

ANALISIS EN FRECUENCIA (NYQUIST)

HOJA *

FECHA

$$1) G(s) H(s) = \frac{1000}{s + 2000}$$

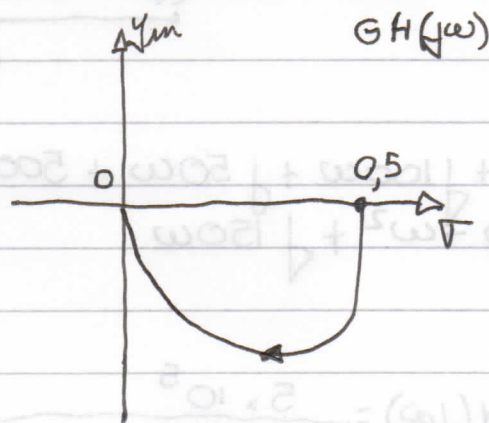
$$s = j\omega \Rightarrow GH(j\omega) = \frac{1000}{2000 + j\omega} \times \frac{2000 - j\omega}{2000 - j\omega}$$

$$GH(j\omega) = \frac{1000(2000 - j\omega)}{(2000)^2 + \omega^2} = \frac{1000 \cdot 2000}{2000^2 + \omega^2} - j \frac{1000\omega}{2000^2 + \omega^2}$$

$$\omega \rightarrow 0 \quad GH(j0) = \frac{1000 \cdot 2000}{2000^2} - j0 = 0,5 - j0$$

$$\omega \rightarrow \infty \quad GH(j\infty) = 0 - j0$$

CER: no hay
CEI: no hay



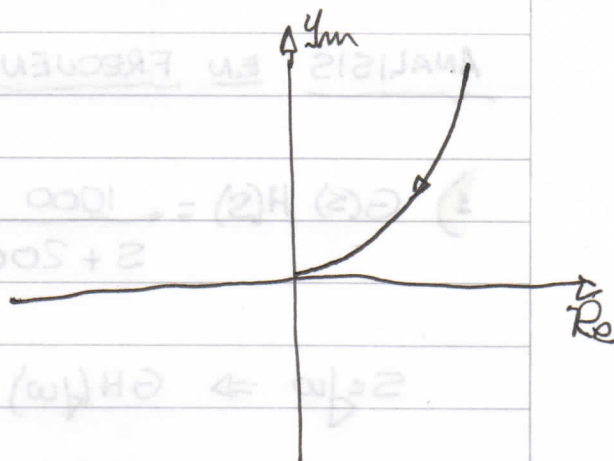
$$2) G(s) \cdot H(s) = \frac{10(s+1)}{s(s+10)}$$

$$P/s = j\omega \Rightarrow GH(j\omega) = \frac{10(1+j\omega)}{(j\omega)(10+j\omega)} = \frac{10(1+j\omega)}{(j\omega)(10+j\omega)}$$
$$= \frac{10}{\omega^2 + 100} + j \frac{10\omega}{\omega^2 + 100}$$

$$GH(j\omega) = \frac{10}{\omega^2(\omega^2 + 100)} + j \frac{10}{\omega(\omega^2 + 100)}$$

$$\omega \rightarrow 0 \quad GH(j\omega) = \infty + j\infty$$

$$\omega \rightarrow \infty \quad GH(j\omega) = 0 + j0$$



$$3) \quad G(s)H(s) = \frac{100}{\left(\frac{s}{50}+1\right)\left(\frac{s}{100}+1\right)} = \frac{100 \times 50 \times 100}{(s+50)(s+100)}$$

$$s = j\omega \Rightarrow GH(j\omega) = \frac{5 \times 10^5}{\underbrace{(j\omega+50)(j\omega+100)}_{\textcircled{1}}}$$

$$\textcircled{1} = -\omega^2 + j100\omega + j50\omega + 5000 \\ = 5000 - \omega^2 + j150\omega$$

lengkap

$$GH(j\omega) = \frac{5 \times 10^5}{5000 - \omega^2 + j150\omega} \times \frac{5000 - \omega^2 - j150\omega}{5000 - \omega^2 - j150\omega}$$

