Sistem Dinamik dan Arithmetik

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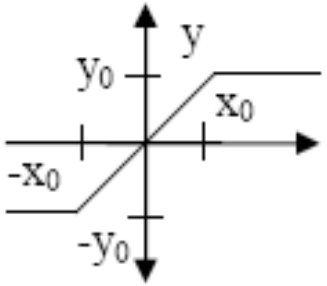
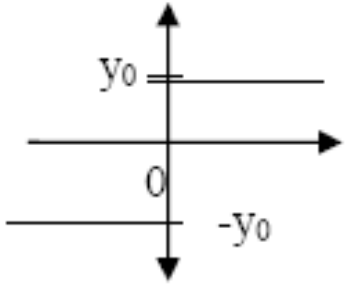
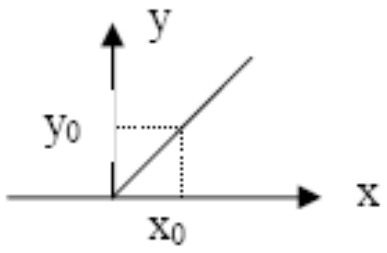
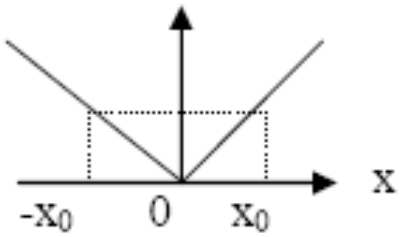
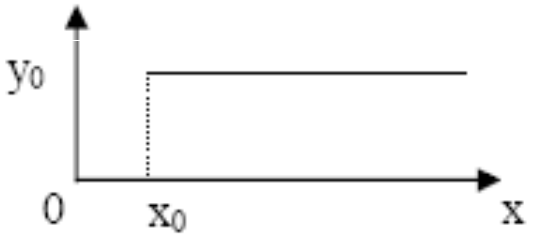
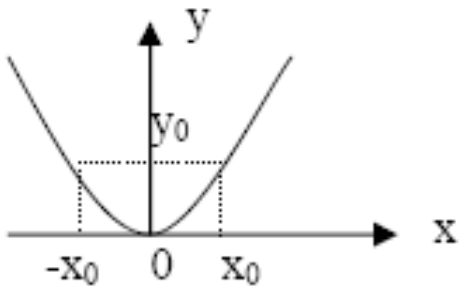
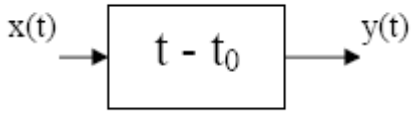
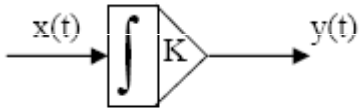
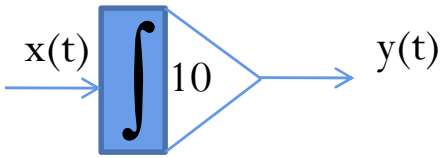
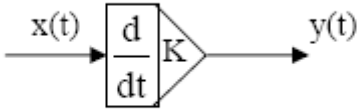
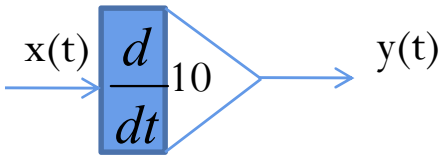
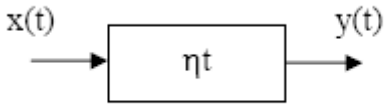
Sistem Elementer Statik

Nama	Deskripsi	Grafik
Soft Limiter	$y = \begin{cases} -y_0 & x < -x_0 \\ y_0 \dfrac{x}{x_0} & \lvert x \rvert \le x_0 \\ y_0 & x > x_0 \end{cases}$	
Hard Limiter	$y = \begin{cases} -y_0 & x < 0 \\ 0 & x = 0 \\ y_0 & x > 0 \end{cases}$	
Half-wave Rectifier	$y = \begin{cases} 0 & x \le 0 \\ y_0 \dfrac{x}{x_0} & x > 0 \end{cases}$	

