$t \rightarrow kT \qquad k = 0, 1, \ldots, N, \ldots$

↑ Periodo di campionamento

$f = \frac{1}{T} \qquad \omega = 2\pi f$

$T = 1\text{–}10\ ms$

$f = 1\ kHz - 100\ Hz$

$\omega \cong 6300 \frac{rad}{s} \div 700$

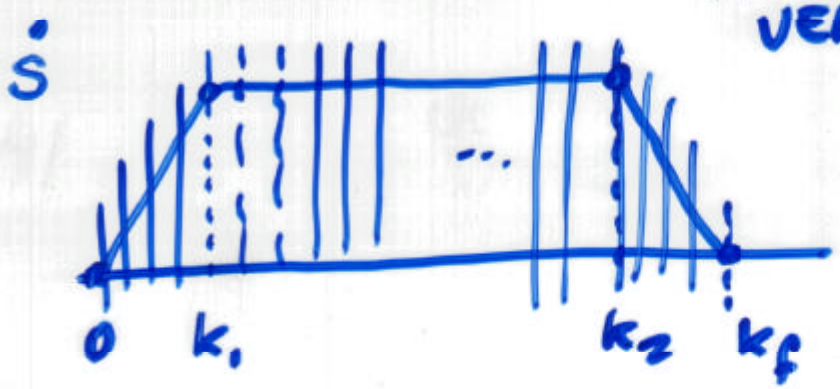
DAL CONTINUO AL DISCRETO

$t: \quad 0 \quad t_1 \quad t_2 \quad t_f$

$k: \quad 0 \quad k_1 \quad k_2 \quad k_f$

$t_1 = k_1 T \qquad t_2 = k_2 T \qquad t_f = k_f T$

NON VEROSIMILE



$\ddot{s}_k \quad \dot{s}_k \quad s_k \qquad s_k = s(kT)$

$$\ddot{s}_k = \begin{cases} \ddot{s}_n^+ \\ 0 \\ -\ddot{s}_n^- \end{cases} \qquad \dot{s}_k = \begin{cases} \ddot{s}_n^+ kT + \dot{s}_0 \\ \dot{s}_n \\ \dot{s}_n - \ddot{s}_n^- (k - k_2)T \end{cases}$$

$s_k \Rightarrow (6.19)$

$\dot{s}_0 = 0$ etc. etc.

$$s_k = \begin{cases} \dots \\ \dots \\ \dots \end{cases}$$

$s_k \xrightarrow{\text{deriv.}} \dot{s}_k$

$\dot{s}_k \xrightarrow{\text{integr.}} s_k$

INTERPOLAZIONE

- ... INCREMENTALE

$\dot{s}_k \longrightarrow$ INTEGR. APPROX s_k

- ... ASSOLUTA

$s_k \longrightarrow$ DERIV. APPROX $\dot{s}_k$

INCREMENTALE

$$\dot{s}_k = \begin{cases} \dot{s}_{k-1} + \ddot{s}^{+}_{n} T \\ \dot{s}_n \\ \dot{s}_{k-1} - \ddot{s}^{-}_{n} T \end{cases}$$

RECORSIVA

EULERO ALL'INDIETRO

$$\dot{s}_k \simeq \frac{s_k - s_{k-1}}{T} \Rightarrow \hat{s}_k = s_{k-1} + \dot{s}_k T$$

$$\dot{s}_k \simeq \frac{s_{k+1} - s_k}{T}$$ CFU IN AVANTI

$$s_{k+1} = s_k + T\dot{s}_k$$

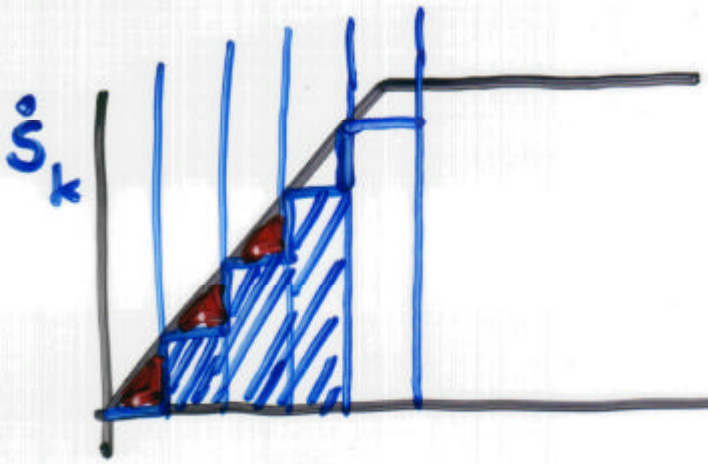
$$\hat{s}_k = s_{k-1} + T\dot{s}_{k-1}$$

