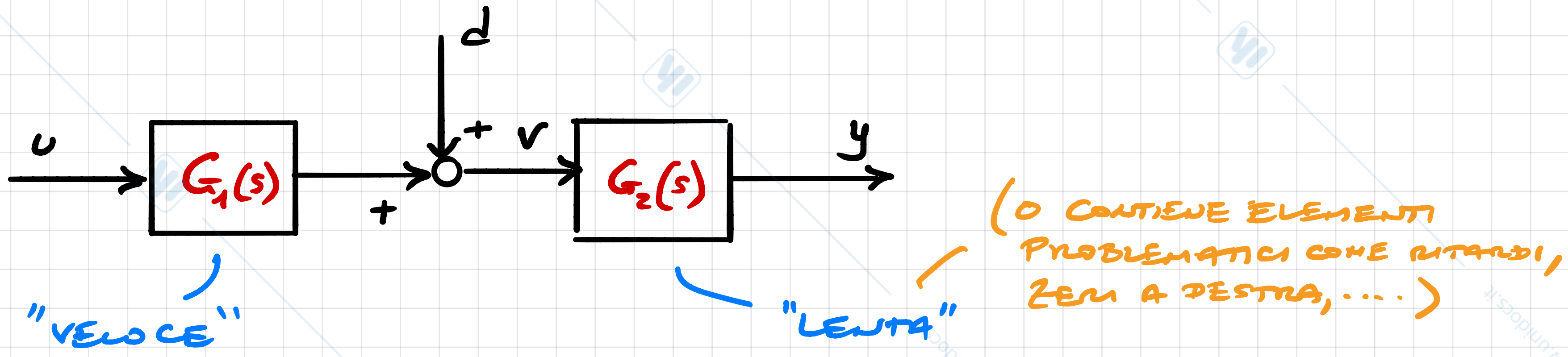
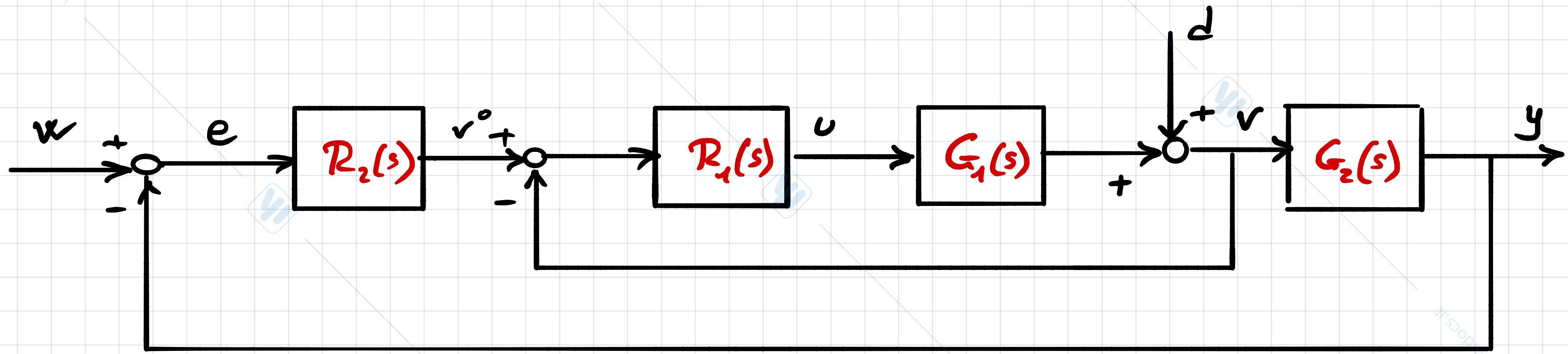
CONTROLLO IN CASCATA

