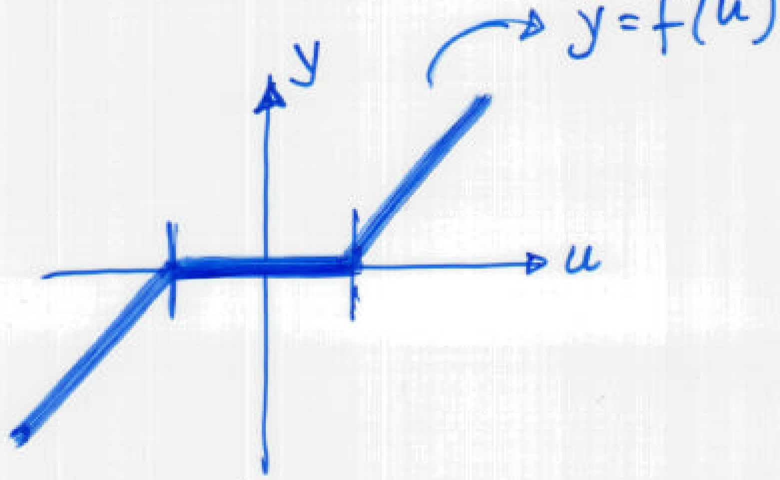
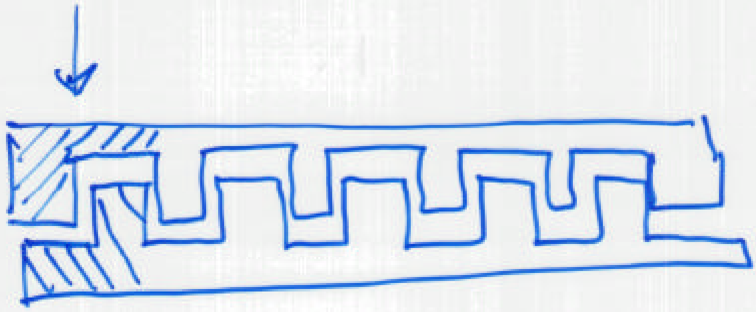
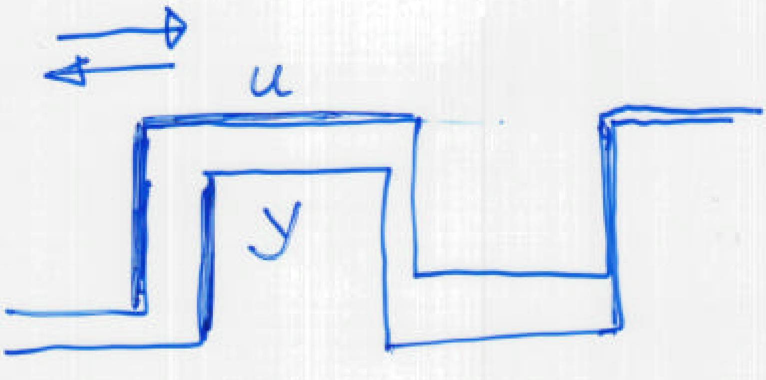
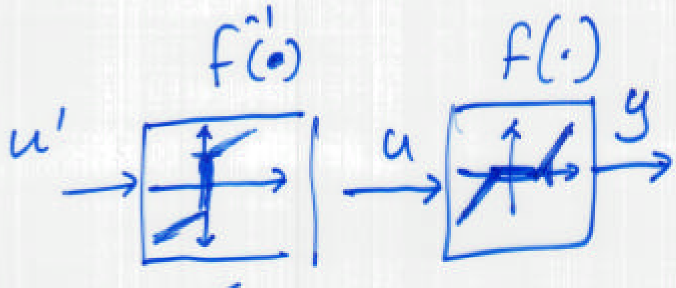
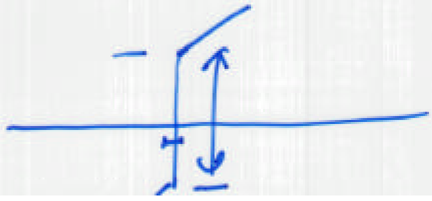
- BANDE MORTE – DEAD ZONE
  " BAND
-







