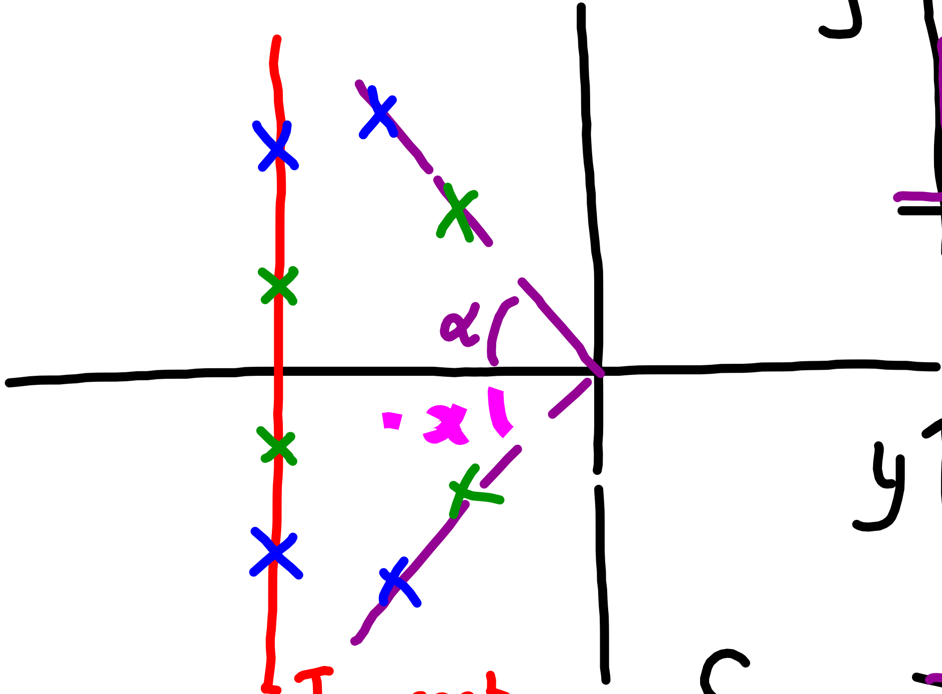
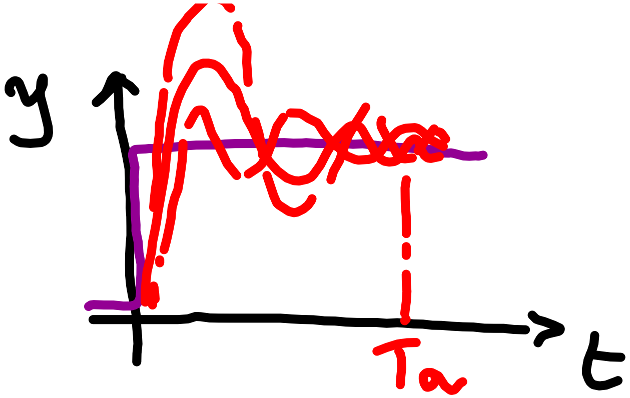
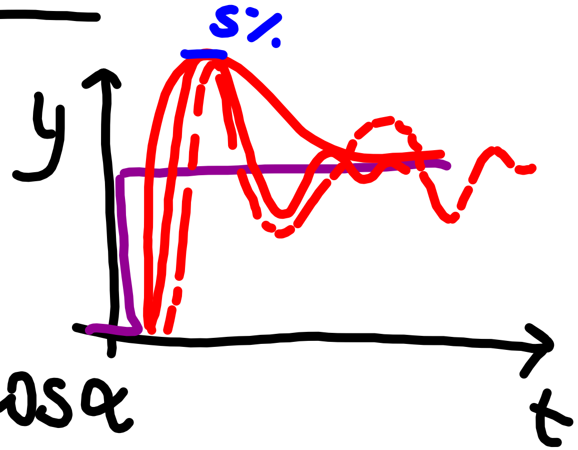
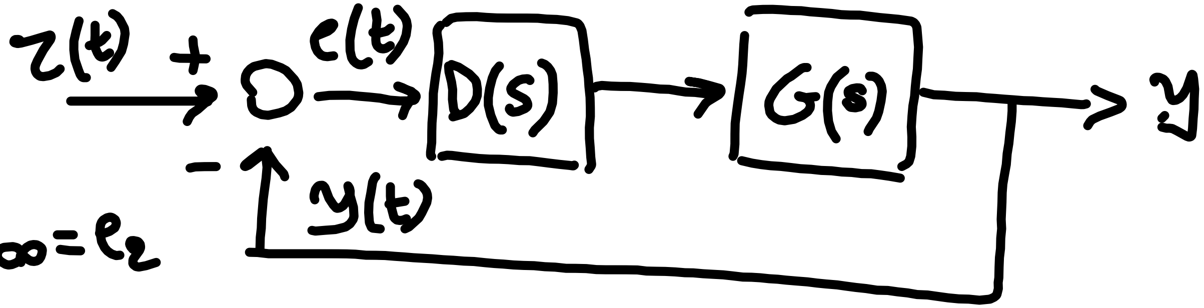