Full-wave Rectifier	$y = y_0 \left\| \frac{x}{x_0} \right\|$	
Comparator	$y = \begin{cases} 0 & x \le x_0 \\ y_0 & x > 0 \end{cases}$	
Square-Law Rectifier	$y = y_0 \left(\frac{x}{x_0} \right)^2$	

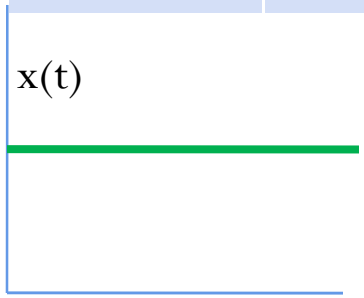
Elemen Dinamik

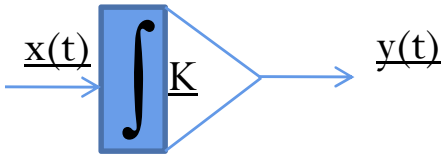
	Contoh untuk $x(t)=x_0u(t)$	
 Elemen delay		$y(t)=x_0u(t-4)$
 Gambar 1.20. Simbol elemen integral		$y(t)=10\int_{-\infty}^{t}x(t)dt=10\int_{-\infty}^{t}x_0u(t)dt$ $=10\int_{0}^{t}x_0dt=10x_0[t]_0^t=10x_0tu(t)$
 Gambar 1.21. Simbol elemen differensiator		$y(t)=10\frac{d}{dt}x(t)=10x_0\frac{d}{dt}u(t)$ $=10x_0\delta(t)$
 Gambar 1.22 Simbol elemen kompresi		$y(t)=x_0u(t-4)$

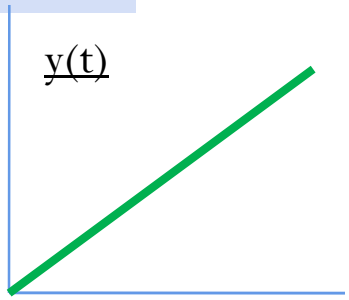
Tabel Lengkap Sistem Dinamik

Input	Output Integral
u(t)	Ktu(t)
δ(t)	Ku(t)
$r\left(\frac{t}{\tau}\right)$	Ktu(t)-K(t-τ)u(t-τ)
cosωt	$\frac{1}{\omega}\sin(\omega t)$
e-at	$-\frac{1}{a}e^{-at}$

$$y(t) = K\int_{-\infty}^{t} x(t)dt$$



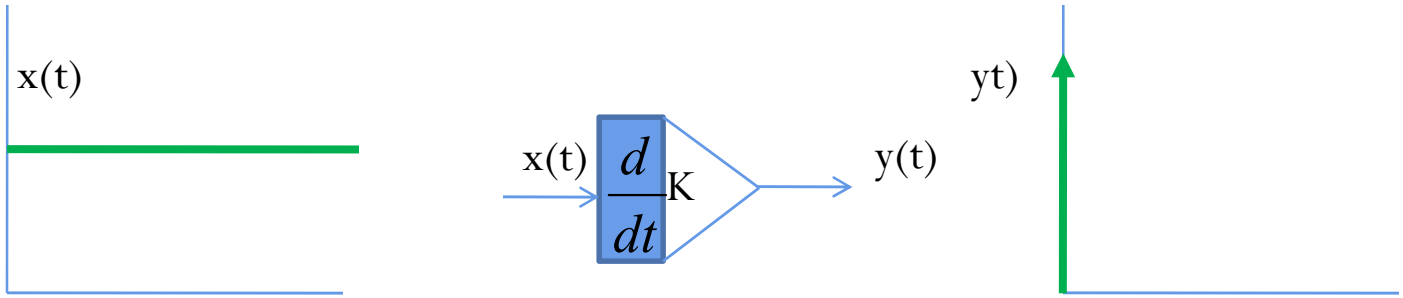




Tabel Lengkap Sistem Dinamik

Input	Output Differensiator
u(t)	Kδ (t)
δ(t)	Kδ'(t)
$r\left(\frac{t}{\tau}\right)$	Kδ(t)-Kδ(t-τ)
cosωt	-ωsinωt
e^{-at}	$-ae^{-at}$

