

$$\begin{array}{r} 25 \\ 6 \overline{) 1510} \\ \underline{12} \\ 31 \\ \underline{30} \\ 10 \end{array}$$

$$\mathcal{L}\{u(t) - u(t-T)\} = \frac{1}{s}(1 - e^{-Ts})$$

$$x(t) \rightarrow \boxed{zOH} \rightarrow \boxed{G(s)} \rightarrow y(t) \rightleftharpoons \boxed{G(s)} \rightarrow \boxed{z^{-1}} \rightarrow y(t-T)$$

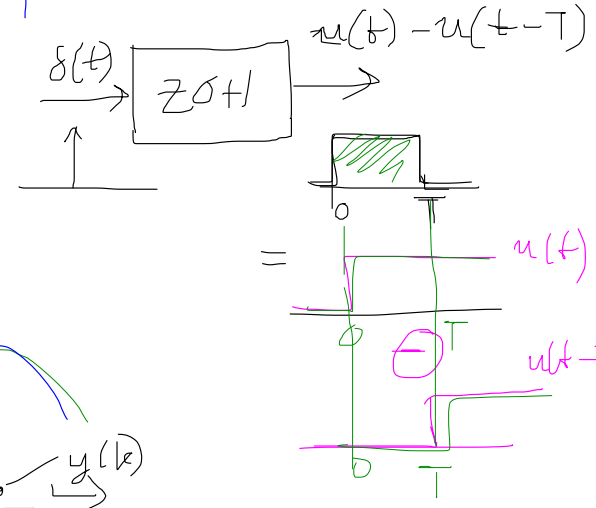
$$G(z) = \mathcal{Z}\{zOH\}G(s) = \mathcal{Z}\left\{\frac{1-e^{-Ts}}{s}\right\}G(s)$$

$$= \mathcal{Z}\{1-e^{-Ts}\} \cdot \mathcal{Z}\left\{\frac{G(s)}{s}\right\}$$

$$= (1-z^{-1}) \mathcal{Z}\left\{\frac{G(s)}{s}\right\}$$

Definisi $z = e^{Ts}$
 $e^{-Ts} = z^{-1}$

$$\boxed{G(z) = \frac{z-1}{z} \mathcal{Z}\left\{\frac{G(s)}{s}\right\}}$$



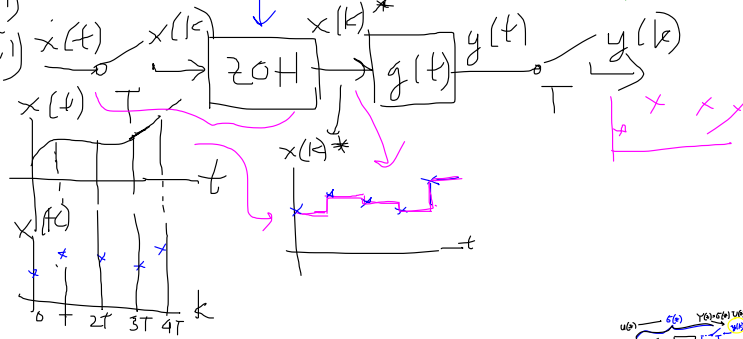
Contoh: $G(s) = \frac{1}{s+1} \rightarrow \frac{G(s)}{s} = \frac{1}{s(s+1)}$

$$G(z) = \frac{z-1}{z} \mathcal{Z}\left\{\frac{1}{s(s+1)}\right\}$$

$T=0,1$

$$= \frac{z-1}{z} \left(\frac{1}{s} - \frac{1}{s+1} \right)$$

$$= \frac{1-e^{-0,1}}{z-e^{-0,1}}$$



$$X(z) = \frac{z}{z-1}$$

$$Y(z) = G(z)X(z)$$

$$= \frac{z(1-e^{-0,1})}{(z-1)(z-e^{-0,1})}$$

$$= \frac{z(1-e^{-0,1})}{z^2 - (1+e^{-0,1})z + e^{-0,1}}$$

$$\frac{(1-e^{-0,1})z^2 - (1-e^{-0,1})z + e^{-0,1}}{(1-e^{-0,1})z^2 - (1+e^{-0,1})z + e^{-0,1}}$$

k	y(k)
0	1-e ^{-0,1}
1	1-e ^{-0,2}
2	1-e ^{-0,3}
...	...