$$GH(j\omega) = \frac{5 \times 10^5 (5000 - \omega^2)}{(5000 - \omega^2)^2 + 150^2 \omega^2} - j \frac{5 \times 10^5 \times 150 \omega}{(5000 - \omega^2)^2 + 150^2 \omega^2}$$

$$\omega \rightarrow 0 \quad GH(j\omega) = \frac{5 \times 10^5 \times 5 \times 10^3}{5 \times 10^3 \times 5 \times 10^3} - j0 = \boxed{100 - j0}$$

$$\omega \rightarrow \infty \quad GH(j\omega) = \frac{-5 \times 10^5 \omega^2}{\omega^4} - j \frac{\omega 5 \times 10^5 \times 150}{\omega^4} = \boxed{-0 - j0}$$

CER ($y_{lm}=0$) \Rightarrow NO HAY

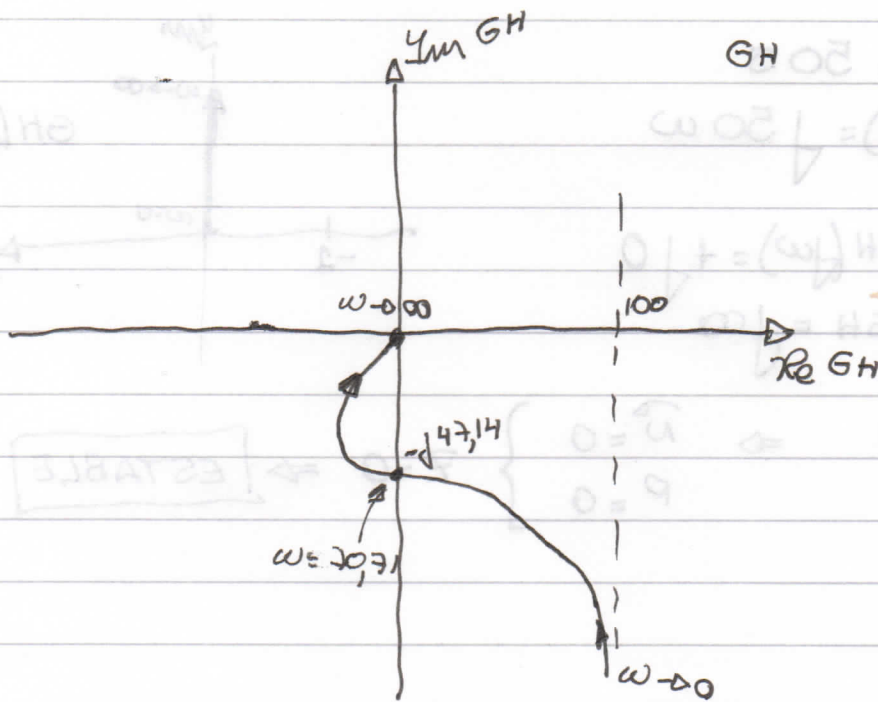
GEI ($Re=0$) $\Rightarrow 5000 - \omega^2 = 0$

$$\omega = \pm \sqrt{5000} = 70,71$$

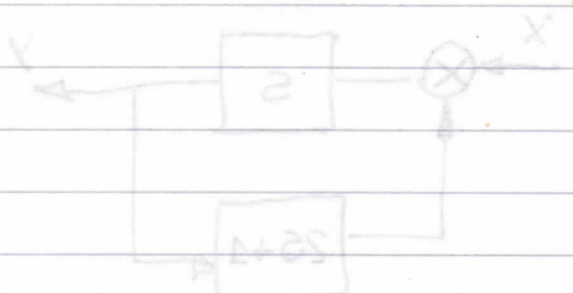
CEI (cont)

$$p/ \omega = 70,71 \Rightarrow GH(j70,71) = 0 - j \frac{250 \times 10^5 \omega}{150^2 \omega^2}$$

$$GH(j70,71) = -j \frac{5 \times 10^5}{150 \times 70,71} = -47,14$$



$$G(s) = \frac{2}{s^2 + 2s + 1}$$



$$GH(s) = \frac{2}{s^2 + 2s + 1}$$