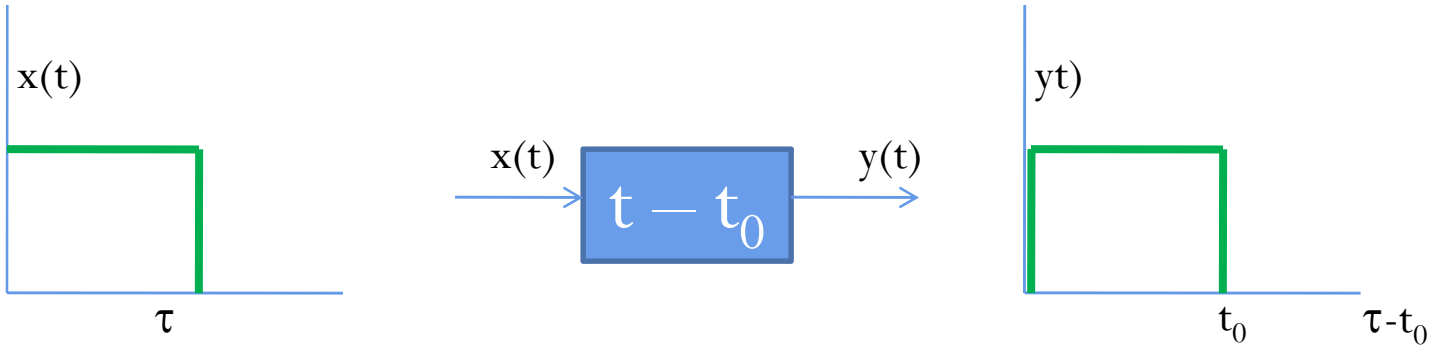
$$y(t) = K\frac{d}{dt}x(t)$$



Tabel Lengkap Sistem Dinamik

Input	Output Delay
$u(t)$	$u(t-t_0)$
$\delta(t)$	$\delta(t-t_0)$
$r\left(\frac{t}{\tau}\right)$	$r\left(\frac{t-t_0}{\tau}\right)$
$\cos\omega t$	$\cos[\omega(t-t_0)]$
e^{-at}	$\exp[-a(t-t_0)]$

