Örnek:

$$y[n] - \frac{3}{4} y[n-1] + \frac{1}{8} y[n-2] = 2x[n]$$

şeklinde tanımlanan fark denklemine sahip LTI sistemin $x[n] = \left(\frac{1}{4}\right)^n u[n]$ girişine cevabını bulun.

Çözüm: Denklemin Fourier dönüşümü alınır.

$$Y(\Omega) - \frac{3}{4} e^{-j\Omega} Y(\Omega) + \frac{1}{8} e^{-j2\Omega} Y(\Omega) = 2X(\Omega)$$

$$\left(1 - \frac{3}{4} e^{-j\Omega} + \frac{1}{8} e^{-j2\Omega}\right) Y(\Omega) = 2X(\Omega)$$

$$H(\Omega) = \frac{Y(\Omega)}{X(\Omega)} = \frac{2}{1 - \frac{3}{4} e^{-j\Omega} + \frac{1}{8} e^{-j2\Omega}}$$

Frekans cevabıdır.

$$x[n] = \left(\frac{1}{4}\right)^n u[n] \xrightarrow{\mathcal{F}} X(\Omega) = \frac{1}{1 - \frac{1}{4} e^{-j\Omega}}$$

Tablodan

$$Y(\Omega) = H(\Omega) \cdot X(\Omega)$$

$$Y(\Omega) = \frac{2}{1 - \frac{3}{4} e^{-j\Omega} + \frac{1}{8} e^{-j2\Omega}} \cdot \frac{1}{1 - \frac{1}{4} e^{-j\Omega}}$$

Paydayı çarpanlarına ayır

$$Y(\Omega) = \frac{2}{\left(1 - \frac{1}{2} e^{-j\Omega}\right)\left(1 - \frac{1}{4} e^{-j\Omega}\right)} \cdot \frac{1}{1 - \frac{1}{4} e^{-j\Omega}}$$

$$Y(\Omega) = \frac{A}{\left(1-\frac{1}{2}e^{-j\Omega}\right)} + \frac{B}{\left(1-\frac{1}{4}e^{-j\Omega}\right)} + \frac{C}{\left(1-\frac{1}{4}e^{-j\Omega}\right)^2}$$

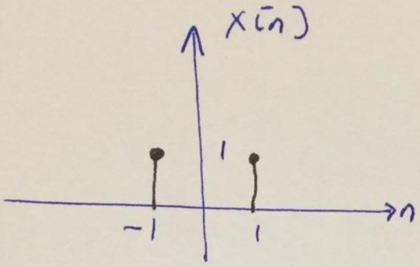
$A = 8 \qquad B = -4 \qquad C = -2$

$$Y(\Omega) = \frac{8}{1-\frac{1}{2}e^{-j\Omega}} - \frac{4}{1-\frac{1}{4}e^{-j\Omega}} - \frac{2}{\left(1-\frac{1}{4}e^{-j\Omega}\right)^2}$$

Ters Fourier dönüşümü

$$y[n] = 8\left(\frac{1}{2}\right)^n u[n] - 4\left(\frac{1}{4}\right)^n u[n] - 2(n+1)\left(\frac{1}{4}\right)^n u[n]$$

Örnek:



$X(\Omega) = ?$

Çözüm:

$$x[n] = \delta[n+1] + \delta[n-1]$$

$$\Big\downarrow \tilde{\mathcal{F}}$$

$$X(\Omega) = e^{j\Omega} + e^{-j\Omega} \qquad \frac{2}{2} \text{ çarp}$$

$$X(\Omega) = \frac{2}{2}\left(e^{j\Omega} + e^{-j\Omega}\right)$$

$$X(\Omega) = 2 \cdot \left(\frac{e^{j\Omega} + e^{-j\Omega}}{2}\right)$$

$$X(\Omega) = 2 \cos \Omega$$