– Controllo in cascata



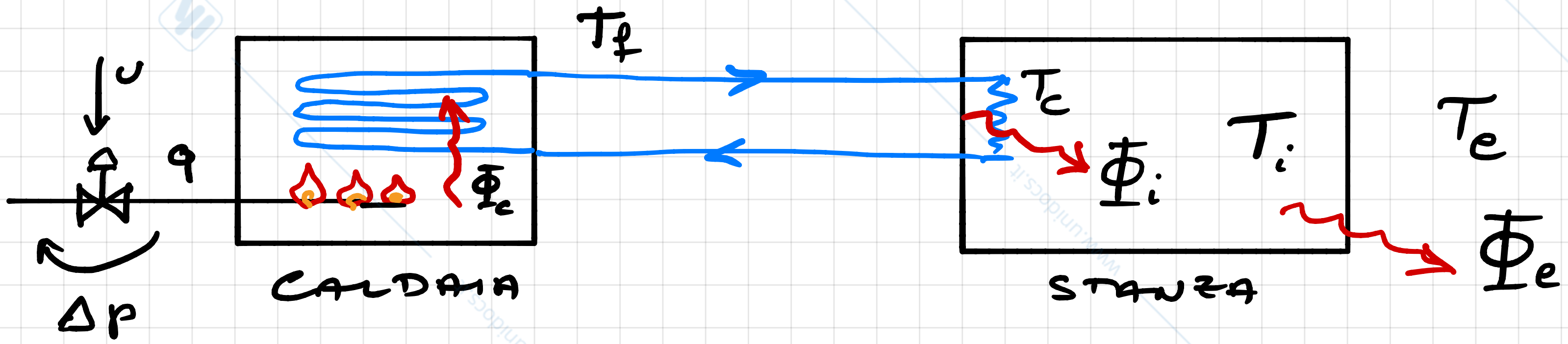
– SE v È MISURABILE PUÒ ESSERE CONVENIENTE IL **CONTROLLO IN CASCATA**

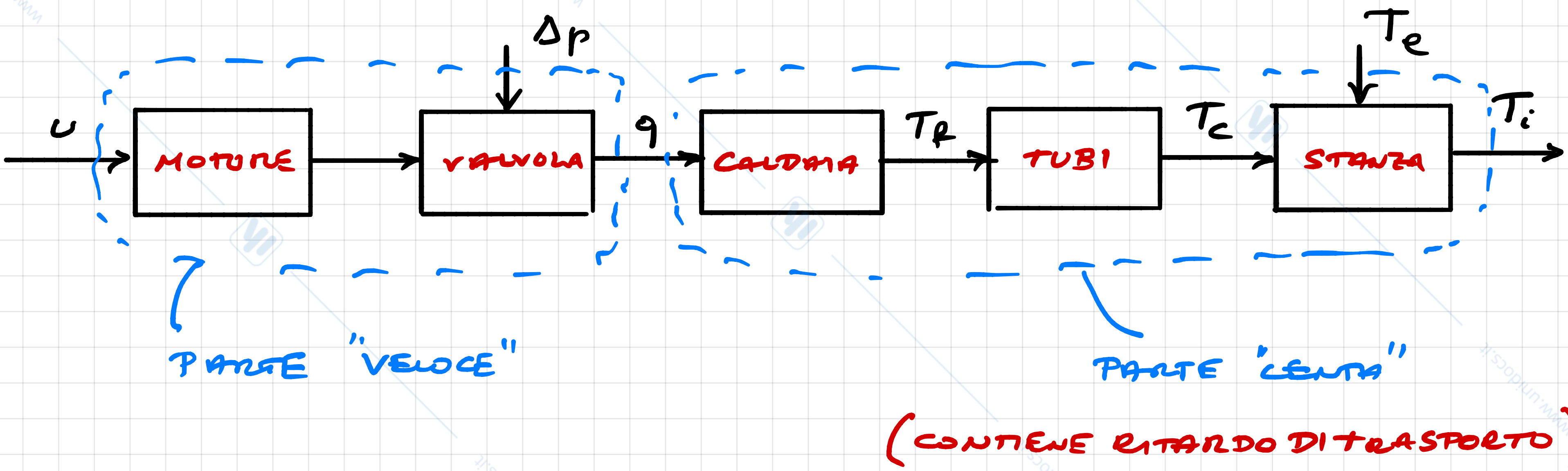


– TALE SCHEMA È EFFICACE PER ATTENUARE MEGLIO IL DISTURBO d

- Esempio 1

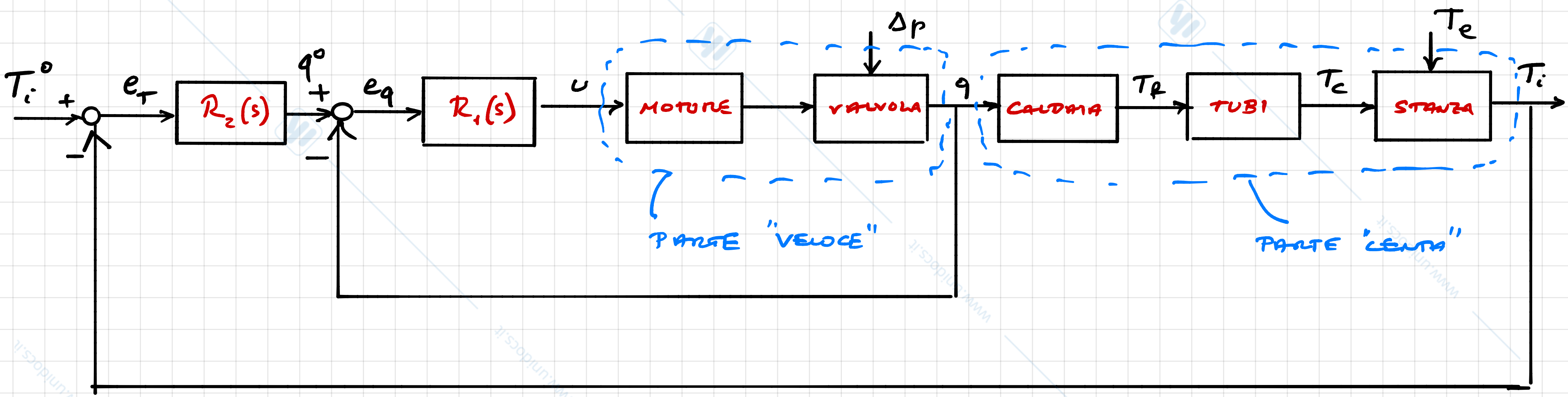
- Controllo di temperatura di una stanza





