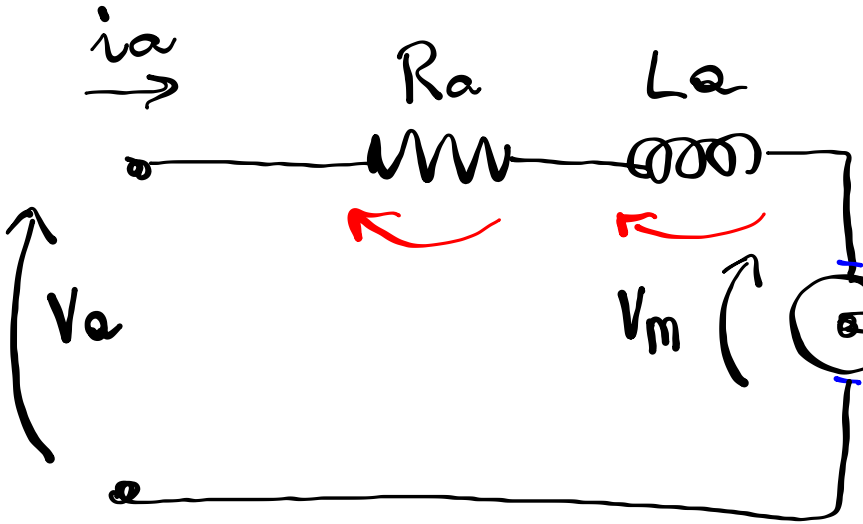


$y(t) = \omega(t)$

C_c, J, f

$$x(t) = \begin{bmatrix} i_a(t) \\ \omega(t) \end{bmatrix}$$

$$\begin{cases} V_a(t) = R_a i_a(t) + L_a \dfrac{d\, i_a(t)}{dt} + K_m\, \omega(t) \\ J\dot{\omega}(t) = K_m \cdot i_a(t) - f\, \omega(t) - C_c(t) \end{cases}$$

$$u(t) = \begin{bmatrix} V_a \\ C_c \end{bmatrix}$$

Modello per l'esercizio

$$y(t) = \alpha(t) \quad \text{con} \quad \omega(t) = \dot{\alpha}(t)$$

$$u(t) = V_a(t)$$

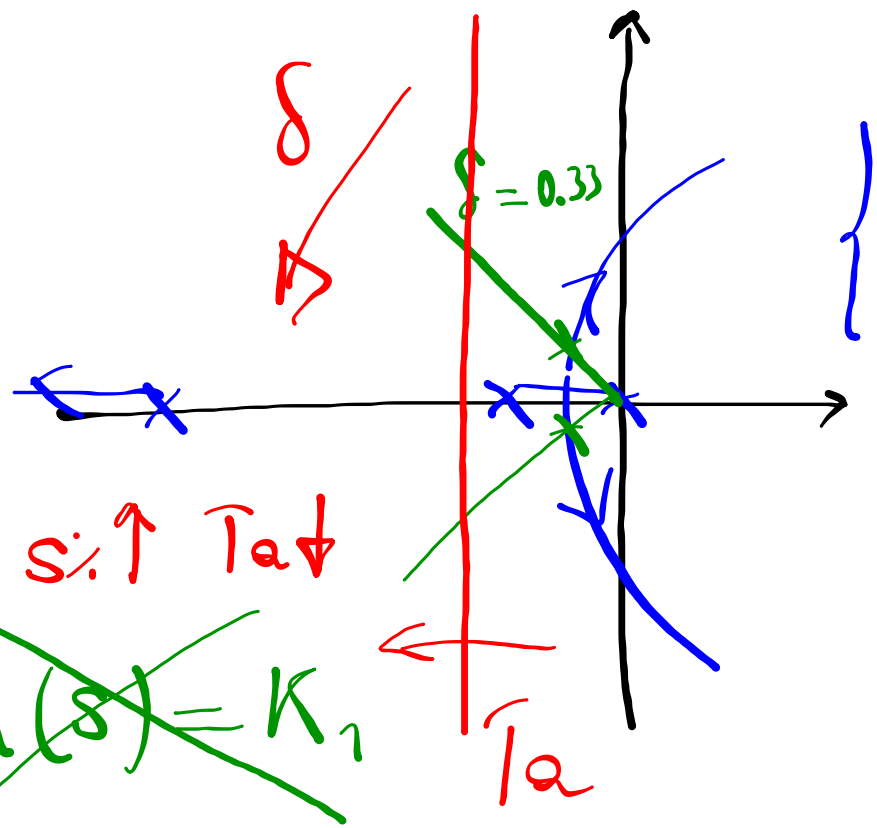
$$x = \begin{bmatrix} i_a(t) \\ \omega(t) \\ \alpha(t) \end{bmatrix}$$

$$R(s) = K \frac{1 + s/10}{1 + s/150}$$

Rete anticipatrice

$s = 0$ → Guadagno statico unitario

$$\begin{cases} T_a \leq 0.5\,s \\ S\% \leq 35\% \quad (\delta \geq 0.3) \end{cases}$$



