Z transform

Solution

① definite

$$X(z) = \sum_{k=0}^{\infty} x(kT)\, z^{-k}$$

$$x(0) = x(t)\big|_{t=0} = \lim_{z\to\infty} X(z)$$

exist

precondition

Final Value Theorem

all poles of $X(z)$ lie inside the unit circle, with the possible exception of a simple pole at

$z = 1$

$$\lim_{k\to\infty} x(k) = \lim_{z\to 1}(1-z^{-1})X(z)$$

$z \to s$

$$z = a + bj$$

$$\downarrow$$

$$z = r \angle \theta$$

$$\downarrow$$

$$z = e^{sT} \qquad s = \sigma + j\omega$$

$$= e^{(\sigma + j\omega)}$$

$$= e^{\sigma} \cdot e^{j\omega}$$

$$s = \frac{\ln z}{T}$$

$$= \frac{\ln r e^{j\theta}}{T}$$

$$= \frac{\ln r + j\theta}{T}$$

$$\zeta = \frac{-Re(s)}{|s|}$$