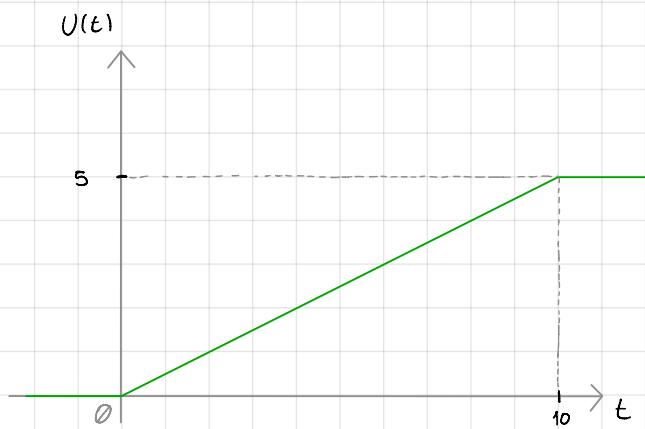


## Funzione Con Polo Doppio

$$G(s) = 14 \cdot \frac{10s + 1}{(s+2)^2}$$

Con  $U(t) = \begin{cases} 0 & t < 0 \\ \frac{1}{2}t & 0 \leq t < 10 \\ 5 & t \geq 10 \end{cases}$

(1) Grafico  $U(t)$



$$\begin{cases} U_1(t) = \frac{1}{2}t \cdot \mathbb{1}(t) \\ U_2(t) = -\frac{1}{2}(t-10) \cdot \mathbb{1}(t-10) \end{cases}$$

\* Forme Standard

(2) Sceglio il segnale fittizio:  $\hat{U}(t) = t \cdot \mathbb{1}(t) \Leftrightarrow \hat{U}(s) = \frac{1}{s^2}$

$$\Rightarrow \hat{Y}(s) = 14 \cdot \frac{10s + 1}{s^2(s+2)^2} = \underbrace{140 \cdot \frac{s+0.1}{s^2(s+2)^2}}_{\text{Forme Standard}} = \frac{\varepsilon_1}{s} + \frac{\varepsilon_2}{s^2} + \frac{\varepsilon_3}{s+2} + \frac{\varepsilon_4}{(s+2)^2}$$

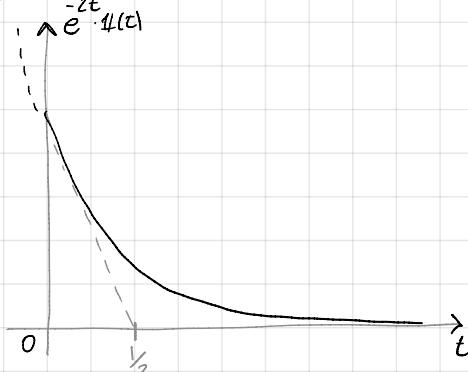
$$\begin{aligned} &= \varepsilon_1 s (s+2)^2 + \varepsilon_2 (s+2)^2 + s^2 \varepsilon_3 (s+2) + \varepsilon_3 s^2 = \varepsilon_1 s (s^2 + 4s + 4) + \varepsilon_2 (s^2 + 4s + 4) + \\ &\quad + s^2 \varepsilon_3 (s+2) + \varepsilon_3 s^2 \\ &= s^3 (\varepsilon_1 + \varepsilon_3) + s^2 (4\varepsilon_1 + \varepsilon_2 + 2\varepsilon_3 + \varepsilon_4) + (4\varepsilon_1 + 4\varepsilon_2) + \frac{4\varepsilon_2}{0.1} \end{aligned}$$

$$\cdot \varepsilon_2 = \lim_{s \rightarrow 0} s^2 \cdot \hat{Y}(s) = \frac{0.1}{4} = 0.025$$

$$\cdot \varepsilon_4 = \lim_{s \rightarrow -2} (s+2)^2 \cdot \hat{Y}(s) = -\frac{1.9}{4} = 0.475$$

$$\varepsilon_1 + \varepsilon_3 = 0 \Rightarrow \varepsilon_3 = -\varepsilon_1 = 0.475, \quad \varepsilon_2 + \varepsilon_4 = 0.25 \Rightarrow \varepsilon_4 = 0.225$$

$$\hat{Y}(t) = 140 \cdot (0.225 + 0.025t - 0.225e^{-2t} - 0.475e^{-2t}) \quad t \geq 0 \quad \text{con } \hat{U}(t) = t \cdot \mathbb{1}(t)$$



$$\begin{aligned} f_2 &= t e^{-2t} \\ \Rightarrow f_2 &= \bar{e}^{-2t} - 2t \bar{e}^{-2t} = 0 \quad \text{per } \bar{t} = \frac{1}{2} \end{aligned}$$

(3) Scrivo  $y(t)$  Reale

$$* \quad \hat{U}_2(t) = \frac{1}{2} (t-10) \mathbb{U}(t-10) \Leftrightarrow \hat{U}_2(s) = \frac{1}{s^2} e^{-10s}$$

$$y(t) = y_1(t) + y_2(t)$$

$$\begin{cases} y_1(t) = \frac{1}{2} \hat{g}(t) \\ y_2(t) = -\frac{1}{2} \hat{g}(t-10) \cdot \mathbb{U}(t-10) \end{cases}$$