$$T_a = \text{cost} = \frac{3}{\delta \omega_n}$$

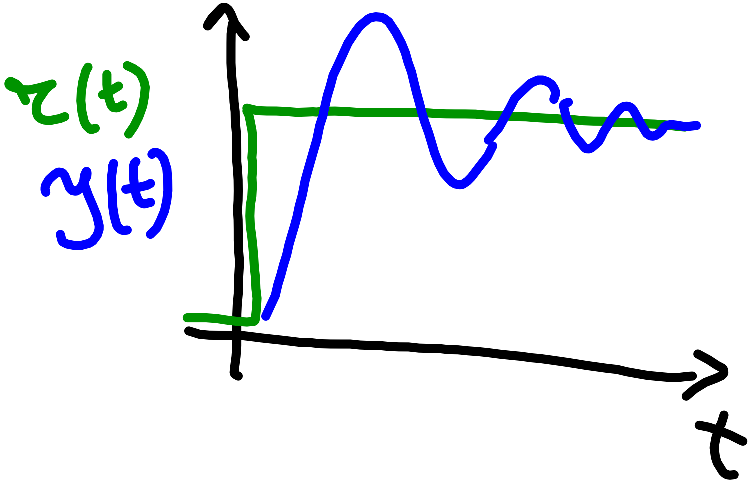


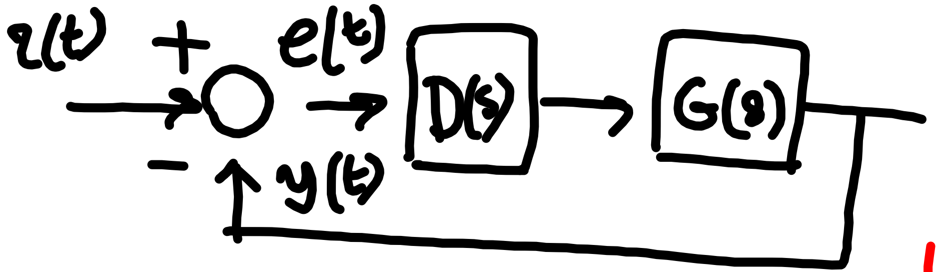


$$\delta = \cos\alpha$$



$\lim_{t \to \infty} e(t) = e_{\infty} = e_2$





$$\lim_{t\to\infty} e(t) = \lim_{s\to 0} s\,\underbrace{E(s)} = \lim_{s\to 0} \cancel{s}\,\cancel{R(s)}\,\frac{1}{1+D(s)G(s)} \qquad R(s) = \frac{1}{\cancel{s}^{2}}$$

$$= \lim_{s\to 0} \frac{1}{1+D(s)G(s)} = 0$$

$$\lim_{s\to 0} D(s)G(s) = \infty$$

$$D(s)G(s) = \frac{\boxed{K}(1+q_1 s)\cdot \ldots (1+q_m s)}{s^N (1+p_1 s)(1+p_2 s)\ldots(1+p_n s)}$$

$N=0$ sistema 'di tipo $\emptyset$'

$N=1$ " 'di tipo 1'