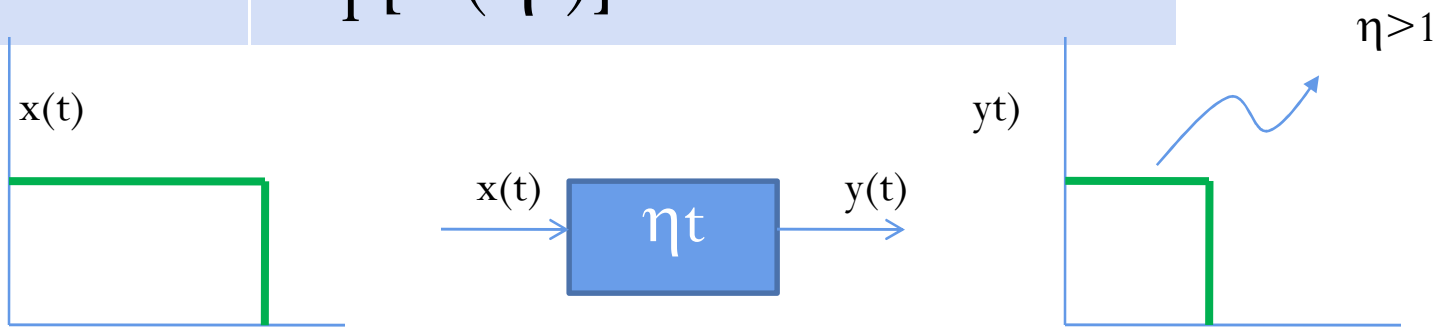
$$y(t) = x(t - t_0)$$



Tabel Lengkap Sistem Dinamik

Input	Output Kompresi
u(t)	u(t)
δ(t)	δ(t)
$r\left(\frac{t}{\tau}\right)$	$r\left(\frac{\eta t}{\tau}\right)$
cosωt	cos(ηωt)
e^{-at}	exp[-a(ηt)]