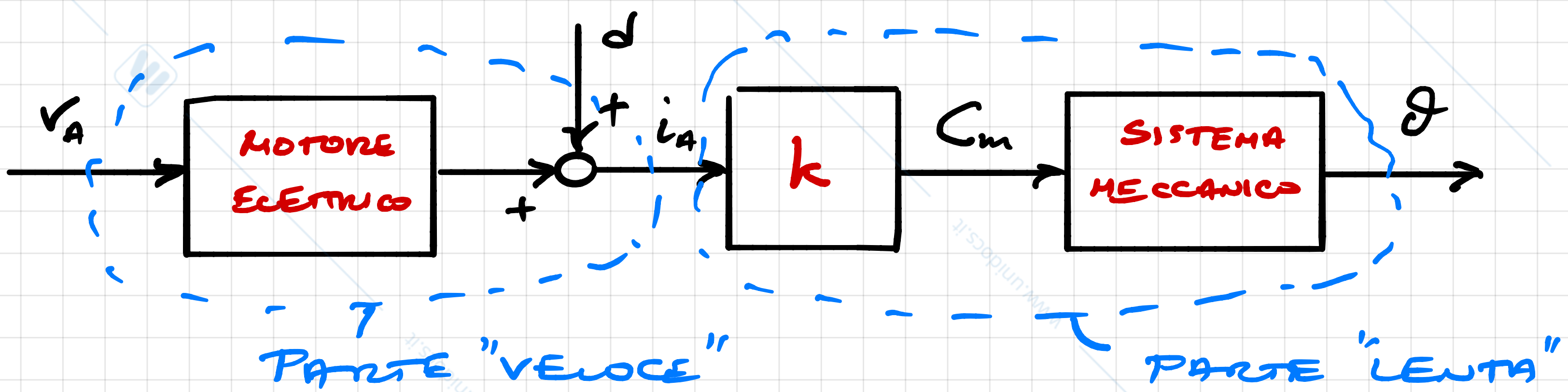
- SE q È MISURABILE PUÒ ESSERE USATA PER IL CONTROLLO IN CASCATA

- Esempio 1 - Controllo in Cascata



– ESEMPIO 2

– CONTROLLO DI SISTEMI ELETTROMECCANICI



v_A TENSIONE DI ARMATURA

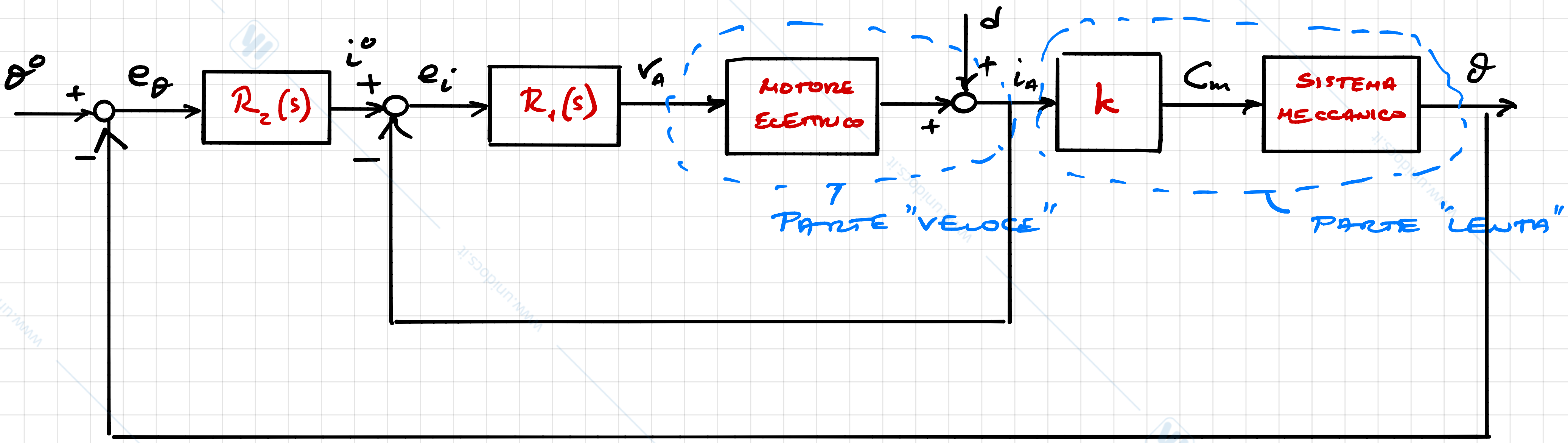
i_A CORRENTE DI ARMATURA