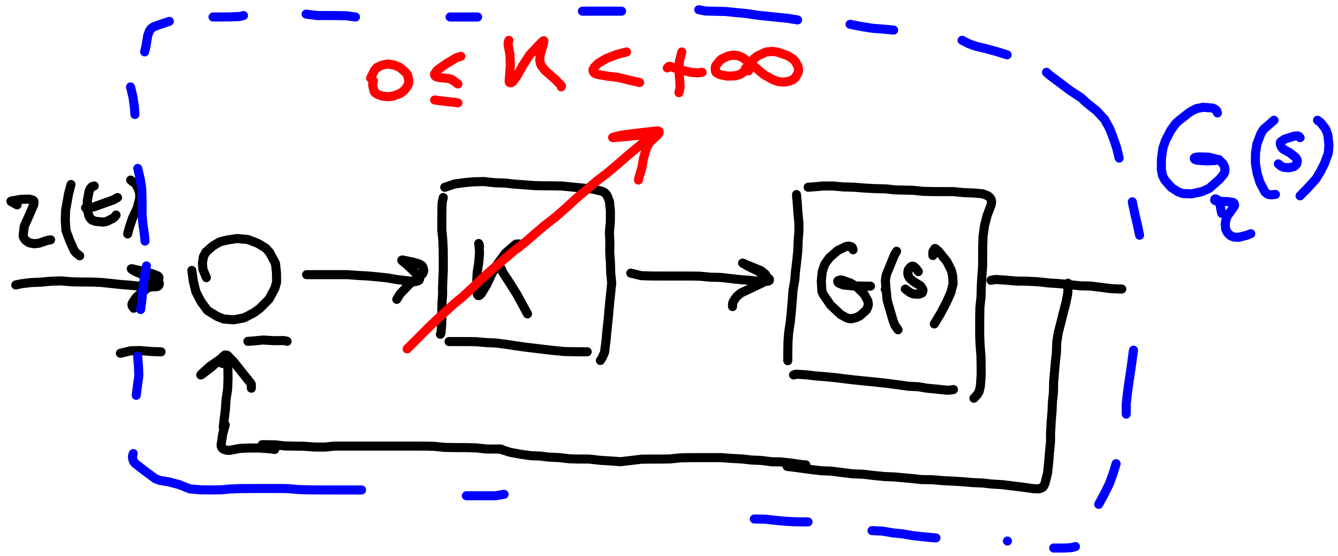
$N=2$ s^2

$$\boxed{D(s)\,G(s)} = K\,\frac{(1+q_1 s)\cdots(1+q_m s)}{s\,(1+p_1 s)\cdots(1+p_n s)}$$

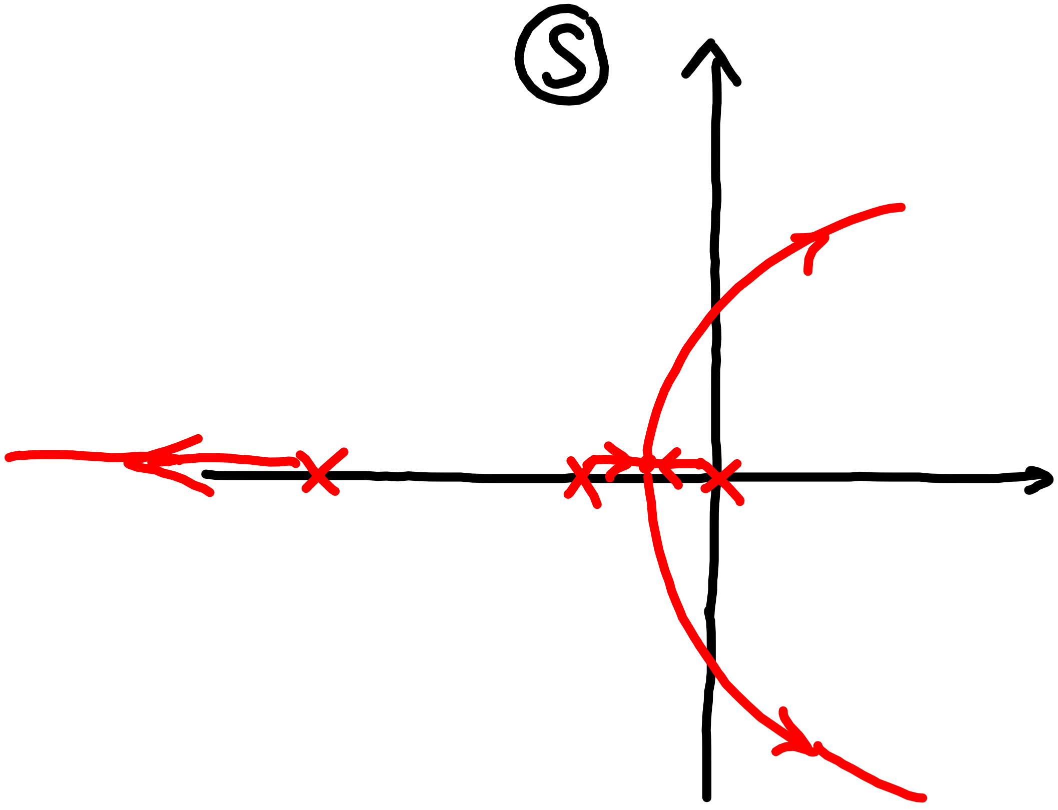
se $G(s)$ e' di tipo 0'

