

T57

$$4. y(n) = x(n-3) + x(n-2) + x(n-1) + x(n)$$

$$Y(z) = X(z)(z^{-3} + z^{-2} + z^{-1} + 1)$$

$$T(z) = \frac{Y(z)}{X(z)} = \frac{z^3 + z^2 + z + 1}{z^3}$$

$$T(z) \big|_{z=j\Omega}$$

$$T(j\Omega) = \frac{1 + e^{j\Omega} + e^{2j\Omega} + e^{3j\Omega}}{e^{3j\Omega}}$$

$$= \frac{e^{j3/2\Omega} (e^{-3/2j\Omega} + e^{-1/2j\Omega} + e^{1/2j\Omega} + e^{3/2j\Omega})}{e^{3j\Omega}}$$

aplicando la fórmula de Euler

$$e^{j\theta} + e^{-j\theta} = 2\cos(\theta)$$

$$T(j\Omega) = e^{-3/2j\Omega} (2\cos(3/2\Omega) + 2\cos(1/2\Omega))$$

$$\angle T = -3/2 \Omega$$

$$B. y(n) = x(n-4) + x(n-3) + x(n-2) + x(n-1) + x(n)$$

$$T(z) = \frac{z^4 + z^3 + z^2 + z + 1}{z^4}$$

$$T(j\Omega) = \frac{1 + e^{j\Omega} + e^{2j\Omega} + e^{3j\Omega} + e^{4j\Omega}}{e^{4j\Omega}}$$

$$= \frac{e^{2j\Omega} (e^{-2j\Omega} + e^{-j\Omega} + e^{j\Omega} + e^{2j\Omega} + 1)}{e^{4j\Omega}}$$

$$T(j\Omega) = e^{-2j\Omega} (2\cos(2\Omega) + 2\cos(\Omega) + 1)$$

$$\Delta T = -2\Omega$$

$$C. y(n) = x(n) - x(n-1)$$

$$T(z) = \frac{z - z^0}{z}$$

$$T(j\Omega) = \frac{e^{j\Omega} - e^{j0}}{e^{j\Omega}} = e^{1/2j\Omega} \frac{(e^{-1/2j\Omega} + e^{1/2j\Omega})}{e^{j\Omega}}$$

$$= e^{-1/2j\Omega} 2j \sin(1/2\Omega)$$

$$\Delta T = -\frac{1}{2}\Omega$$

$$D. y(n) = x(n] - x(n-2)$$

$$T(Z) = \frac{Z^2 - Z^0}{Z^2}$$

$$T(\Omega) = \frac{-e^{j0} + e^{2j\Omega}}{e^{2j\Omega}} = e^{j\Omega} (e^{-j\Omega} + e^{j\Omega})$$

$$= e^{-j\Omega} 2j \sin \Omega$$