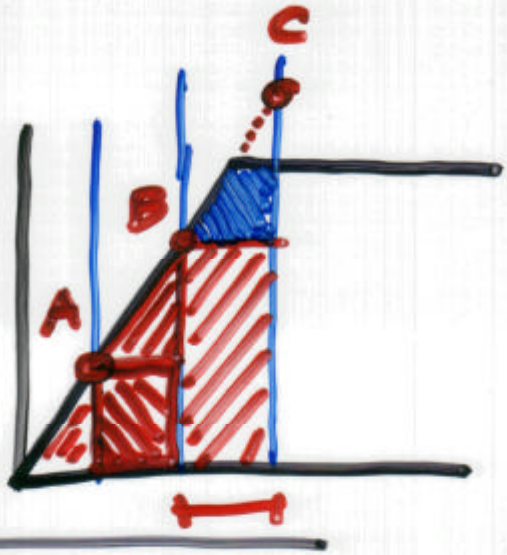
ASSOLUTA

$$s_k = \begin{cases} s_{k-1} + \dot{s}_{k-1}T + \frac{1}{2}\ddot{s}_m^+ T^2 \\ s_{k-1} + \dot{s}_m T \\ s_{k-1} + \dot{s}_{k-1}T - \frac{1}{2}\ddot{s}_m^- T^2 \end{cases}$$

$$\hat{\dot{s}}_k = \frac{s_k - s_{k-1}}{T}$$

INTERP. INCREMENTALE





SCOPO : CALCOLARE s_k

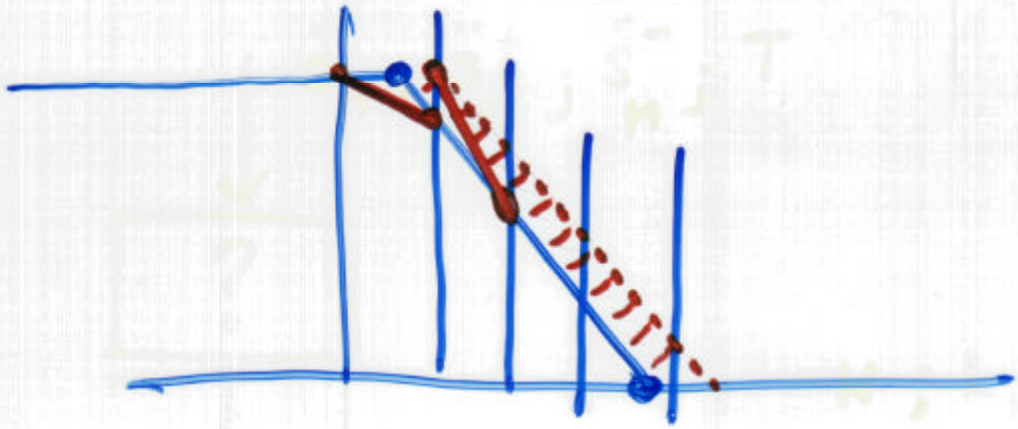
GARANTIRE CHE COSA

$\dot{s}_k \leq \dot{s}_M$

$\ddot{s}_k \leq \ddot{s}^+_M$

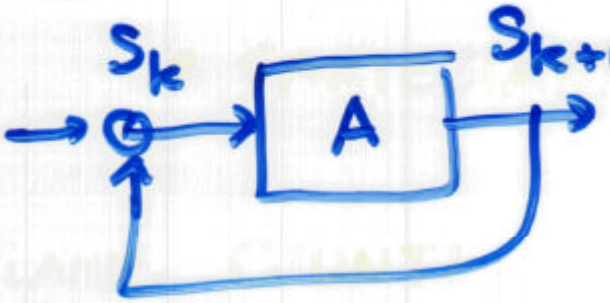
$\ldots \geq -\ddot{s}^-_M$

$s_{kf} = 1$



a) GARANTIRE AD OGNI ISTANTE CHE RIUSCIRÒ A PORTARE $\dot{S} = 0$ CON DECELERAZIONE AMMISSIBILE

b) FILTRO DINAMICO (NON LINEARE)



