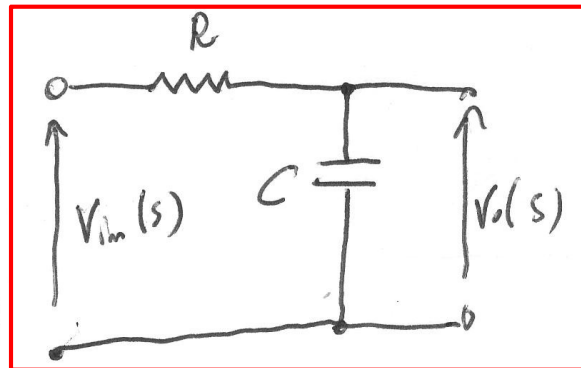


Derivazione delle forme di trasferimento



$$C \Rightarrow q = C V \Rightarrow \frac{dq}{dt} = C \frac{dV}{dt} \Rightarrow \boxed{I = C \dot{V}}$$

$$I \Rightarrow \Phi = L i \Rightarrow \frac{d\Phi}{dt} = L \dot{i} \Rightarrow \boxed{V = L \dot{i}}$$

zero

$$\Rightarrow i(t) = C \frac{dV(t)}{dt} [C]$$

$$V(t) = L \frac{di(t)}{dt} [I]$$

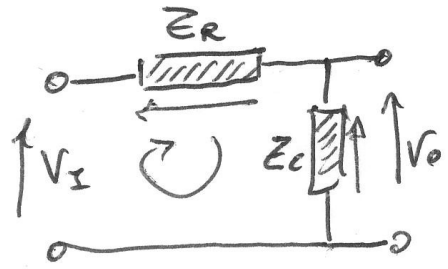
$$\mathcal{F}[i(t)] = C j\omega V(f) = I(f) \quad \text{e} \quad \mathcal{F}[V(t)] = L j\omega I(f)$$

$$\boxed{I = C \cdot j\omega V} \quad (\text{Condensatore}) \quad \text{e} \quad \boxed{V = L \cdot j\omega I}$$

$$V = \underset{\substack{\uparrow \\ \text{impedenza}}}{Z} I \Rightarrow Z = \frac{V}{I}$$

$$c) \quad Z_c = \frac{V}{I} = \frac{1}{j\omega C}$$

$$I) \quad Z_L = \frac{V}{I} = j\omega L$$



$$\Rightarrow V_I - V_R - V_C = 0 \Rightarrow V_I = V_R + V_C$$

$$V_R = Z_R I \quad \text{e} \quad V_C = Z_C I$$

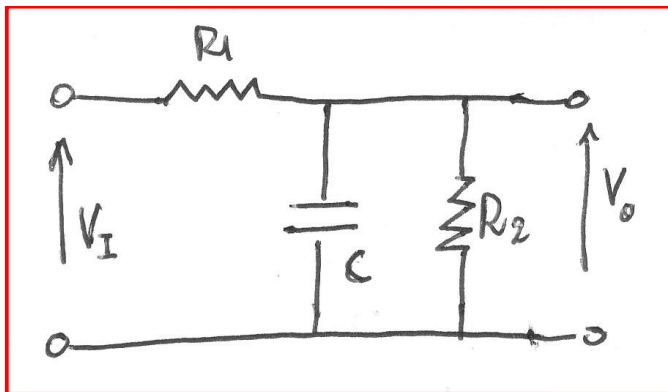
$$V_R = RI \quad V_C = \frac{1}{j\omega C} \cdot I$$

$$V_I = RI + \frac{1}{j\omega C} I = I \cdot \left(R + \frac{1}{j\omega C} \right)$$

$$V_O = V_C = Z_C \cdot I$$

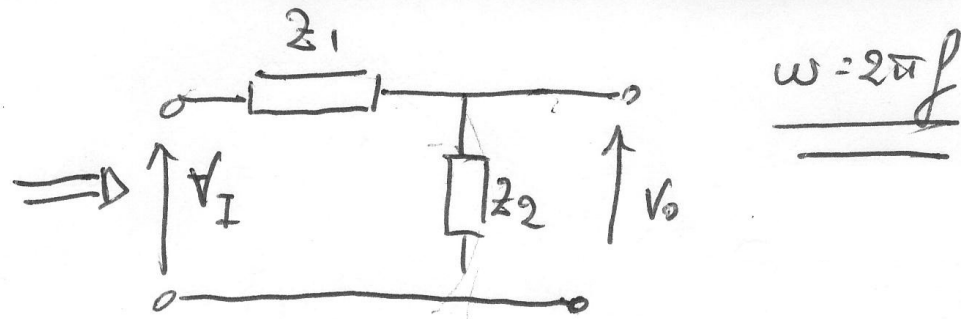
$$\Rightarrow H \Rightarrow \frac{V_O}{V_I} = \frac{\cancel{V_C}}{(R + 1/j\omega C) \cdot \cancel{V_I} \cdot j\omega C} \Rightarrow$$

