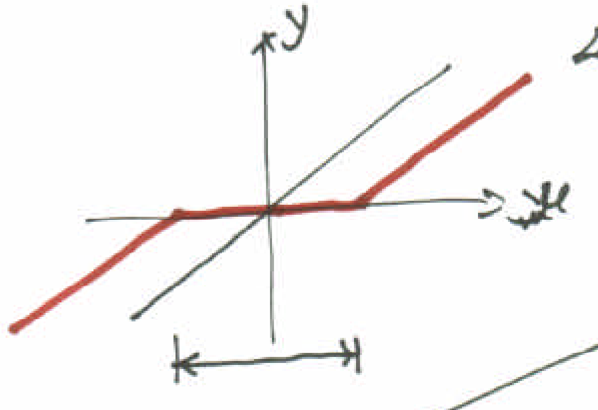
CONSIDERAZIONI PRATICHE X IL CONTROLLISTA

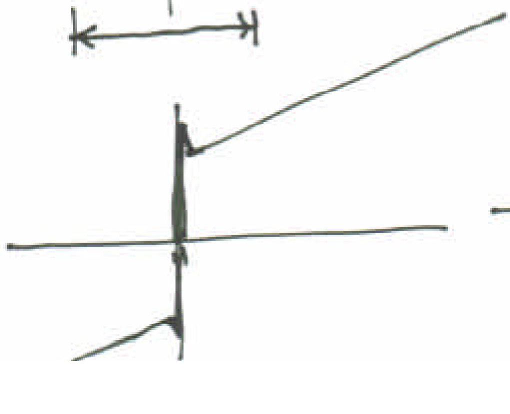
31 MAR. 2004

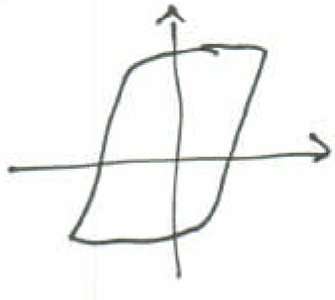
- trascurato la dinamica elettrica ...
- " l'elasticità
- " gli attuatori saturanti
- " gli attriti nonlineari
  e in generale i fenomeni nonlineari

attrito di primo distacco ($\dot{\theta}_i \cong 0$)

zone morte nei motoriduttori







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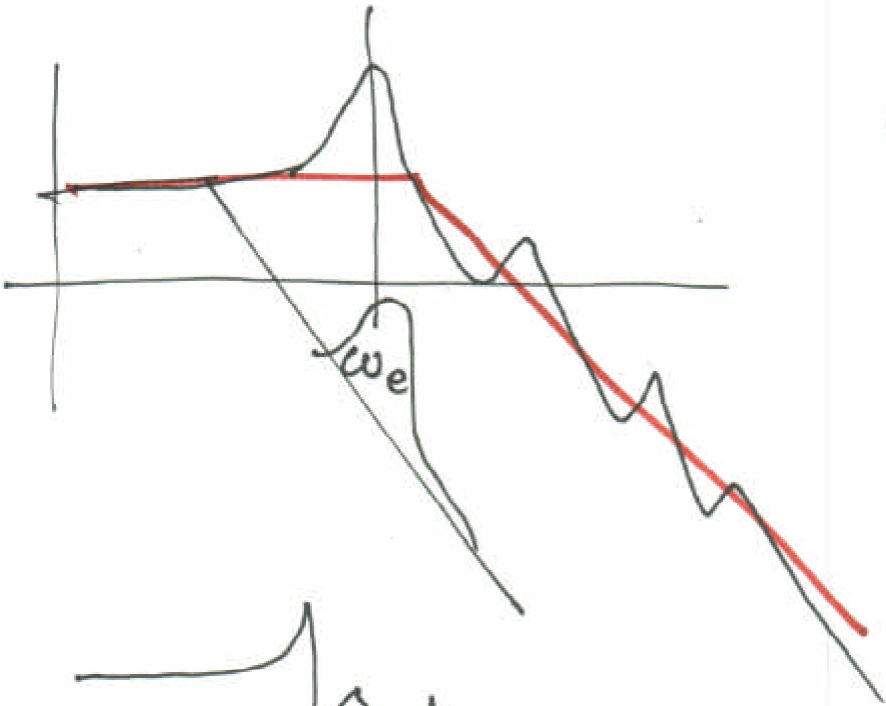
3 1 MAR. 2004



3 1 MAR. 2004

$$H\ddot{q} + C\dot{q} + g = \tau$$

$$\Downarrow$$

$$\ldots \quad = u_c \leftarrow$$ tensione di comando

$$\tau = R_m \left[\tau_m - \tau_p \right]$$

$\uparrow$ matrice motoriduttori $\quad R_m = \begin{bmatrix} r_1 & & & \emptyset \\ & r_2 & & \\ & & \ddots & \\ \emptyset & & & r_6 \end{bmatrix}$

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

$$= R_m K_a v_a - R_m^2 K_\omega \dot{q} - R_m^2 \left[J_m \ddot{q} + B_m \dot{q} \right]$$

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

$$\underline{u}_c := R_m K_a \underline{v}_a$$

$$M(q)\ddot{q} + h(q,\dot{q}) + J^T F_e = u_c$$

3 1 MAR. 2004

IPOTESI $\rightarrow$ $\underline{Fe} \equiv \underline{0}$

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

METODO della DINAMICA INVERSA

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

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

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

se la stima è esatta

$$\ddot{q} = (\ddot{q}_r - v_c) + 0$$

$$\Downarrow$$

$$\ddot{q}_r - \ddot{q} = v_c \implies \ddot{e} = v_c$$

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

$$\Downarrow$$

$$E(q) := M^{-1}(q)\hat{M} - I$$

$$\eta(q, \dot{q}, \ddot{q}_r, v_c) = E(q)(\ddot{q}_r - v_c) - M^{-1}\Delta h$$

$$\Downarrow$$

$$\ddot{q} = \ddot{q}_r - v_c + \eta$$

$$\Downarrow$$

$$\ddot{q}_r - \ddot{q} = v_c - \eta$$

$$\ddot{e} = v_c - \eta$$