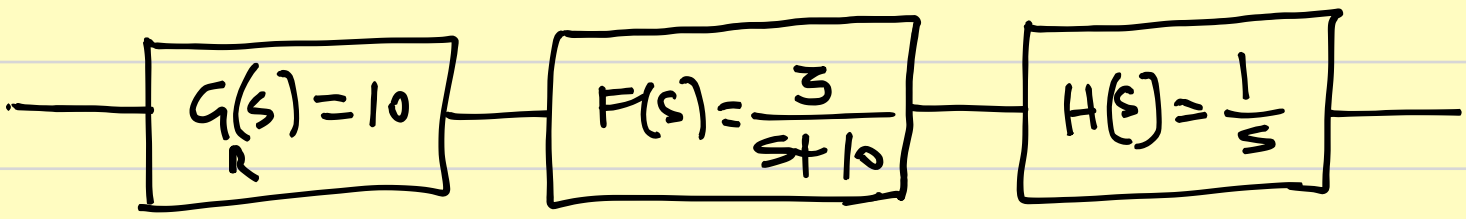
1.




$$G(s) = G_R(s) \cdot F(s) \cdot H(s) = 10 \cdot \frac{3}{s+10} \cdot \frac{1}{s}$$

$$G_R(j\omega) = 10 \longrightarrow |G_R(j\omega)|_{dB} = 20 \log 10 = 20$$

$$\angle G_R(j\omega) = \arctan \frac{0}{10} = 0$$

$$F(j\omega) = \frac{3}{j\omega+10} \cdot \frac{-j\omega+10}{-j\omega+10} = \frac{30 - 3\omega j}{10^2+\omega^2} = 3\,\frac{10 - j\omega}{10^2+\omega^2}$$

$$|F(j\omega)| = \frac{3}{10^2+\omega^2}\sqrt{10^2+\omega^2} = 3 \cdot (10^2+\omega^2)^{-1/2}$$

$$|F(j\omega)|_{dB} = 20 \log |F(j\omega)| = 20 \cdot \log 3 - 20 \cdot \frac{1}{2} \log(10^2+\omega^2)$$

$$= 9{,}54 - 10 \log(10^2+\omega^2)$$

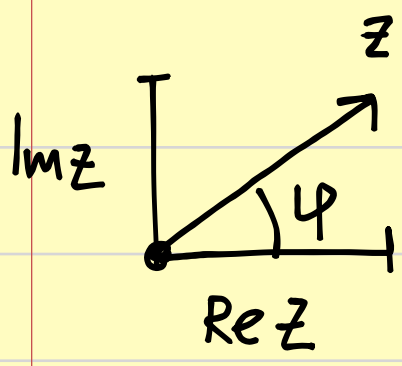
$$\angle F(j\omega) = \arctan \frac{-\omega}{10}$$

$$H(j\omega) = \frac{1}{j\omega} \cdot \frac{-j\omega}{-j\omega} = \frac{-j\omega}{\omega^2} = \frac{-j}{\omega}$$