$$D(s) = \frac{1}{s}$$

$$PID(s) = P + \boxed{\frac{I}{s}} + D \cdot s$$

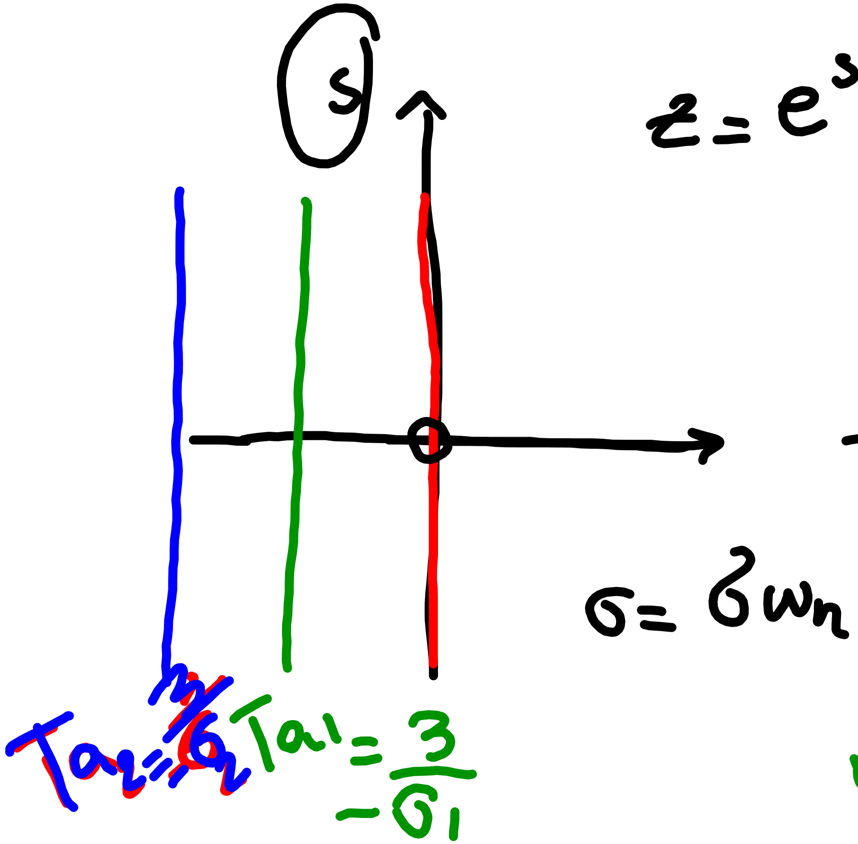


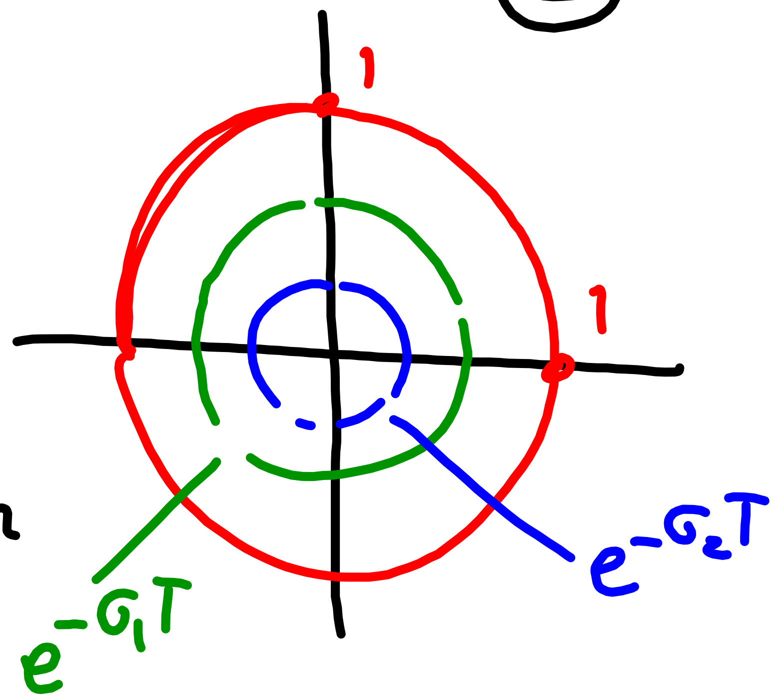
$$G_z(s) = \frac{K\,G(s)}{1 + K\,G(s) = F(s)}$$