C_m COPPIA MOTRICE

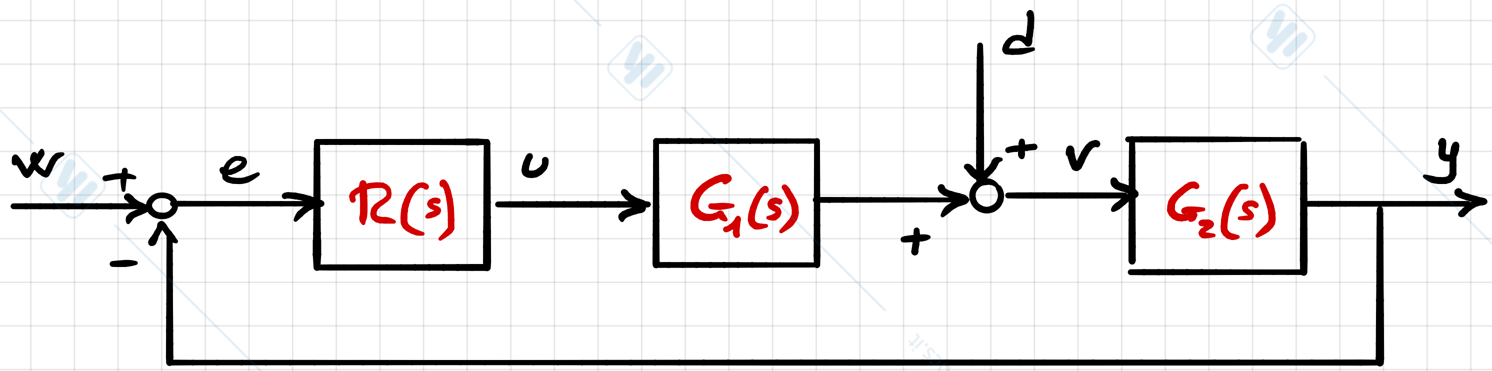
ϑ POSIZIONE ANGOLARE

– SE i_A È MISURABILE PUÒ ESSERE USATA PER IL CONTROLLO IN CASCATA

- ESEMPIO 2 - CONTROLLO IN CASCATA



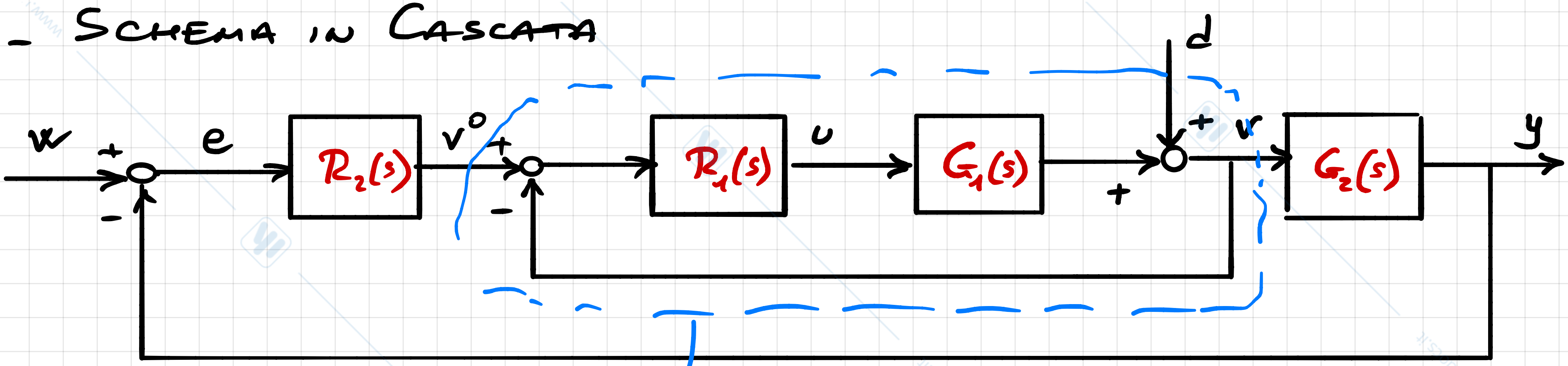
– Schema Standard

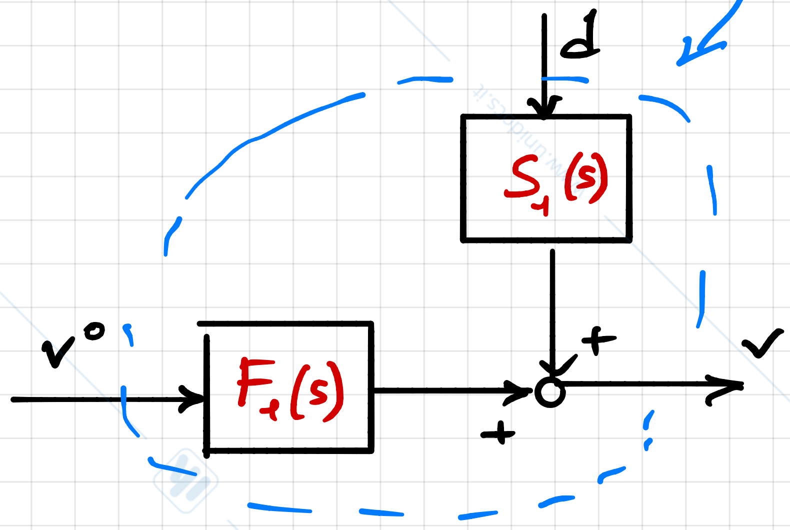