$$|H(j\omega)| = \frac{1}{\omega}$$

$$\angle H(j\omega) = \arctan \frac{-1/\omega}{0} = \frac{-\pi}{2}$$

$$\boxed{A \longrightarrow A_{dB} = 20 \log A}$$

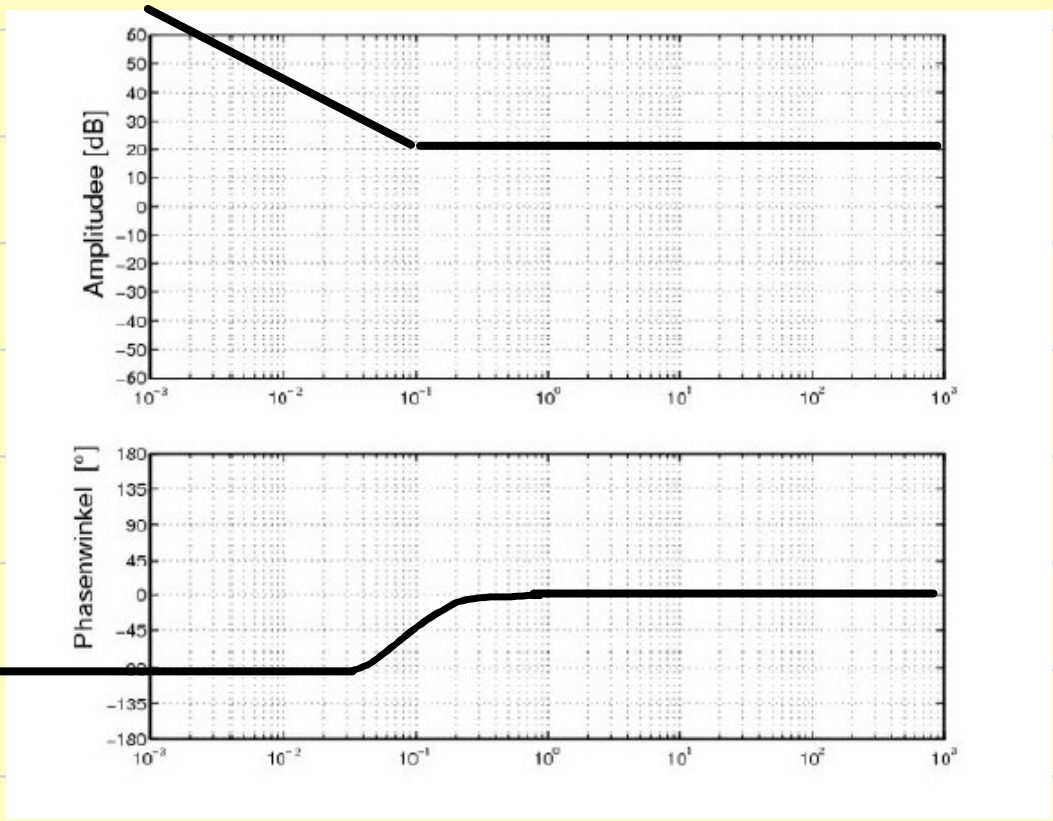



$$\varphi = \arctan \frac{\mathrm{Im}\,z}{\mathrm{Re}\,z}$$

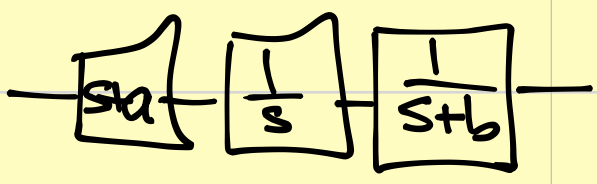
$$z = 10 - j\omega \rightarrow \varphi = \arctan \frac{-\omega}{10}$$

$$|G_R|_{dB} = 20 \qquad |F|_{dB} = 9{,}54 - 10\log(\omega^2 + 10^2) \qquad |H|_{dB} = 20\log\frac{1}{\omega}$$

$$\angle G_R = 0° \qquad \angle F = \arctan\frac{-\omega}{10} \qquad \angle H = -\frac{\pi}{2}$$



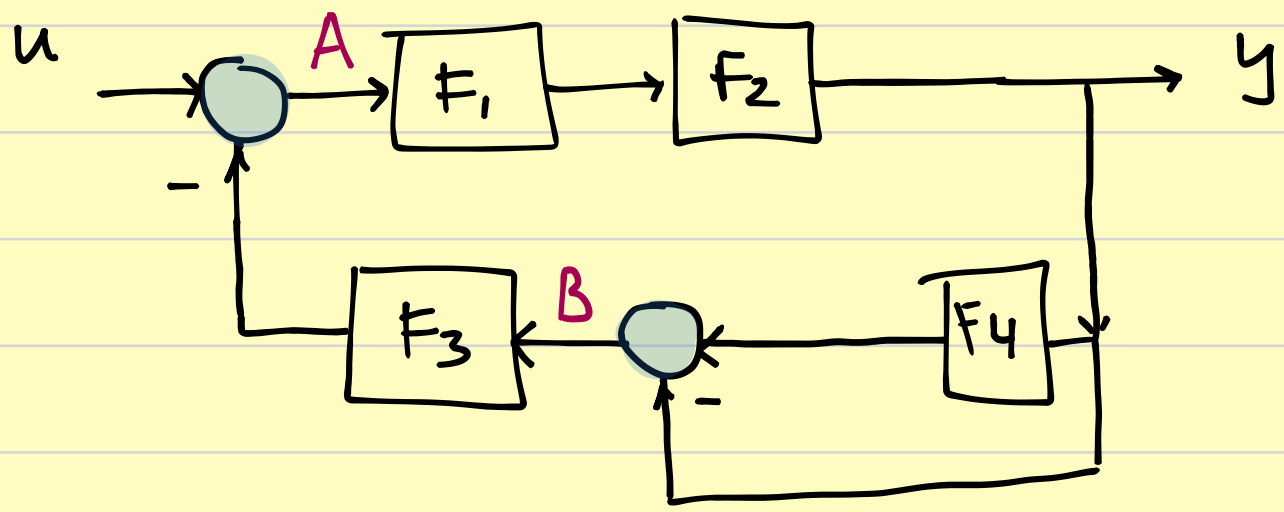

⑥ $\frac{3}{s+10} = \frac{3}{10} \cdot \frac{1}{1+\frac{s}{10}} = \frac{k}{1+\omega_E T}$ PT1-Glied




$$F(s) = \frac{s+a}{s^2+bs} = \frac{s+a}{s(s+b)} = (s+a)\cdot\frac{1}{s}\cdot\frac{1}{s+b}$$

① $\frac{1}{s+b} = \frac{1}{b} \cdot \frac{1}{1+\frac{s}{b}} \rightarrow \omega_E = \frac{1}{b}$

2.




$$A = u - B F_3 \qquad (1)$$

$$y = A \cdot F_1 \cdot F_2 \qquad (2) \qquad \frac{y}{u} ?$$

$$B = y F_4 - y \qquad (3)$$

$$(2)+(1) \rightarrow \quad y = \left[u - B F_3\right] \cdot F_1 \cdot F_2 \qquad (4)$$

$$(4)+(3) \rightarrow \quad y = \left[u - y(F_4 - 1) F_3\right] F_1 F_2$$

$$\frac{y}{F_1 F_2} + y(F_4 - 1) F_3 = u$$

$$y\left[\frac{1}{F_1 F_2} + F_3(F_4 - 1)\right] = u \rightarrow$$

$$\rightarrow \frac{y}{u} = \frac{F_1 F_2}{1 + F_1 F_2 F_3 (F_4 - 1)}$$