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TT-43-11

1. $y[n] = x[n] + 3x[n-2] + x[n-4]$

a. orde 4

b. $y[n] = x[n] + 3x[n-2] + x[n-4]$

$$Y(z) = X(z) + 3z^{-2}X(z) + z^{-4}X(z)$$

$$\frac{Y(z)}{X(z)} = 1 + 3z^{-2} + z^{-4} = H(z)$$

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

$$z^2 - z + 1 = 0$$

$$z^2 + z + 1 = 0$$

$$z_1 = 0,5 + j0,87$$

$$z_3 = -0,5 + j0,87$$

$$z_2 = 0,5 - j0,87$$

$$z_4 = -0,5 - j0,87$$

$$|z_1| = \sqrt{0,5^2 + 0,87^2} = 1$$

$|z_1|, |z_2|, |z_3|, |z_4| = 1$, maka sistem stabil

c. $H(z) = 1 + 3z^{-2} + z^{-4}$

$$H(e^{j\omega}) = 1 + 3e^{-j2\omega} + e^{-j4\omega}$$

$$= 1 + 2e^{-j2\omega} + e^{-j2\omega} + e^{-j4\omega}$$

$$= 1 + 2e^{-j2\omega} + e^{-j2\omega}(e^{j2\omega} + e^{-j2\omega})$$

$$= 1 + 2e^{-j2\omega} + e^{-j2\omega}(2\cos 2\omega)$$

$$= 1 + 2e^{-j2\omega}(1 + \cos 2\omega)$$

$$= 1 + 2(\cos 2\omega - j\sin 2\omega)(1 + \cos 2\omega)$$

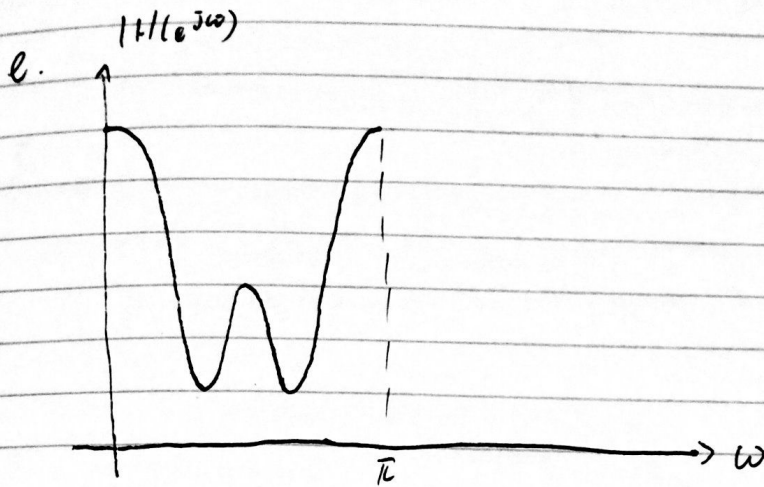
$$= 1 + 2\cos 2\omega + 2\cos^2 2\omega - j(2\sin 2\omega + 2\cos 2\omega \sin 2\omega)$$

$$= 1 + 2\cos 2\omega(1 + \cos 2\omega) - j(2\sin 2\omega(1 + \cos 2\omega))$$

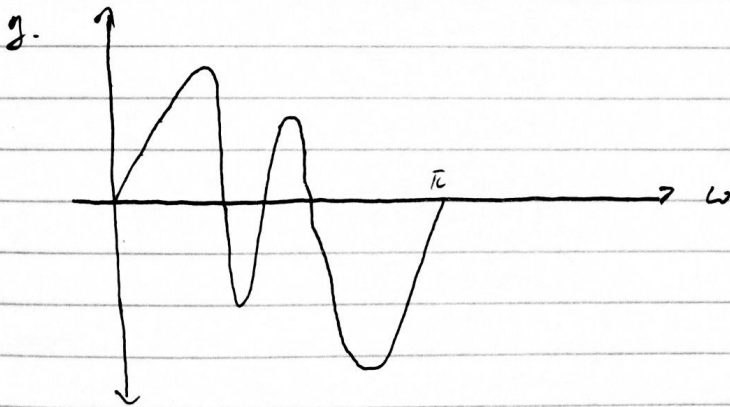
d. $|H(e^{j\omega})| = \sqrt{(1 + 2\cos 2\omega(1 + \cos 2\omega))^2 + (2\sin 2\omega(1 + \cos 2\omega))^2}$

$$= \sqrt{(1 + 2\cos 2\omega + 2\cos^2 2\omega)^2 + (2\sin 2\omega + \sin 4\omega)^2}$$

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TT-93-11



$$\begin{aligned}
 f. \arg \{H(e^{j\omega})\} &= \tan^{-1} \left(\frac{2 \sin 2\omega (1 + \cos 2\omega)}{1 + 2 \cos 2\omega (1 + \cos 2\omega)} \right) \\
 &= \tan^{-1} \left(\frac{\sin 2\omega + \sin 4\omega}{1 + 2 \cos 2\omega + 2 \cos^2 2\omega} \right)
 \end{aligned}$$



$$h. x[n] = n \{u[n] - u[n-6]\}$$

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TT-13-11

i. Band stop filter terlihat dari gambar pada grafik e