$$G_{yd}(s) = \frac{G_2(s)}{1 + \underbrace{R(s)G_1(s)G_2(s)}_{L(s)}} = \underbrace{S(s)}_{\text{attenua in } [0, \omega_c]} G_2(s)$$

ω_c può avere limitazioni!

- SCHEMA IN CASCATA





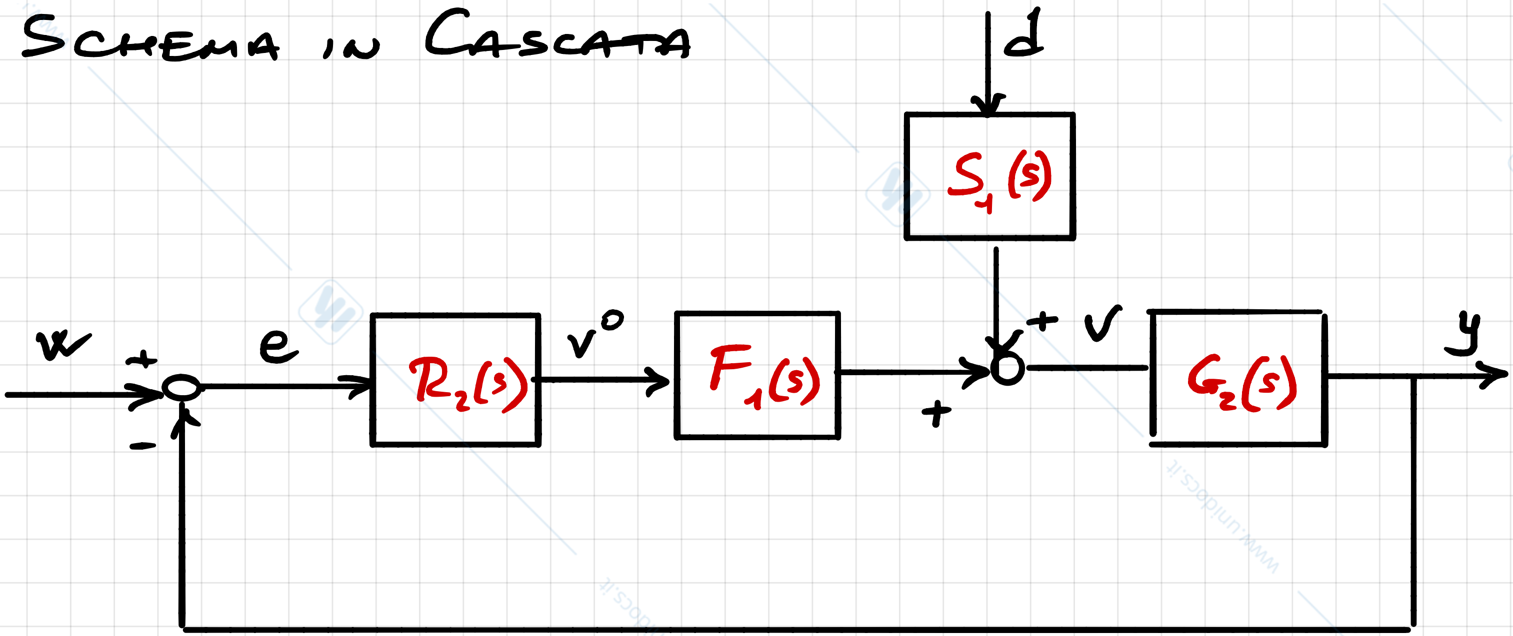
$$F_1(s) = \frac{R_1(s)G_1(s)}{1 + R_1(s)G_1(s)}$$