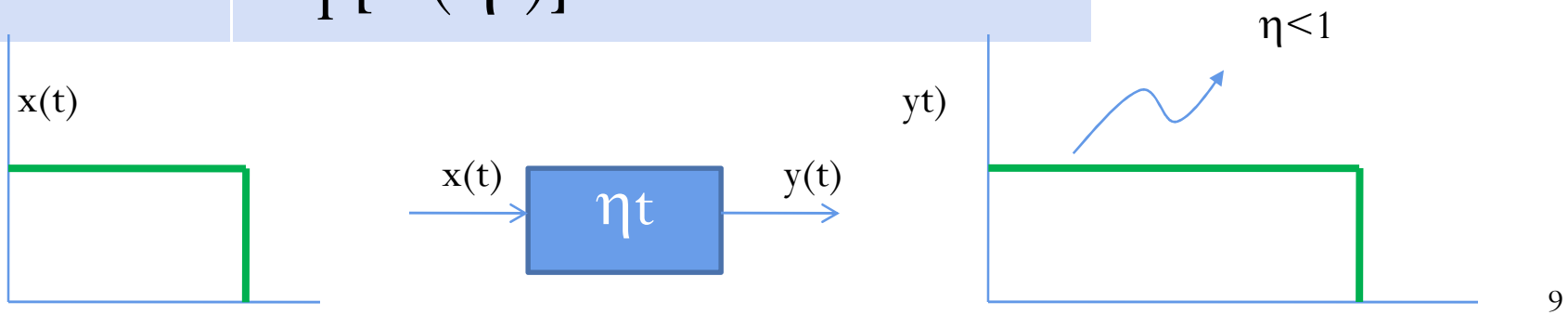
$$y(t) = x(\eta t)$$



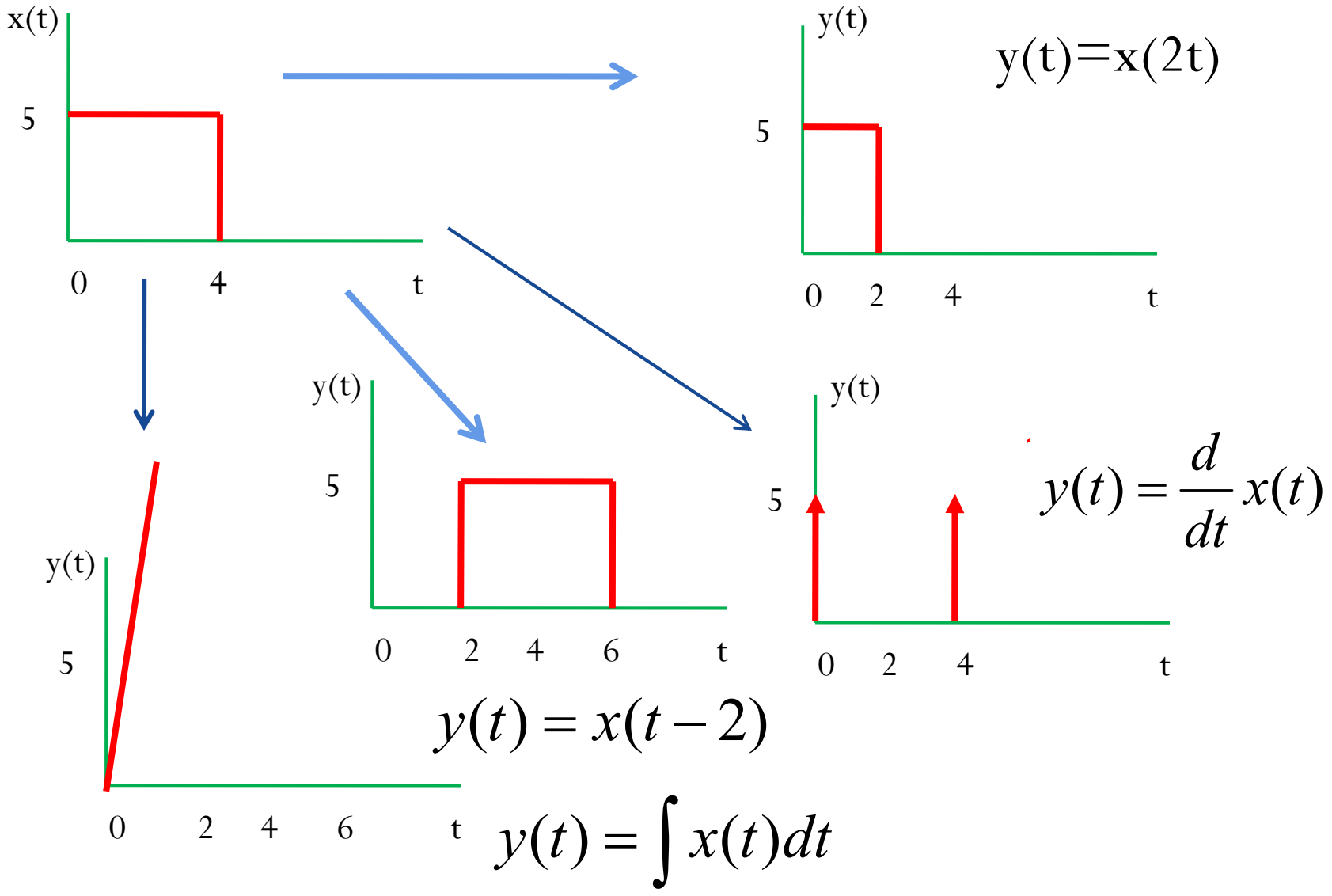
Tabel Lengkap Sistem Dinamik

Input	Output Kompresi
u(t)	u(t)
δ(t)	δ(t)
$r\left(\frac{t}{\tau}\right)$	$r\left(\frac{\eta t}{\tau}\right)$
cosωt	cos(ηωt)
e^{-at}	exp[-a(ηt)]