(4) Considerazioni

\* Audio

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

$$\zeta_1 = -\frac{1}{10} \rightarrow \omega_1 = 0.1 \text{ rad/s}$$

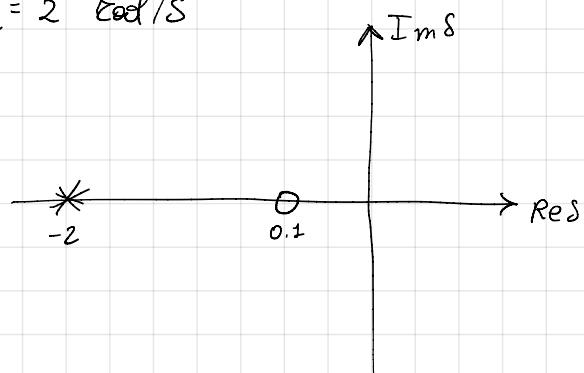
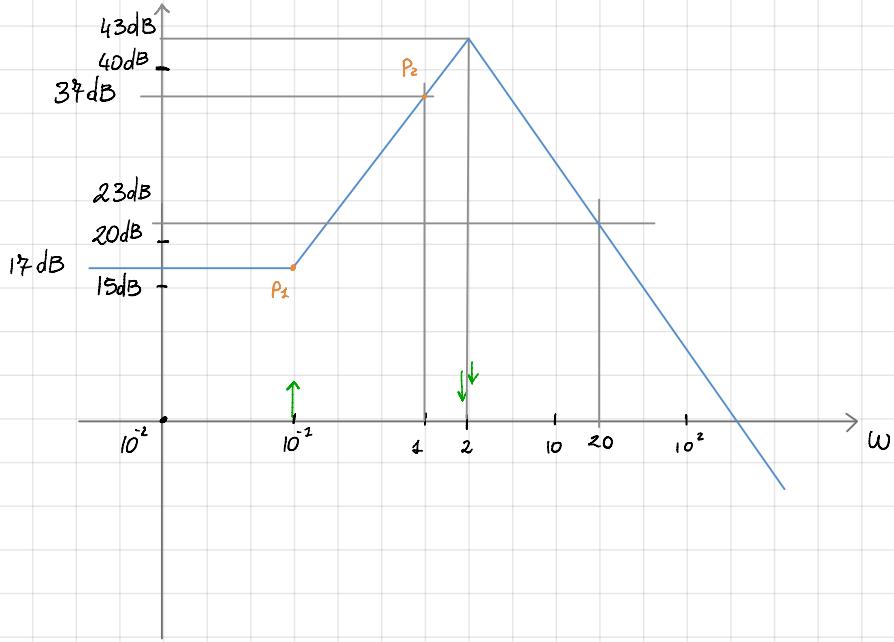
$$P: \omega_2 = 2 \text{ rad/s}$$

$$\Rightarrow \omega \in [10^{-2}; 10^2] \text{ rad/s}$$

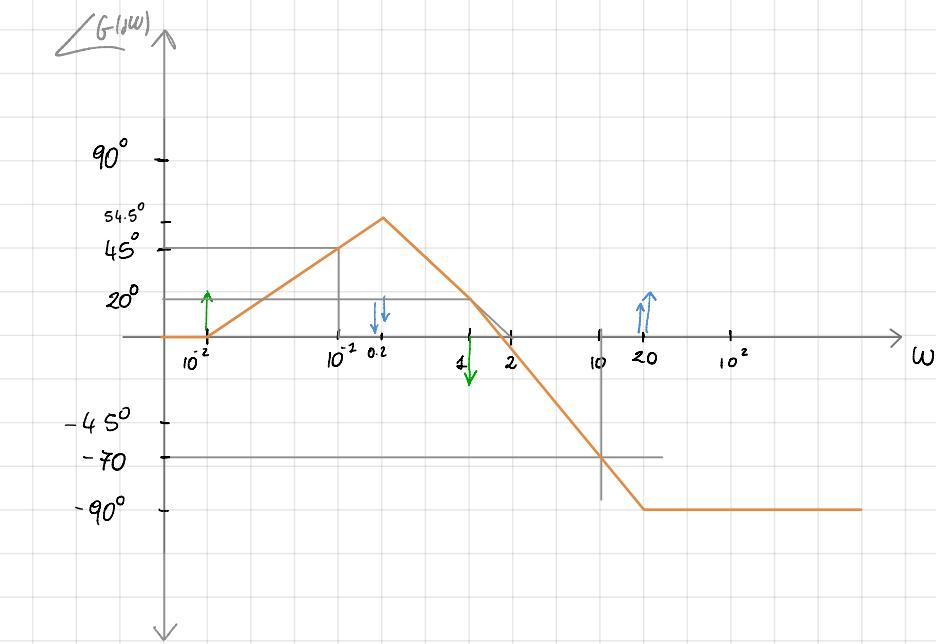
$$G(0) = \frac{1}{2} \cdot \frac{1}{1^2} = \frac{1}{2} = 0 \quad |G(0)|_{dB} \approx 17 dB$$

$$G(\omega \rightarrow \infty) = \begin{cases} 1 \text{ zero} \\ 2 \text{ poli} \end{cases} \Rightarrow -20 dB/\text{dec}$$

$$|G(j\omega)|_{dB}$$



\* Calcolo retta tra  $P_1$  e  $P_2$



\* IMPO

\* Risposta in freq



$$1(t) - 1(t-1) \Rightarrow \frac{1}{s} - \frac{e^{-s}}{s} = \frac{-e^{-s} + 1}{s}$$

Come lo scrivo in Matlab ??