$$S_1(s) = \frac{1}{1 + R_1(s)G_1(s)}$$

(ATTENUA IN $[0, \omega_{c1}]$

ω_{c1} PUÒ ESSERE ARBITRARIAMENTE GRANDE !

- Schema in Cascata



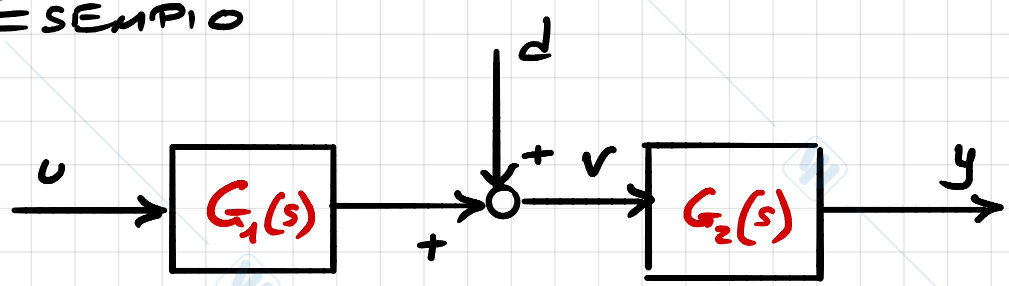
$$G_{yd}(s) = \frac{S_1(s)\,G_2(s)}{1+\underbrace{R_2(s)F_1(s)G_2(s)}_{L_2(s)}}$$

. SE SI SCEGLIE $R_2(s)$ IN MODO CHE $L_2(s) \simeq L(s)$

$$\Longrightarrow \quad G_{yd}(s) = S_1(s)\frac{1}{1+L(s)}G_2(s) = \underbrace{S_1(s)}_{\text{ATTENUA IN } [0,\omega_{c1}]}\ \overbrace{S(s)\,G_2(s)}^{\text{COME SCHEMA STANDARD}}$$

$\omega_{c1} >> \omega_c$

- ESEMPIO



$$G_1(s) = \frac{1}{1+0.05s}$$

$$G_2(s) = \frac{e^{-4s}}{(1+s)^2}$$

- PROGETTO CON SCHEMA STANDARD

$$R(s) = 0.2\,\frac{1+s}{s} \implies L(s) = \frac{0.2\,e^{-4s}}{s(1+s)(1+0.05s)}$$

$\omega_c \cong 0.2$
$\varphi_m \cong 33°$

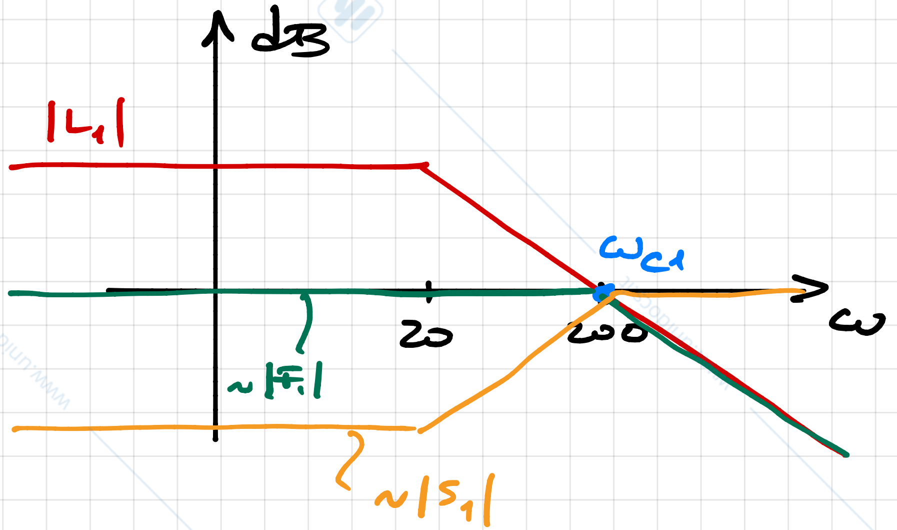
- IL DISTURBO d È ATTENUATO IN $[0, \omega_c] = [0, 0.2]$