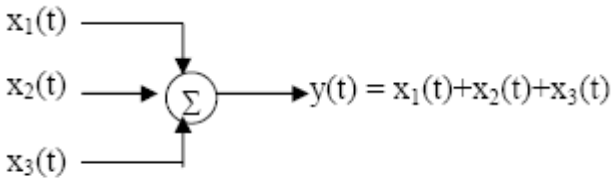
$$y(t) = x(\eta t)$$



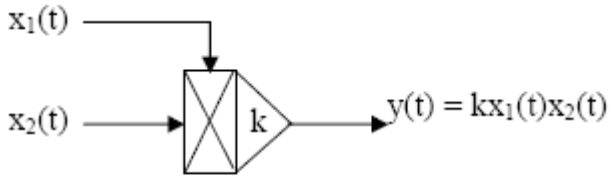
Sebutkan proses apa yang terjadi



Elemen Arithmatik



Gambar 1.23. Simbol elemen penjumlahan



Gambar 1.24. Simbol elemen perkalian

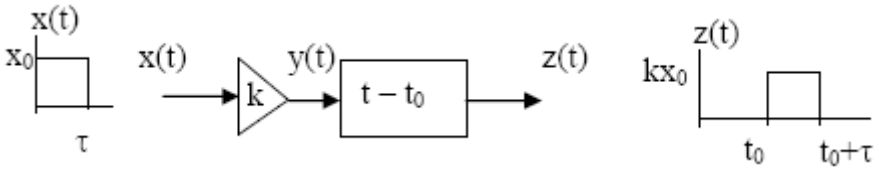
Contoh

$$r\left(\frac{t}{\tau}\right) = u(t) - u(t-\tau)$$

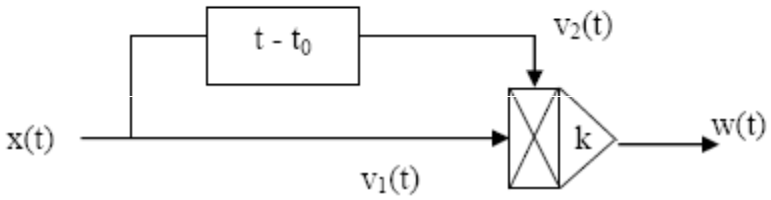
Modulasi Amplituda:

