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Tugas Isyarat & Sistem.

6.71 Diketahui :

sistem LTI diskret kausal sebagai berikut

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

dimana $x[n]$ adl input dan $y[n]$ adl output sistem.

Ditanyakan :

- Tentukan tanggapan frekuensi $H(\Omega)$ dari sistem
- Temukan tanggapan impulse $h[n]$ dari sistem
- Temukan $y[n]$ jika $x[n] = \left(\frac{1}{2}\right)^n u[n]$.

Jawab :

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

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

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

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

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

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

invers transform Fourier dari $H(\Omega)$, kita dapatkan :

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

$$c). \quad x[n] = \left(\frac{1}{2}\right)^n u[n]$$

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

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

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

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

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