- Progetto con schema in cascata

- Progetto di $R_1(s)$

$$R_1(s) = 10 \implies L_1(s) = R_1(s)G_1(s) = \frac{10}{1+0.05s}$$

$\omega_{c1} \simeq 200$, $\varphi_{m1} > 90°$



$$F_1(s) = \frac{L_1(s)}{1+L_1(s)} \simeq \frac{1}{1+0.005s} \simeq 1$$

$$S_1(s) = \frac{1}{1+L_1(s)}$$

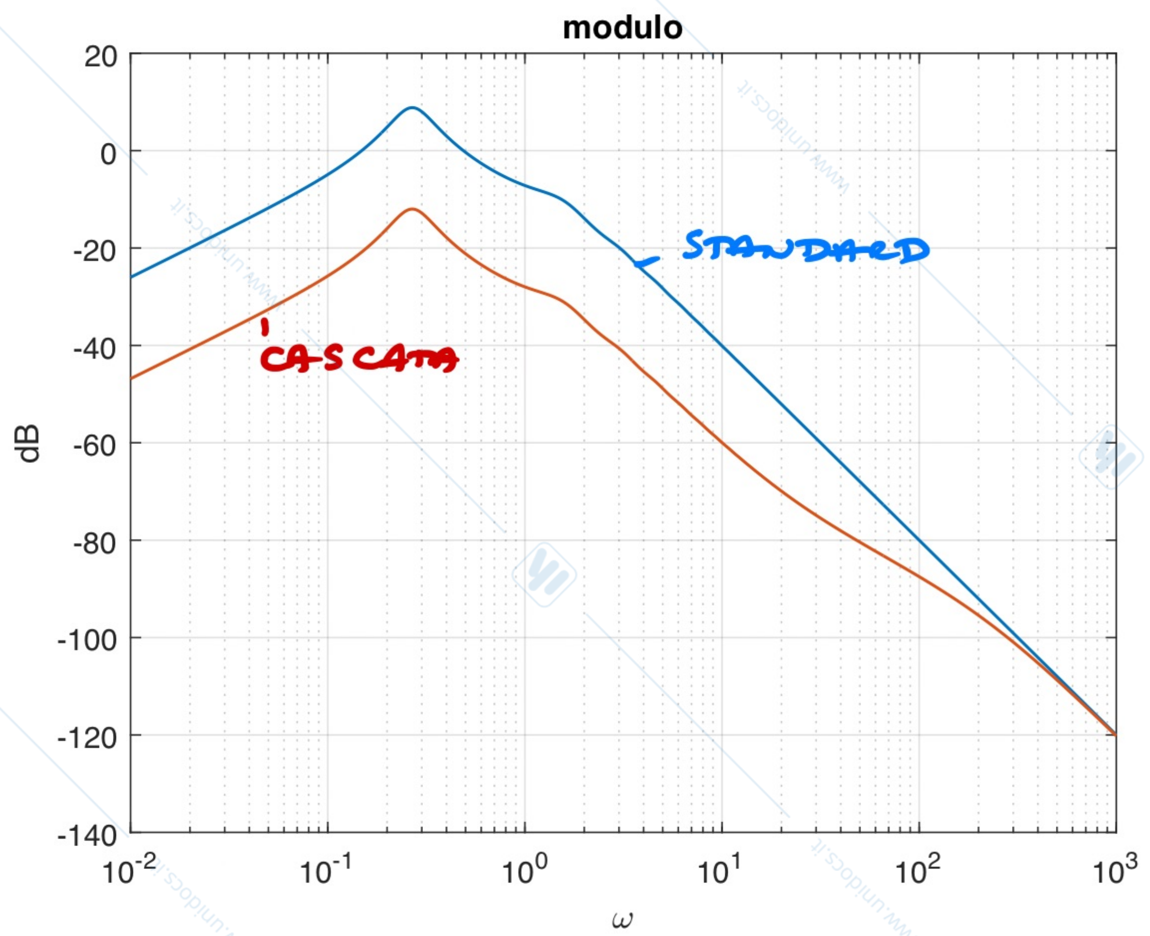
- Progetto di $R_2(s)$

$$L_2(s) = R_2(s)\underbrace{F_1(s)}_{\simeq 1}G_2(s) \simeq L(s) = R(s)\underbrace{G_1(s)}_{\simeq 1}G_2(s) \implies R_2(s) = R(s)$$

