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RT1 - Assistenz - Übung 8 - 13.11.15

Gegeben: Plot → Bode

Lösung: $P(s) = \dfrac{(s+1)^2}{(-s+1)(0{,}01s+1)(0{,}1s+1)} e^{-0{,}0001 \cdot s}$

Check: $|P(0)| = \dfrac{|1|}{|(-1)| \cdot |1| \cdot |1|} = 1 = 0\,dB$ ✓

$\omega = 1$ → Betrag $+20$ → Pole + 2 Null
Phase $+270$ → Inst Pol + 2 Null
$\Big\}\ \pi_1 = +1 \quad \xi_{1,2} = 1$

$\omega = 10$ → Betrag -20 → Pol
Phase -90 → stab. Pol
$\Big\}\ \pi_2 = 10$

$\omega = 100$ → Betrag -20 → Pol
Phase -90 → stab. Pol
$\Big\}\ \pi_3 = 100$

Was fehlt? → Phase ↓ → Totzeit

e^{-Ts} → $\hat{=}\ \frac{\wedge}{T}$ Frequenz von $-57{,}3° = 1$ rad

Phase? $+90$ → $\frac{\wedge}{T}$ → $90 - 57{,}3° \cong 33$

→ $\frac{\wedge}{T} = 10000$ → $T = 0{,}0001$

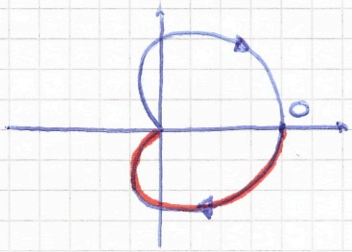
$$\Rightarrow \quad P(s) = \frac{(s+1)^2}{(-s+1)(0{,}01s+1)(0{,}1s+1)} e^{-0{,}0001 \cdot s}$$

Gegeben: Bode → $\Sigma(s)$, Nyquist

$$P(s) = 10\,\frac{0{,}1s+1}{(s+1)^2}$$

Aus Bode: $\omega \to 0$: $|P| = 1$, $\angle(P) = 0$ → 1 (Phase)

$\omega \to \pm\infty$: $|P| = 0$, $\angle(P) = -90°$



Gegeben

1) $P(s) = \frac{1}{s(s+2)}$ $\rightsquigarrow$ Integrator

2) $P(s) = \frac{1}{(s+1)(s+2)}$ $\rightsquigarrow$?

3) $P(s) = \frac{1}{s+2} e^{-s}$ $\rightsquigarrow$ Totzeit

4) $P(s) = \frac{1}{(-s+1)(s+2)}$ $\rightarrow$?

$$\angle\left(\frac{1}{(s+1)(s+2)}\right) = ?$$

$$\lim_{\omega\to\infty} \angle\left(\frac{1}{(s+1)(s+2)}\right) = \lim_{\omega\to\infty}\left(\angle(1) - \angle(j\omega+1) - \angle(j\omega+2)\right)$$

$$= \lim_{\omega\to\infty}\left(\arctan(0) - \arctan\left(\frac{\omega}{1}\right) - \arctan\left(\frac{\omega}{2}\right)\right)$$

$$= 0 - \frac{\pi}{2} - \frac{\pi}{2} = -\pi$$

$$\lim_{\omega\to\infty} \angle\left(\frac{1}{(-s+1)(s+2)}\right) = \lim_{\omega\to\infty}\left(\angle(1) - \angle(-j\omega+1) - \angle(j\omega+2)\right)$$

$$= \lim_{\omega\to\infty}\left(\arctan(0) - \arctan\left(\frac{-\omega}{1}\right) - \arctan\left(\frac{\omega}{2}\right)\right)$$

$$= 0 + \frac{\pi}{2} - \frac{\pi}{2} = 0$$