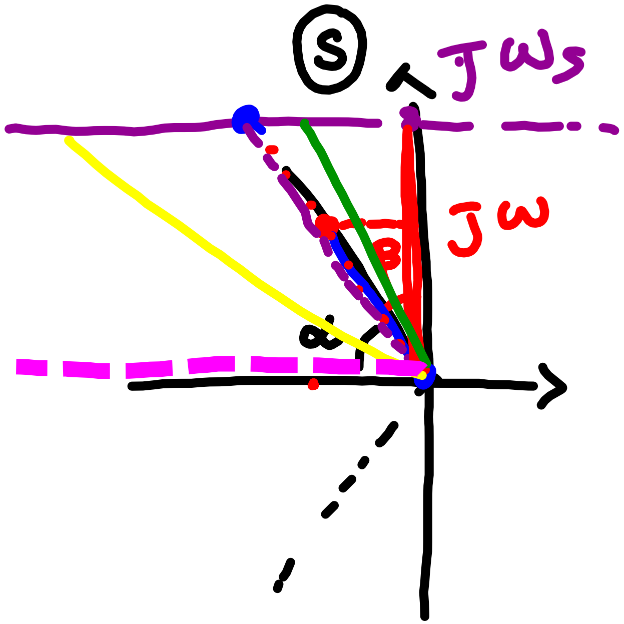


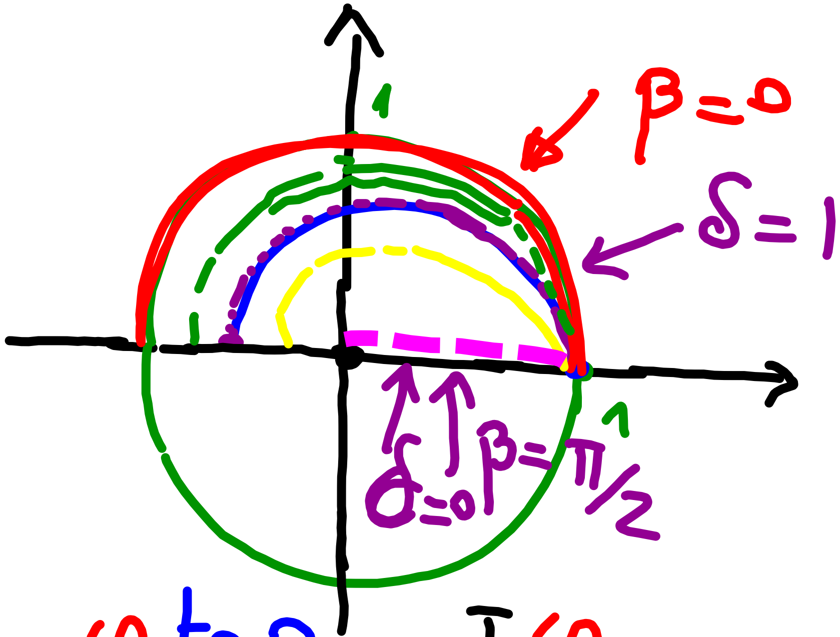
$$G(s) = \frac{1}{s(s+1)(s+10)}$$

$z = e^{sT}$


s
$\sigma = \zeta\omega_n$
$T_{a2} = \frac{3}{-\sigma_2}$
$T_{a1} = \frac{3}{-\sigma_1}$


z
1
1
$e^{-\sigma_1 T}$
$e^{-\sigma_2 T}$





$\delta = \cos\alpha$ $\quad z = e^{sT} = e^{-\varphi \, tg\beta} \cdot e^{j\varphi}$ $\quad \varphi = \omega T$

Specifiche

- nel tempo
  - 1) in transitorio — T_a, $S\%$
  - 2) a regime — e_r
- in frequenza — M_a, M_f

$$G(s)\Big|_{s=j\omega}$$

$$G(j\omega)$$

Risp. freq. $\begin{cases} \text{Diagrammi di Bode} \\ \text{Diagramma di Nyquist} \end{cases}$

Diagrammi Bode

$$G(j\omega)$$

$$A = |G(j\omega)| \qquad \varphi = \arg\left(G(j\omega)\right)$$

Diagramma di Nyquist

$1 < M_a = \frac{1}{|G(j\omega)|}$

$M_f = \pi - \arg G(j\omega)$