- Il disturbo d è attenuato in $[0, \omega_{c1}] = [0, 200]$

- Confronto

$$G_{yd}(s) = \begin{cases} S(s)\,G_2(s) \\ S_1(s)\,S(s)\,G_2(s) \end{cases}$$

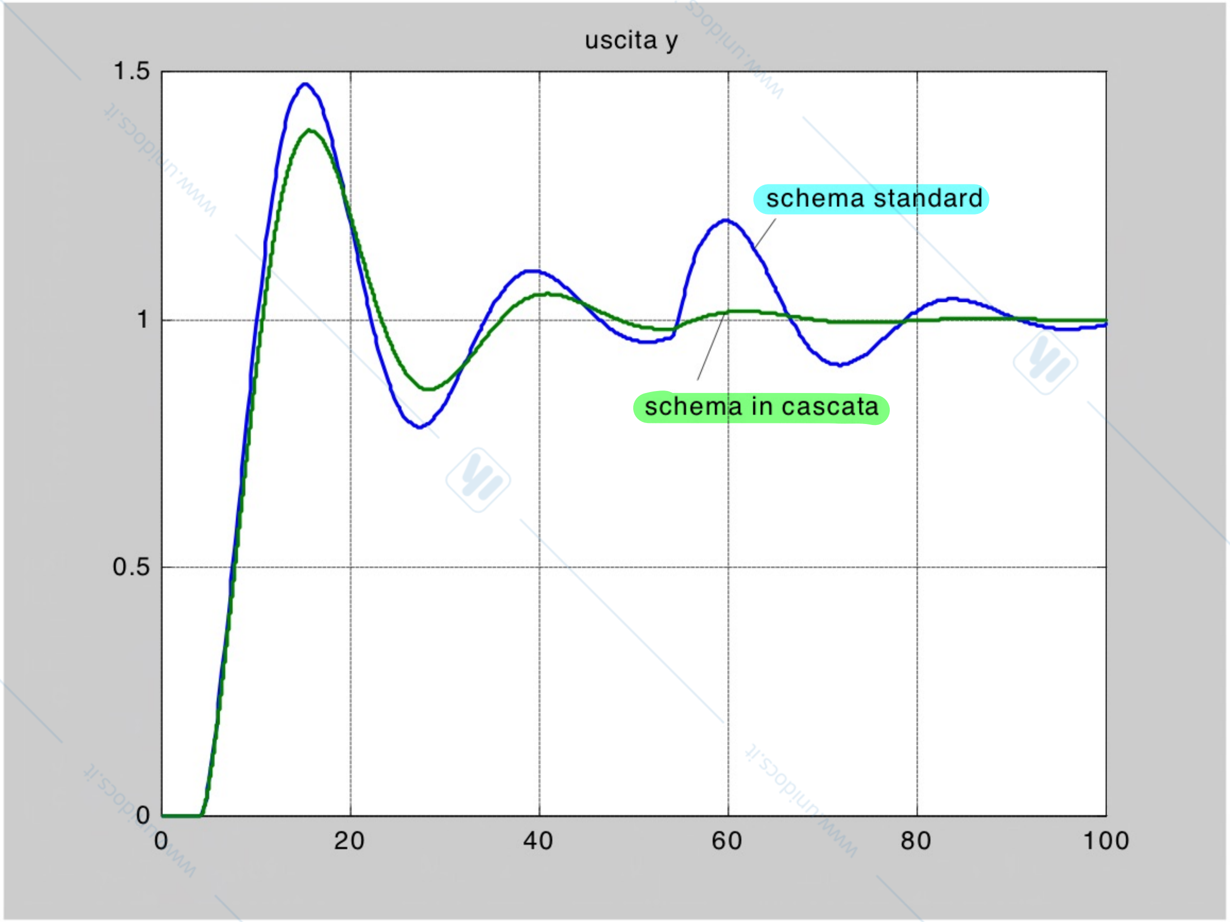


- SIMULAZIONI

① $w(t) = sca(t)$ → POCA DIFFERENZA NEL TRANSITORIO INIZIALE

$d_1(t) = 0.2\, sca(t-50)$ → MEGLIO CONTROLLO IN CASCATA!

1. CONTROLLO IN CASCATA – RIFERIMENTO E DISTURBO A SCALINO



- SIMULAZIONI

(2) $w(t) = 0$

$d_1(t) = \text{sen}(t)$, $\bar{\omega} = 1$ → MEGLIO CONTROLLO IN CASCATA !

$\omega_c < \bar{\omega} < \omega_{c1}$

2. CONTROLLO IN CASCATA – DISTURBO SINUSOIDALE