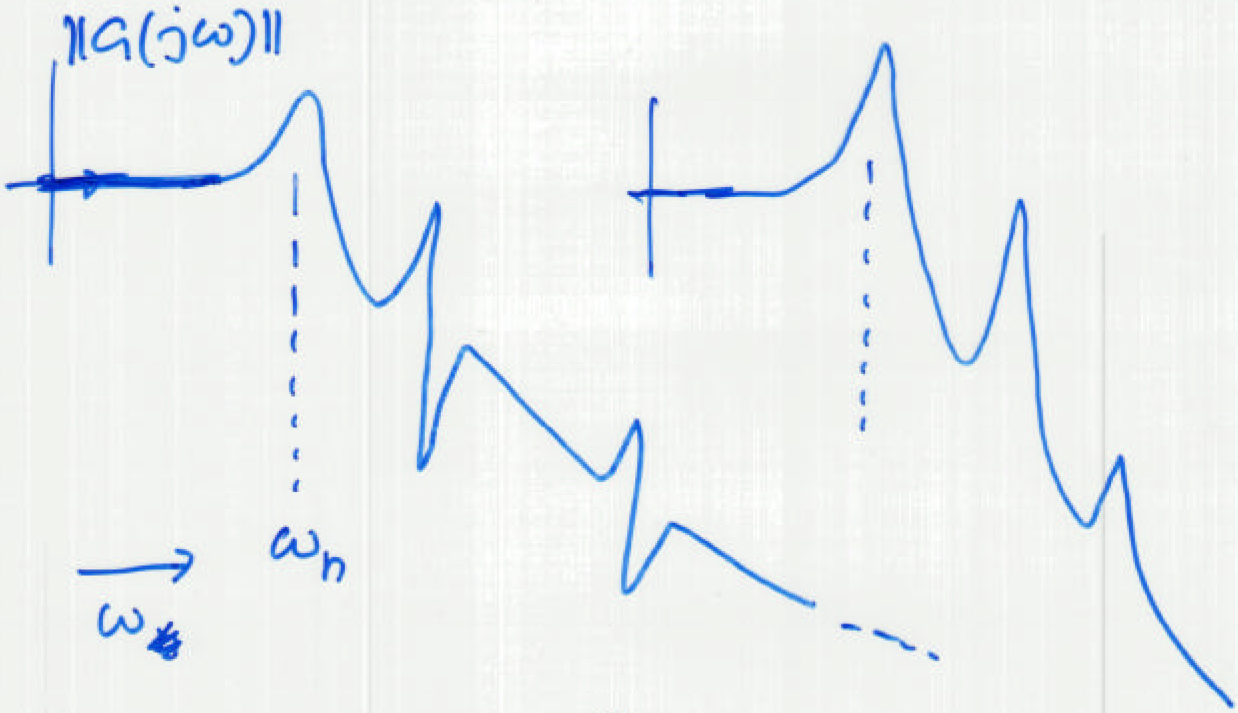


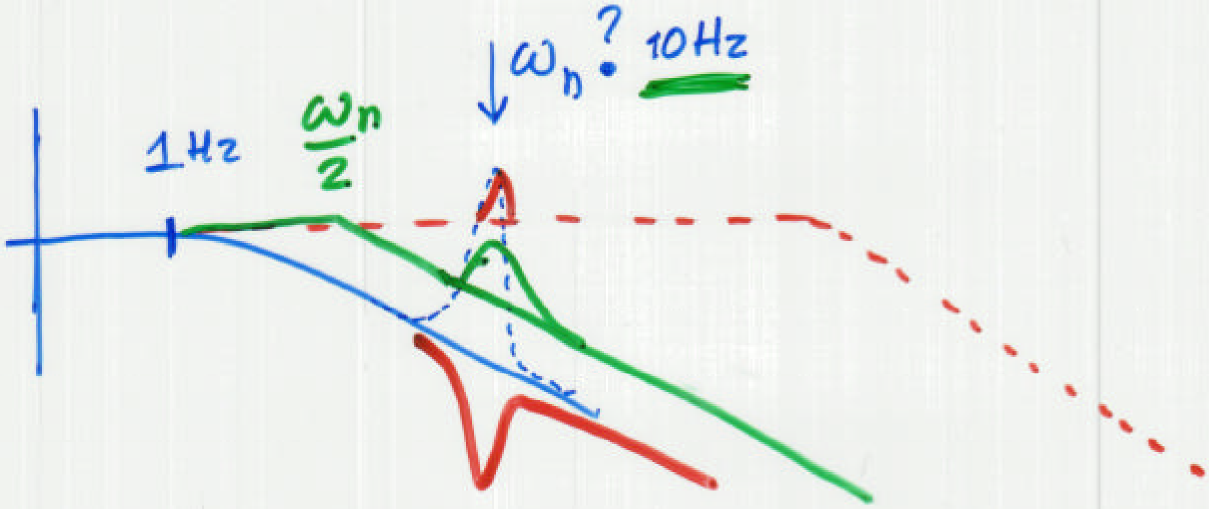


ELASTICITÀ STRUTTURALE

caratterizzata da una o più frequenze di vibrazione propria

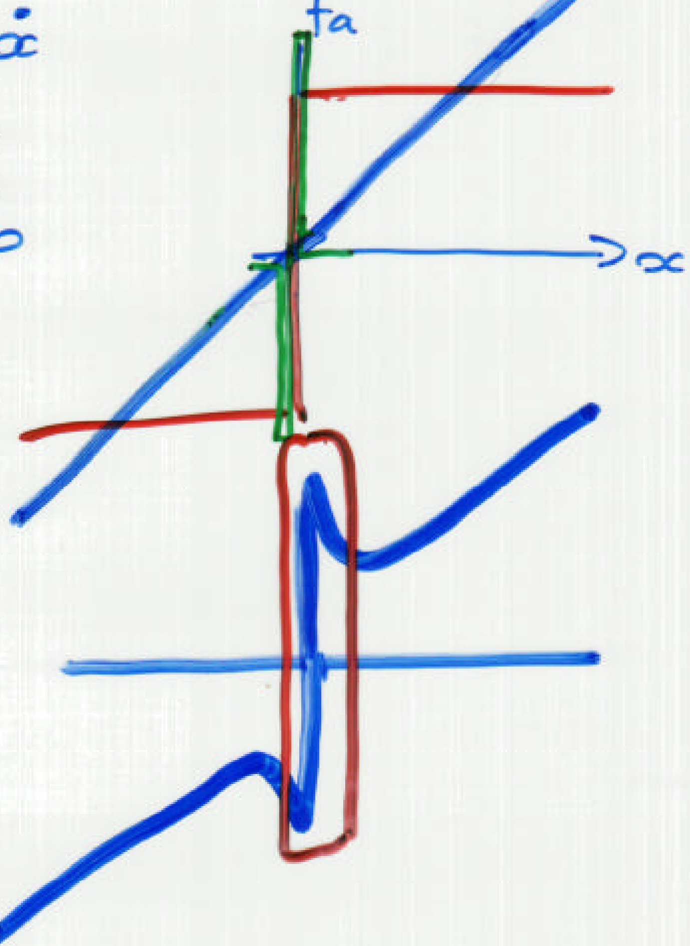
ω_n





ATTRITI È SEMPRE PRESENTE

- VISCOSO $f_a = \beta \dot{x}$
- COULOMBIANO
- ATTRITO DI PRIMO DISTACCO



modello di motore + rete PD è 2° ordine

$$\xi \sim \frac{1}{\sqrt{J_t}}$$

$$\omega \sim \frac{1}{\sqrt{J_t}}$$

CONFIGURAZIONE DIPENDENTE

$$\xi = \frac{1}{\sqrt{J_t}} \cdot \overline{\sqrt{\dots K_D K_P \dots}} = 0.5$$

4

$J_{t\,min}$ $J_{t\,MAX}$

$J_{t\,min} \rightarrow K_D K_P$ max

$J_{t\,max} \rightarrow K_D K_P$ min

$$\underline{u}_c = M(\underline{q})\ddot{\underline{q}}(t) + R(\underline{q}, \dot{\underline{q}})$$

$$H\ddot{q} + C(\cdot,\cdot)\dot{q} + B\dot{q} + g(\cdot) + J^T F_e$$

$$= R_m(\tau_m - \tau_p)$$

$\downarrow$ motoriduzione

$$R_m = \begin{bmatrix} r_1 & & & \\ & r_2 & & \\ & & \ddots & \\ & & & r_6 \end{bmatrix}$$

$$R_m \tau_p = R_m \left[J_m q_m + B_m q_m \right]$$

$\downarrow$ $\qquad\qquad$ $\downarrow$ idem

$$\begin{bmatrix} \ddots & & 0 \\ & J_{mi} & \\ 0 & & \ddots \end{bmatrix}$$

$$\ddot{q}_m = R_m \ddot{q} \qquad \dot{q}_m = R_m \dot{q}$$

$$R_m \tau_p = R_m^2 (J_m \ddot{q} + B_m \dot{q})$$

$$R_m \tau_m = R_m K_a v_a - R_m^2 K_\omega \dot{q}$$

$$K_a = \begin{bmatrix} \ddots & & \\ & \frac{K_{\tau i}}{R_{ai}} & \\ & & \ddots \end{bmatrix}$$

