

2. $H(s) = \frac{s^2 + 40s + 4000}{s^2 + 220s + 4000}$

a. Pole:

$$s^2 + 220s + 4000 = 0$$

$$(s + 20)(s + 200) = 0$$

$$s_1 = -20 \text{ V } s_2 = -200$$

Zero:

$$s^2 + 40s + 4000 = 0$$

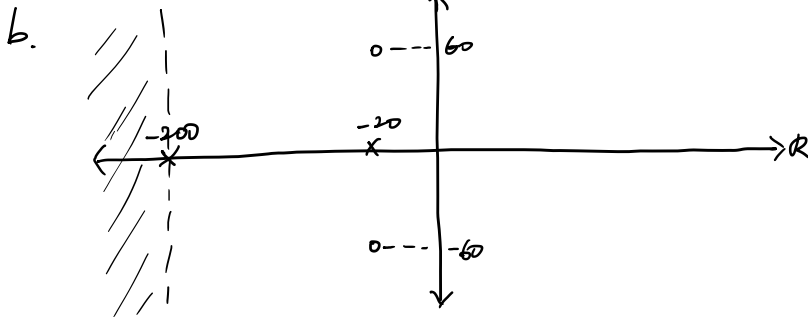
$$s_{1,2} = \frac{-40 \pm \sqrt{40^2 - 4 \cdot 1 \cdot 4000}}{2 \cdot 1}$$

$$s_{1,2} = \frac{-40 \pm \sqrt{-14400}}{2}$$

$$s_{1,2} = \frac{-40 \pm 120i}{2} = -20 \pm 60i$$

$$s_1 = -20 + 60i$$

$$s_2 = -20 - 60i$$



o = Zero
x = Pole

$$\begin{aligned} \text{ROC}_1 &= \text{Re}(s) < -20 \\ \text{ROC}_2 &= \text{Re}(s) < -200 \\ \text{ROC} &= \text{ROC}_1 \cap \text{ROC}_2 = \text{Re}(s) < -200 \end{aligned}$$

Filter analog stabil karena semua pole < 0

c.

$$\begin{aligned} H(s) &= \frac{s^2 + 40s + 4000}{s^2 + 220s + 4000} = 1 + \frac{-180s}{(s + 200)(s + 20)} \\ &= 1 - \left(\frac{A}{s + 200} + \frac{B}{s + 20} \right) \end{aligned}$$

$$A(s+20) + B(s+200) = 180s$$

$$(A+B)s + 20A + 200B = 180s$$

$$A+B = 180$$

$$20A + 200B = 0$$

$$A + 10B = 0$$

$$\begin{array}{r} A+B = 180 \\ A+10B = 0 \\ \hline 9B = -180 \end{array}$$

$$B = -20 \rightarrow A = 200$$

$$H(s) = 1 - \left(\frac{A}{s+200} + \frac{B}{s+20} \right) = 1 - \left(\frac{200}{s+200} - \frac{20}{s+20} \right)$$

$$H(s) = 1 - \frac{200}{s+200} + \frac{20}{s+20}$$

$$h(t) = \delta(t) - 200 e^{-200t} \cdot u(t) + 20 e^{-20t} \cdot u(t)$$

$$H(s) = \frac{s^2 + 40s + 4000}{s^2 + 220s + 4000}$$

$$H(j\Omega) = \frac{(j\Omega)^2 + 40(j\Omega) + 4000}{(j\Omega)^2 + 220(j\Omega) + 4000}$$

$$H(j\Omega) = \frac{4000 - \Omega^2 + j(40\Omega)}{4000 - \Omega^2 + j(220\Omega)}$$

$$d. |H(j60)| = \frac{\sqrt{(4000 - 60^2)^2 + (40 \cdot 60)^2}}{\sqrt{(4000 - 60^2)^2 + (220 \cdot 60)^2}} = 0,18$$

$$H(j60) = \frac{4000 - 60^2 + j(40 \cdot 60)}{4000 - 60^2 + j(220 \cdot 60)} = \frac{400 + j2400}{400 + j13200} = \frac{1+j6}{1+j33} \cdot \frac{1-j33}{1-j33}$$

$$H(j60) = \frac{199}{1090} - j\left(\frac{27}{1090}\right)$$

$$\arg(H(j60)) = \tan^{-1}\left(\frac{\operatorname{Im} H(j60)}{\operatorname{Re} H(j60)}\right) = \tan^{-1}\left(\frac{27}{199}\right) = \underline{\underline{7,73^\circ}}$$

5.

4. $x(t) = \cos(60t)$

$$X(s) = \frac{s}{s^2 + 60^2}$$

$$Y(t) = x(t) * h(t)$$

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

$$Y(s) = \frac{s}{s^2 + 60^2} \cdot \frac{s^2 + 40s + 4000}{s^2 + 220s + 4000}$$

$$Y(s) = \frac{s^3 + 40s^2 + 4000s}{(s^2 + 60^2)(s^2 + 220s + 4000)}$$

5. $H(s)$ mürer funksur unum BSF (Band-stop Filter)

$$H(s) = \frac{s^2 + \Omega_u \Omega_c}{s^2 + (\Omega_u + \Omega_c)s + \Omega_u \Omega_c} = \frac{s^2 + 4000 + 4000}{s^2 + 220s + 4000}$$

$$\Omega_u - \Omega_c = 220$$

$$\Omega_u \cdot \Omega_c = 4000$$