Example 3-3

Q: Figure 3-12 (a) $G(z)=?$ 3.12(b) $Y(z)=?$

$G(s)=\frac{1}{s+a}$ $x(t)=1(t)$

Solution

(i) 有输入采样器 $G(z)=Z(G(s))=\frac{1}{1-e^{-aT}z^{-1}}$

(ii) 对于 $G(s)$，有输入采样器

$$G(s)=\frac{U(s)}{X^*(s)} \quad (1)$$

对于 $H(s)$，没输入采样器

$$H(s)=\frac{Y(s)}{U(s)} \quad (2)$$

from (1) (2)，消去 $U(s)$

$$G(s)X^*(s)=\frac{Y(s)}{H(s)}$$

$$G(s)=\frac{Y(s)}{H(s)X^*(s)}$$

$$Y(s)=G(s)H(s)X^*(s)$$

assume $H(s)=1$

$$Y(s)=G(s)X^*(s)$$

$$Y^*(s)=G^*(s)X^*(s)$$

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

$$U^*(s)=[G(s)H(s)X(s)]^*$$

$$=GH^*(s)X^*(s)$$

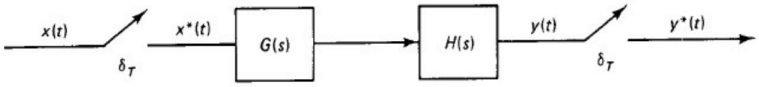
$x(t)=1(t)$

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

$$=\frac{1}{1-e^{-aT}z^{-1}}\cdot\frac{1}{1-z^{-1}}$$

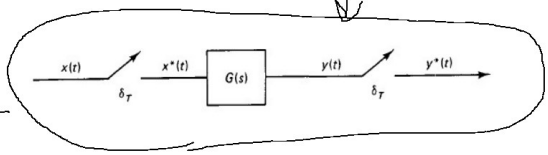
$$Y(z) = G\,H(z)\frac{1}{1-z^{-1}}$$

答案 $$Y(z) = \frac{1}{a}\frac{(1-a^{-aT})z^{-1}}{(1-z^{-1})(1-e^{-aT}z^{-1})}$$



(b)

假设H（s）=1



Therefore, the presence or absence of the ***input sampler*** *is* ***crucial.*** But the presence or absence of ***a sampler at the output*** of the element (or the system) ***does not affect*** the pulse transfer function.

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same

3.3.3. General Procedure of Obtaining Pulse Transfer Functions

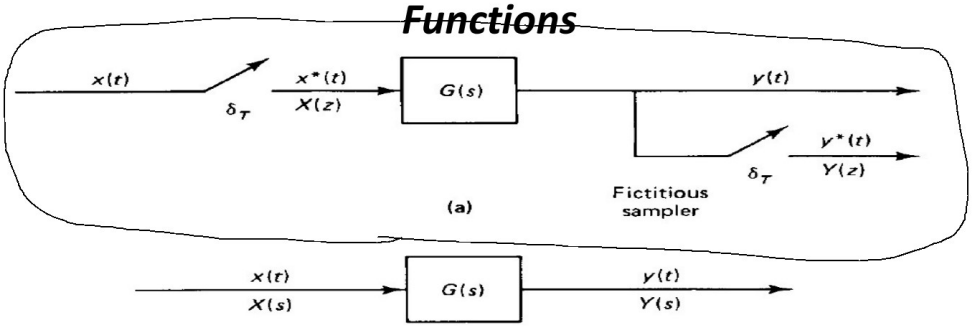

图3.10 (a)输入有脉冲采样器的连续时间系统；(b)连续时间系统

Figure 3.10 (a) Continuous-time system with an impulse sampler at the input (b) Continuous-time system

For Figure 3-10(a), input sampler is present. Then

对于图3-10(a)，存在输入采样器。然后

$$Y(s) = G(s)X^*(s)$$ same $$Y(s) = G(s)X^*(s)$$

So $Y^*(s) = G^*(s)X^*(s)$ and hence $Y(z) = G(z)X(z)$

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same $Y^*(s) = G^*(s)X^*(s)$