$$K_\omega = \begin{bmatrix} \ddots & & \\ & \frac{K_{\tau i} K_{\omega i}}{R_{ai}} & \\ & & \ddots \end{bmatrix}$$

$$H\ddot{q} + \{C(\ ) + B\}\dot{q} + g + J^T F_e =$$

$$u_c \qquad = \boxed{R_m K_a v_a} - R_m^2 K_\omega \dot{q}$$

$$- R_m^2 (J_m \ddot{q} + B_m \dot{q})$$

$$\underbrace{\left\{ H(q) + R_m^2 J_m \right\}}_{M(q)} \ddot{q} + \underbrace{\left\{ C(q,\dot{q}) + B(q) + R_m^2 (B_m + K_\omega) \right\} \dot{q} + g(q) + J^T F_e}_{h(\underline{q},\underline{\dot{q}})} = u_c$$

$$\Downarrow$$

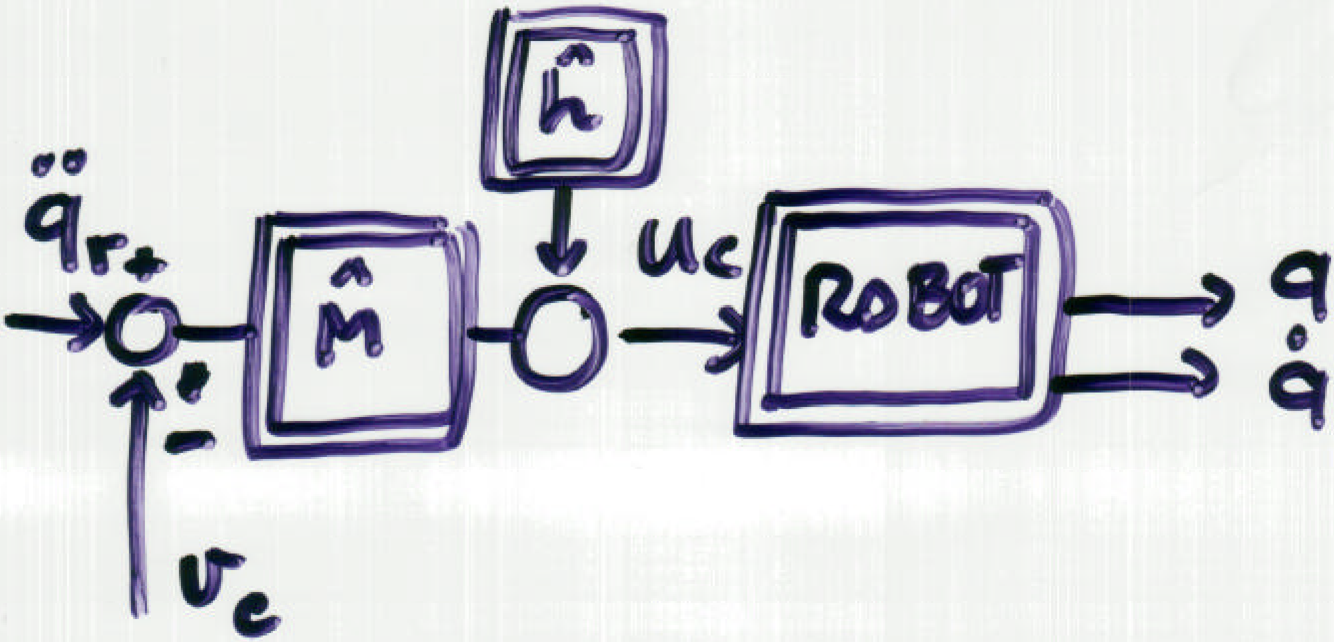
$$M(\underline{q})\,\underline{\ddot{q}} + \underline{h}(\underline{q},\underline{\dot{q}}) = \underline{u}_c$$

$J^T F_e = 0$

METODO DELLA DINAMICA INVERSA

Progettare $\underline{u}_c$ come

$$u_c := \hat{M}(\underline{\ddot{q}}_r - \underline{v}_c) + \underline{\hat{h}}$$



$$M(q)\ddot{q} + h(q,\dot{q}) = \hat{M}(\ddot{q}_r - v_c) + \hat{h}(q,\dot{q})$$

$$\ddot{q} = M(q)^{-1}\hat{M}\ddot{q}_r - M(q)^{-1}\hat{M}v_c + M(q)^{-1}(\hat{h} - h)$$

$$\Delta h \to 0$$

$$M(q)^{-1}\hat{M} \simeq I$$

$\ddot{q} = (\ddot{q}_r - v_c)$ lineare