

$$\textcircled{1} \quad y[n] = x[n] + 1.4 y[n-1] - 0.75 y[n-2]$$

$$Y(z) = X(z) + 1.4 z^{-1} Y(z) - 0.75 z^{-2} Y(z)$$

$$Y(z) (1 - 1.4 z^{-1} + 0.75 z^{-2}) = X(z)$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{1}{1 - 1.4 z^{-1} + 0.75 z^{-2}}$$

$$= \frac{z^2}{z^2 + b z + c}$$

$$b = -1.4 = -\frac{7}{5}$$

$$c = 0.75 = \frac{3}{4}$$

$$p_1, p_2 = -\frac{b}{2} \pm \frac{\sqrt{b^2 - 4c}}{2}$$

$$= +\frac{7}{10} \pm \frac{\sqrt{\frac{49}{25} - 3}}{2}$$

$$= -\frac{7}{10} \pm \frac{\sqrt{49 - 3 \cdot 25}}{2}$$

$$\frac{6}{75} \\ - 49$$

$$10 \pm \frac{26}{2 \cdot \sqrt{25}}$$

$$\frac{71}{26}$$

$$= \frac{7}{10} \pm j \frac{\sqrt{26}}{10}$$

$$\sigma = -\ln \left| 0.7 + j \frac{\sqrt{26}}{10} \right|$$

$$= -\ln \sqrt{\left(\frac{7}{10}\right)^2 + \frac{26}{1000}}$$

$$BW = 2\sigma = -2 \ln \sqrt{\left(\frac{7}{10}\right)^2 + \frac{26}{1000}}$$

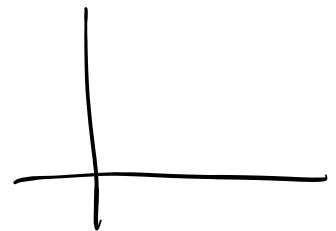
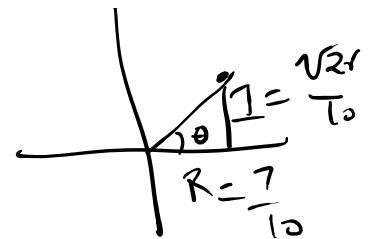
$$\omega_0 = \angle p_1$$

$$\angle \tan^{-1}(\dots)$$

$$= \tan^{-1} \left(\frac{\text{Im}(p_1)}{\text{Re}(p_1)} \right)$$

$$= \tan^{-1} \left(\frac{\sqrt{26}/10}{7/10} \right)$$

$$\omega_0 = \tan^{-1} \left(\frac{\sqrt{26}}{7} \right)$$



$$\textcircled{2} h[n] \propto (0.9)^n \sin\left(\frac{\pi}{16}(n+1)\right)$$

$$\text{or } e^{-\sigma n} \sin(\omega_0(n+1))$$

$$= (1 - 0.9e^{j\frac{\pi}{6}} z^{-1})(1 - 0.9e^{-j\frac{\pi}{6}} z^{-1})$$

$$= 1 - 0.9(e^{j\frac{\pi}{6}} + e^{-j\frac{\pi}{6}})z^{-1} + (0.9)^2 z^{-2}$$

$$= 1 - 1.8 \cos\left(\frac{\pi}{6}\right) z^{-1} + 0.81 z^{-2}$$

$$Y(z)$$

$$\frac{Y(z)}{X(z)} = \frac{1 + bz^{-1} + cz^{-2}}{1 + bz^{-1} + cz^{-2}}$$

$$Y(z) = X(z) - bz^{-1}Y(z) - cz^{-2}Y(z)$$

$$y[n] = x[n] - by[n-1] - cy[n-2]$$

$$b = -1.8 \cos\left(\frac{\pi}{6}\right) \quad c = 0.81$$