$y(t) = B\cos(\omega_c t)x(t)$

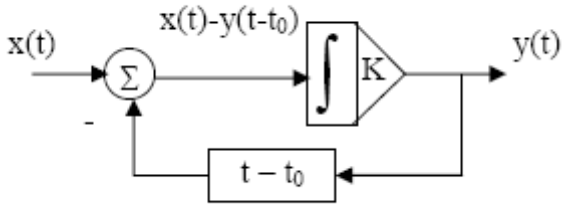
Diagram Blok



Serial

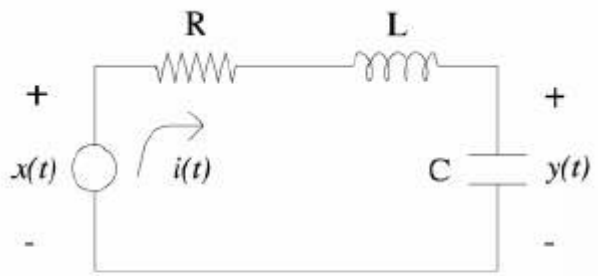


Paralel



Umpan Balik

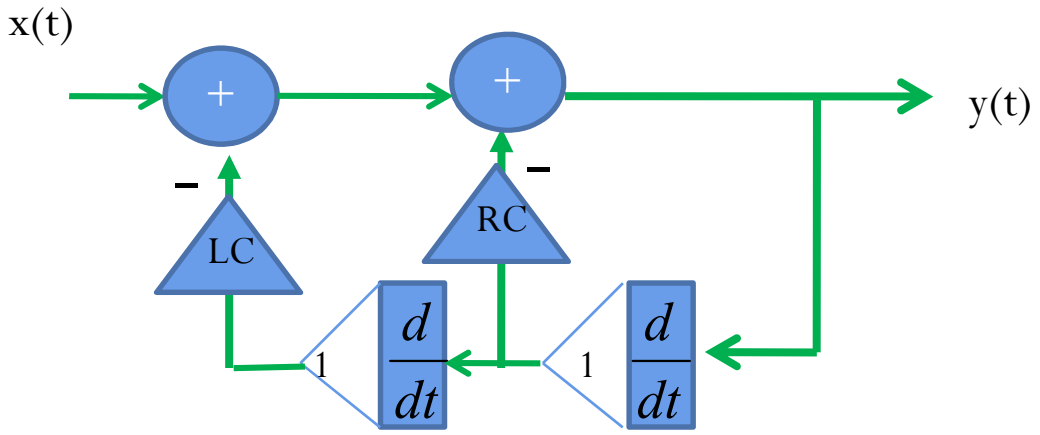
Contoh Pemodelan Listrik RLC



$$\mathrm{R}\, i(t) + \mathrm{L}\frac{di(t)}{dt} + y(t) = x(t)$$

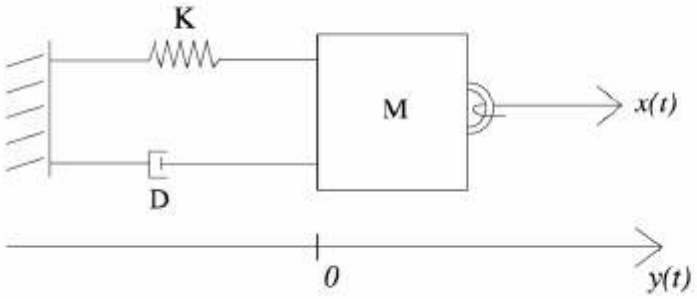
$$i(t) = \mathrm{C}\frac{dy(t)}{dt}$$

$$\mathrm{LC}\frac{d^2y(t)}{dt^2} + \mathrm{RC}\frac{dy(t)}{dt} + y(t) = x(t)$$



Contoh Pemodelan Mekanik

(b) Sistem Mekanik



x(t) - applied force
K - spring constant
D - damping constant
y(t) - displacement from rest

Force Balance:

$$\mathrm{M}\frac{d^2y(t)}{dt^2} = x(t) - \mathrm{K}y(t) - \mathrm{D}\frac{dy(t)}{dt}$$

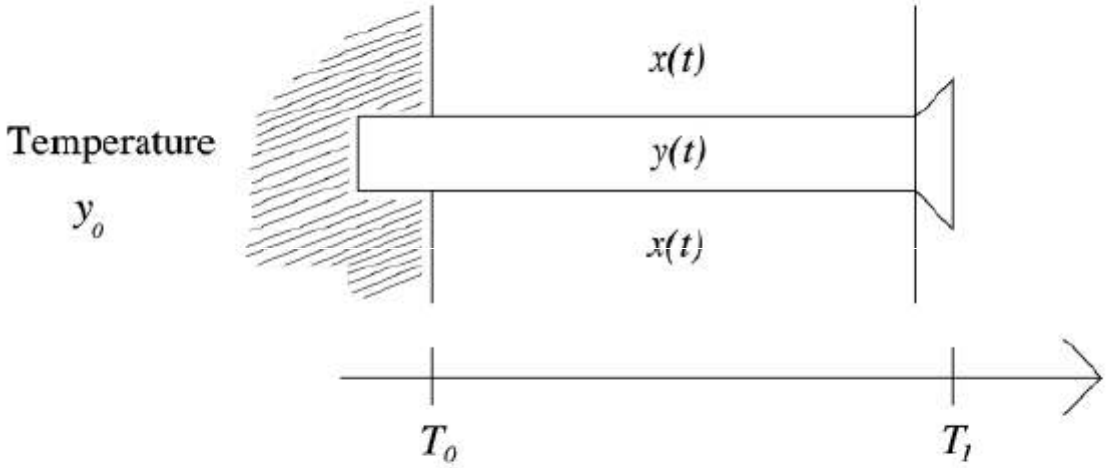
$$\Downarrow$$

$$\mathrm{M}\frac{d^2y(t)}{dt^2} + \mathrm{D}\frac{dy(t)}{dt} + \mathrm{K}y(t) = x(t)$$

Contoh Pemodelan Sensor

(c) Sistem Termal

Cooling Fin in Steady State



$$\frac{d^2y(t)}{dt^2} = k[y(t) - x(t)]$$
$$y(T_0) = y_0$$
$$\frac{dy}{dt}(T_1) = 0$$

t = distance along rod

$y(t)$ = Fin temperature as function of position

$x(t)$ = Surrounding temperature along the fin