$$S\% = 100\, e^{-\frac{\delta\pi}{\sqrt{1-\delta^2}}}$$

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

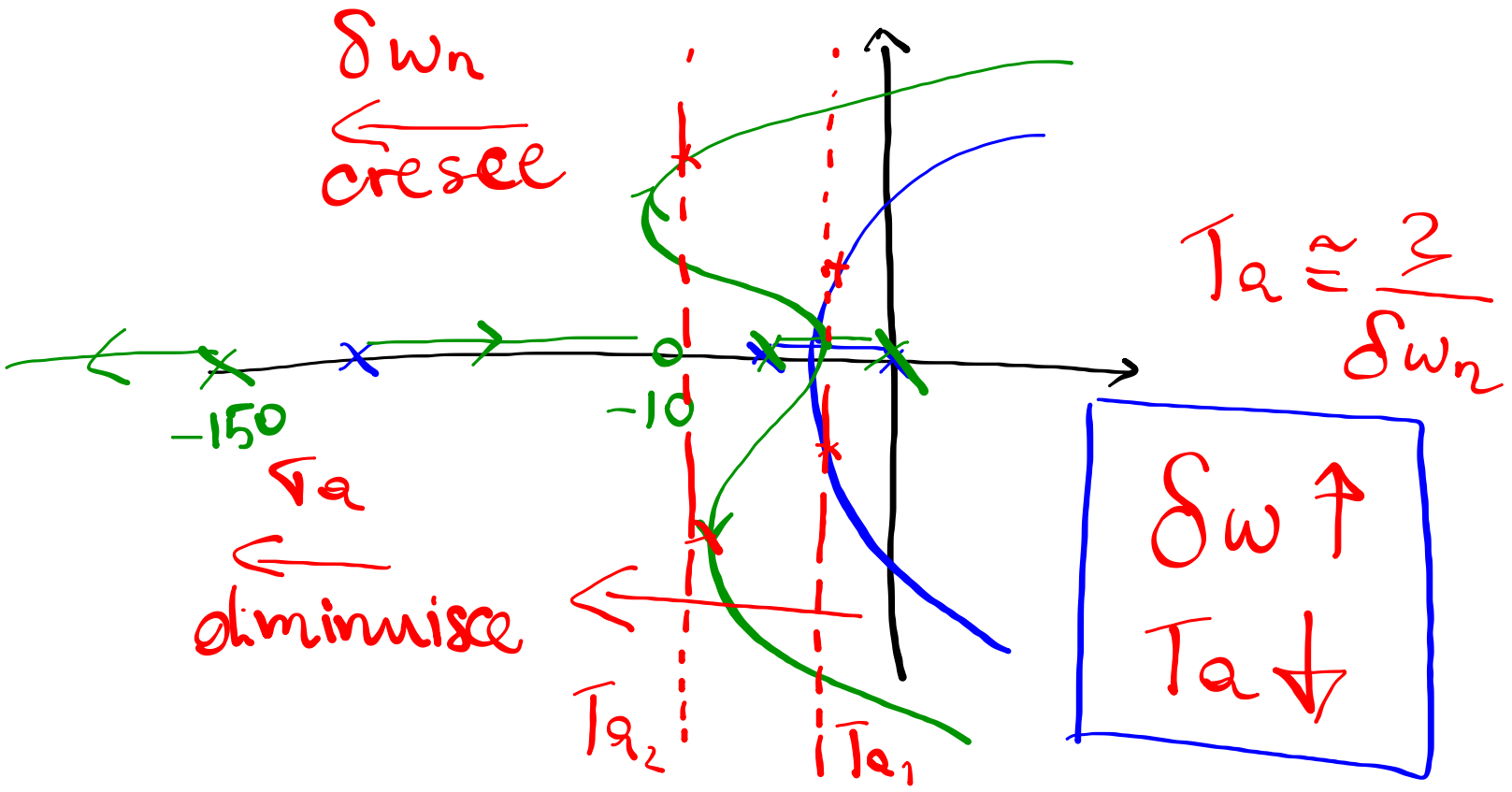
$K\uparrow \Rightarrow S\%\uparrow \; T_a\downarrow$

~~$R(s) = K_1$~~

$\exists K$:

$S\% \leq 35\%$

$T_a \leq 0.5\,s$?


δωn
cresce
-150
-10
Ta
diminuisce
Ta2
Ta1
Ta ≅ ζ / δωn
δω ↑
Ta ↓

Primo tentativo

$K_2 = 2639$

$\begin{cases} T_a = 0.2\,s & \text{OK} \\ S\% = 45\% & (\leq 35\%) \end{cases}$

$K \downarrow \Rightarrow S\% \downarrow \Rightarrow T_a \uparrow$

Secondo tentativo

$K_2 = 1500$

$\begin{cases} T_a = 0.23\,s \\ S\% = 33\% \quad (35\%) \end{cases}$

OK

$R(z)$ dato $R(s)$

$T = 0.05\,s$

Tustin

$$R(z) = R(s)\Big|_{s = \frac{2}{T}\frac{z-1}{z+1}}$$

approssimazione di $z = e^{sT}$

- Inserire dispositivo tenuta ordine zero (ZOH)
- Peggioramento margini stabilità (M_f)
- Influisce sulla sovraelongazione

Sist. a TD

$K = 1500$

$\begin{cases} T_a = 0.25\,s \\ S\% = 40\% \end{cases}$

$K = 800$

$\begin{cases} T_a = 0.42\,s \\ S\% = 35\% \end{cases}$

$K \downarrow \Rightarrow S\% \downarrow \; T_a \uparrow$