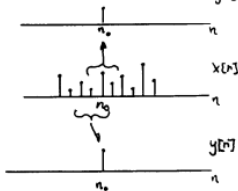
$$y_1(t) = y_2(t) \quad t < t_0$$

Same for discrete Time

Example:

$$y[n] = \frac{1}{3} \{x[n-2] + x[n] + x[n+2]\}$$

~~not~~
Moving Average
y[n]



$$y[n] = \frac{1}{3} \{x[n-2] + x[n] + x[n+2]\}$$

(causal)

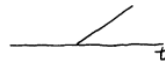
Stability

\Rightarrow For every bounded input the output is bounded

Example

$$y(t) = \int_{-\infty}^t x(\tau) d\tau$$

~~not~~
Stable



Stable?

Karakteristik Sistem

Time Invariance

C-T;

$$x(t) \rightarrow y(t)$$

Then

$$x(t-t_0) \rightarrow y(t-t_0)$$

D-T;

$$x[n] \rightarrow y[n]$$

Then

$$x[n-n_0] \rightarrow y[n-n_0]$$

Example

$$y[n] = \sum_{k=-\infty}^n x[k]$$

Accumulation

Time Invariant?

Example

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

$$x(t) \rightarrow (\sin t)x(t)$$

$$x(t-t_0) \rightarrow (\sin t)x(t-t_0)$$

≠

$$y(t-t_0) = \sin(t-t_0)x(t-t_0)$$

Time Invariant? No

Linearity

C.T & D.T

$$x_1(t) \rightarrow y_1(t)$$

$$x_2(t) \rightarrow y_2(t)$$

Then:

$$ax_1(t) + bx_2(t)$$

$$\rightarrow ay_1(t) + by_2(t)$$

Examples

$$y(t) = \int_{-\infty}^t x(\tau) d\tau \quad \text{yes}$$

$$y[n] = 2x[n] + 3$$

No
But

$$y[n] = x^2[n] \quad \text{Not}$$