2022nov18

Friday, November 18, 2022 12:57

$F_s = 8000\ Hz$

$B = 40\ Hz$

$$\omega_c = \frac{2\pi \cdot 120}{F_s}$$

$$= \frac{2\pi \cdot 120}{8000}$$

$$= \frac{240\pi}{8000}$$

$$= \frac{3\pi}{100} = 0.03\pi$$

$$B = \frac{2\pi \cdot 40}{F_s} = \frac{2\pi\, 40}{8000}$$

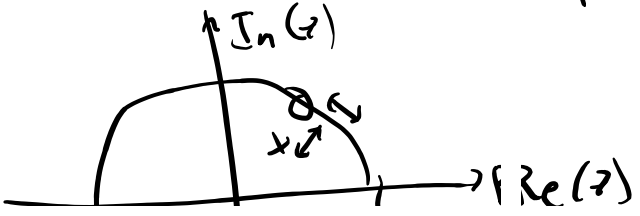
$$= \frac{\pi}{100} = 0.01\pi$$

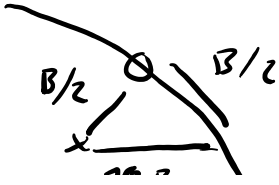
$$H(z) = \frac{(1 - r_1 z^{-1})(1 - r_1^* z^{-1})}{(1 - p_1 z^{-1})(1 - p_1^* z^{-1})}$$

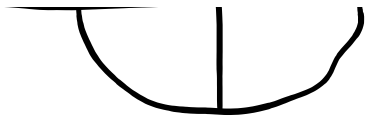
$$= \frac{1 - (r_1 + r_2) z^{-1} + |r_1|^2 z^{-2}}{1 - (p_1 + p_2) z^{-1} + |p_1|^2 z^{-2}}$$

$$r_1 = e^{j\omega_c} = e^{0.03\pi j}$$

$$p_1 = a e^{j 0.03\pi}$$





$$-\ln(a) \approx 1 - a$$

$$= \frac{B}{2} \qquad -\ln(a) = \frac{B}{2} = \frac{0.01\pi}{2} = 0.005\pi$$

$$\ln(a) = -0.005\pi$$

$$a = e^{-0.005\pi}$$

$$p_1 = e^{-0.005\pi} e^{j0.03\pi}$$

$$-0.005\pi \qquad (\quad -]$$

$$p_1 + p_2 = 2e^{\quad} \cos(0.0\quad)$$

$$|p_1|^2 = \left(e^{-0.005\pi}\right)^2 = e^{-0.01\pi}$$

$$H(z) = \frac{1 - (r_1 + r_2)z^{-1} + |r_1|^2 z^{-2}}{1 - (p_1 + p_2)z^{-1} + |p_1|^2 z^{-2}}$$

$$= \frac{1 - 2\cos(0.03\pi)z^{-1} + z^{-2}}{1 - 2e^{-0.005\pi}\cos(0.03\pi)z^{-1} + e^{-0.01\pi}z^{-2}} = \frac{Y(z)}{X(z)}$$

$$(1 - 2\cos(0.03\pi)z^{-1} + z^{-2})$$

$$X(z)(\quad) = Y(z)\left(1 - 2e^{-0.005\pi}\cos(0.03\pi)z^{-1} + e^{-0.01\pi}z^{-2}\right)$$

$$x[n] - 2\cos(0.03\pi)\,x[n-1] + x[n-2]$$
$$= y[n] - 2e^{-0.005\pi}\cos(0.03\pi)\,y[n-1]$$
$$+ e^{-0.01\pi}\,y[n-2]$$

$$y[n] = x[n] - 2\cos(0.03\pi)\,x[n] + x[n-2]$$
$$+ 2e^{-0.005\pi}\cos(0.03\pi)\,y[n-1]$$

$$- e^{-0.01\pi}\,y[n-2]$$