SAMA

Contoh:

$$u(t) = \begin{cases} 1 & 0 \leq t < T \\ 0 & t \geq T \end{cases}$$

$$X(z) = \mathcal{Z}\{u(t)\} = \frac{1}{s} \mathcal{Z}\left\{\frac{1-e^{-Ts}}{s}\right\}$$

$$Y(z) = G(z)X(z) = \frac{1}{s} \mathcal{Z}\left\{\frac{1-e^{-Ts}}{s}\right\}$$

$$Y(z) = \frac{1}{s} \mathcal{Z}\left\{\frac{1-e^{-Ts}}{s}\right\} = \frac{1}{s} \mathcal{Z}\left\{\frac{1}{s} - \frac{e^{-Ts}}{s}\right\}$$

$$Y(z) = \frac{1}{s} \left(\frac{1}{s} - \frac{e^{-Ts}}{s} \right) = \frac{1}{s^2} (1 - e^{-Ts})$$

$$Y(z) = \frac{1}{s^2} (1 - e^{-Ts}) = \frac{1}{s^2} (1 - z^{-1})$$

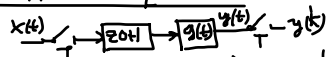
$$Y(z) = \frac{1}{s^2} (1 - z^{-1}) = \frac{1}{s^2} \frac{z-1}{z}$$

$$Y(z) = \frac{z-1}{s^2 z}$$

$$Y(z) = \frac{z-1}{s^2 z} = \frac{z-1}{s^2 z}$$

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Difference Equation



Diketahui $x(t) = u(t)$, isyarat undak satua,
 $g(t) = e^{-t}$
 $T = 0,1 \text{ sec}$

Ditanyakan $y(k)$, $k = 0, 1, 2, 3, \dots$

$$X(s) = \mathcal{L}\{x(t)\} = \mathcal{L}\{u(t)\} = \frac{1}{s} \quad X(z) = \mathcal{Z}\{X(s)\} = \frac{z}{z-1}$$

$$G(s) = \mathcal{L}\{g(t)\} = \mathcal{L}\{e^{-t}\} = \frac{1}{s+1} \quad G(z) = \mathcal{Z}\{G(s)\} = \frac{z-1}{z}$$

* Bagilah pembilang dan penyebut dari $G(z)$

dengan z pangkat tertinggi

$$G(z) = \frac{0,09516 z^{-1}}{1 - 0,90484 z^{-1}}$$

$$\rightarrow 1 - 0,90484 z^{-1}$$

* Perkalian silang

$$G(z) = \frac{Y(z)}{X(z)} = \frac{0,09516 z^{-1}}{1 - 0,90484 z^{-1}}$$

$$(0,09516 z^{-1}) X(z) = (1 - 0,90484 z^{-1}) Y(z)$$

$$0,09516 z^{-1} X(z) = Y(z) - 0,90484 z^{-1} Y(z)$$

$$Y(z) = 0,90484 z^{-1} Y(z) + 0,09516 z^{-1} X(z)$$

* Transformasi z -inverse

Pers difference

$$y(k) = 0,90484 y(k-1) + 0,09516 x(k-1)$$

$$z^{-1} Y(z) = y(k)$$

$$z^{-1} X(z) = x(k)$$

$$z^{-1} z^{-n} Y(z) = y(k-n)$$

$$z^{-1} z^{-n} X(z) = x(k-n)$$

k	x(k)	y(k)
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$$0 \rightarrow 1$$

$$1 \rightarrow 1$$

$$2 \rightarrow 1$$

$$3 \rightarrow 1$$

$$4 \rightarrow 1$$

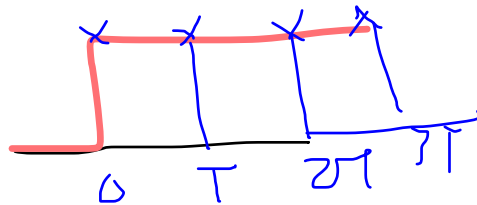
$$0,09516 = 1 - e^{-0,1}$$

$$(0,90484)(0,09516) + 0,09516 = 0,1812645 = 1 - e^{-0,2}$$

$$(0,90484)(0,181264) + 0,09516 = \dots = 1 - e^{-0,3}$$

$$(0,90484)(0,181264) + 0,09516 = \dots = 1 - e^{-0,4}$$

$$(0,90484)(0,181264) + 0,09516 = \dots = 1 - e^{-0,5}$$



$$u(k) = \begin{cases} 0, & k < 0 \\ 1, & k \geq 0 \end{cases}$$

$u(k)$ cuplikan dari $u(t)$