CON I VINCOLI RISPETTATI

N ; k_1 ; k_2

$\{ \dots s_k, \dot{s}_k, \ddot{s}_k \dots \}$

PIANIFICAZIONE COORDINATA

- GIUNTI
- CARTESIANA

PIANIF. GIUNTI

$$\underline{q} = \begin{bmatrix} q_1 \\ \vdots \\ q_n \end{bmatrix} \Rightarrow (s_k) \Rightarrow \{ \dots \underline{q}_k \dots \}$$

$$\underline{q}_1 = \begin{bmatrix} q_{11} \\ q_{21} \\ \vdots \\ q_{n1} \end{bmatrix} \quad \dots \quad \underline{q}_k = \begin{bmatrix} q_{1k} \\ q_{2k} \\ \vdots \\ q_{nk} \end{bmatrix}$$

$$\underline{q}_k = \underline{q}_0 + s_k(\underline{q}_f - \underline{q}_0) = \underline{q}_0 + s_k \underline{\Delta q}$$

$$= \underline{q}_0 - s_k \underline{q}_0 + s_k \underline{q}_f$$

$$= (1 - s_k)\underline{q}_0 + s_k \underline{q}_f$$

COMBINAZIONE CONVESSA

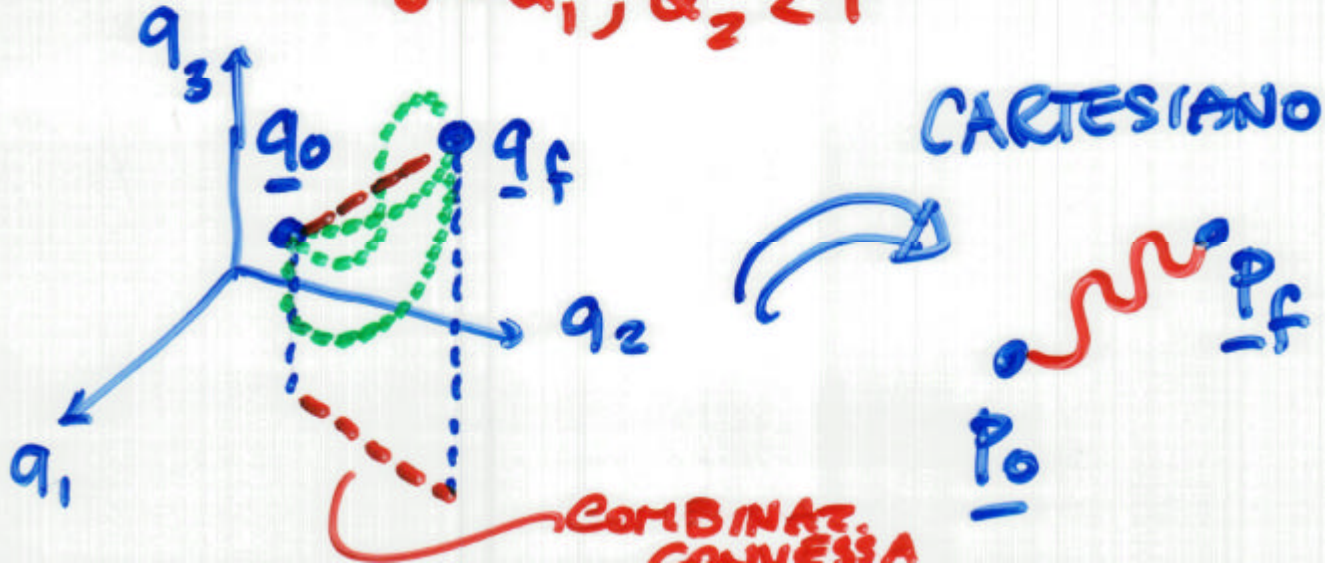
$k = 0 \quad s_k = 0 \quad \underline{q}_k = \underline{q}_0$

$k = k_f \quad s_f = 1 \quad \underline{q}_k = \underline{q}_f$

$$\underline{q} = \alpha_1 \underline{q}_0 + \alpha_2 \underline{q}_f$$

Con $\alpha_1 + \alpha_2 = 1$

$0 < \alpha_1 ; \alpha_2 < 1$



$$\dot{\underline{q}}_k = \dot{s}_k \, \underline{\Delta q}$$

$$\ddot{\underline{q}}_k = \ddot{s}_k \, \underline{\Delta q}$$

CHE SIGNIFICA $\dot{s}'_n \quad \ddot{s}^+_n \quad \overset{\infty}{s}{}^-_n$

IN TERMINI DEI MOTORI ?

$\dot{s}_n = 8 \; ; \; 0.5$

$s_k = 0.3$ HO PERCORSO IL 30% DEL TOTALE

CHI/CHE COSA FISSA $\dot{s}_n$?

OGNI MOTORE i

$\dot{q}^i_n = \underset{\text{targa}}{\text{dato di}} \equiv \dot{s}_n \Delta q_i$

$\vdots$

$\dfrac{\dot{q}^i_n}{\Delta q_i} = \dot{s}^i_n$

$\dot{s}_n = \min_i \dot{s}^i_n \qquad \dot{s}_n = \dfrac{\dot{q}_{MAX}}{\Delta q_{MAX}}$

SPAZIO GIUNTI

SPAZIO CARTESIANO