$$\Rightarrow H = \frac{1}{j\omega RC + 1}$$



$$Z_1 = R_1 \quad Z_2 = C \parallel R_2$$

$$\frac{V_O}{V_I} = \frac{Z_2}{Z_1 + Z_2}$$



$$V_O = Z_2 I = Z_2 \cdot \frac{V_I}{Z_1 + Z_2}$$

SERIE $Z_1 \quad Z_2 \Rightarrow Z_S = Z_1 + Z_2$

PAR. $Z_1 \quad Z_2 \Rightarrow \frac{1}{Z_P} = \frac{1}{Z_1} + \frac{1}{Z_2}$

$$\Rightarrow Z_P = \frac{Z_1 Z_2}{Z_1 + Z_2}$$

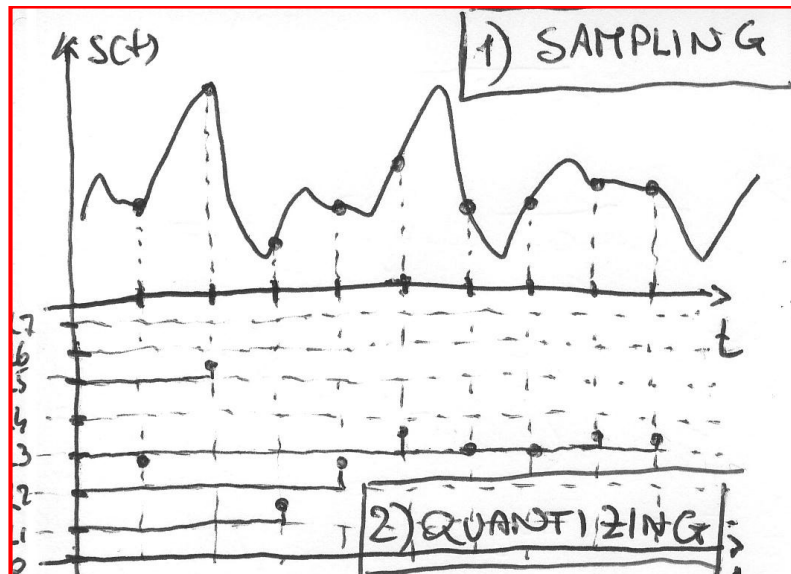
$$Z_2 = \frac{Z_C \cdot Z_{R2}}{Z_C + Z_{R2}}$$

$$\frac{V_o}{V_i} = \frac{\frac{Z_C \cdot Z_{R2}}{Z_C + Z_{R2}}}{Z_1 + \frac{Z_C \cdot Z_{R2}}{Z_C + Z_{R2}}}$$

⇓

$$\frac{V_o}{V_i} = H(f) = \frac{\frac{\frac{1}{j\omega C} \cdot R_2}{\left(\frac{1}{j\omega C} + R_2\right)}}{R_1 + \frac{\frac{1}{j\omega C} \cdot R_2}{\frac{1}{j\omega C} + R_2}} = \frac{\frac{R_2}{j\omega C}}{R_1 \left(\frac{1}{j\omega C} + R_2\right) + \left(\frac{1}{j\omega C} \cdot R_2\right)}$$

$$= \frac{R_2}{R_1 (1 + R_2 j\omega C) + (R_2)} \Rightarrow H = \frac{R_2}{R_1 (1 + R_2 j\omega C) + R_2}$$



2) QUANTIZING

3) CODIFYING

L0 = 000	L4 = 100
L1 = 001	L5 = 101
L2 = 010	L6 = 110
L3 = 011	L7 = 111

L3 - L5 - L1 - L2 - L3 - L3 - L3 - L3 - L3



011 - 101 - 001 - 010 - 011 - 011 - 011 - 011 - 011

"011101001010011011011011011"

PROMPTORI A

ESEMPIO 21)

DATO UN SEGNALE CHE OCCUPA UNA BANDA COMPRESA ~~2000~~ IN:

$$[300 \div 3400] \text{ Hz}$$

STABILIRNE LE CARATTERISTICHE PER POTERNE EFFETTUARE LA TRASFORMAZIONE DIGITALE:

1) f_s

$f_{\text{min}} = 2B = 2 \cdot 3400 \text{ Hz} = 6800 \text{ Hz}$
(samples/s)

FISSIAMO $f_s = 8 \text{ kHz}$

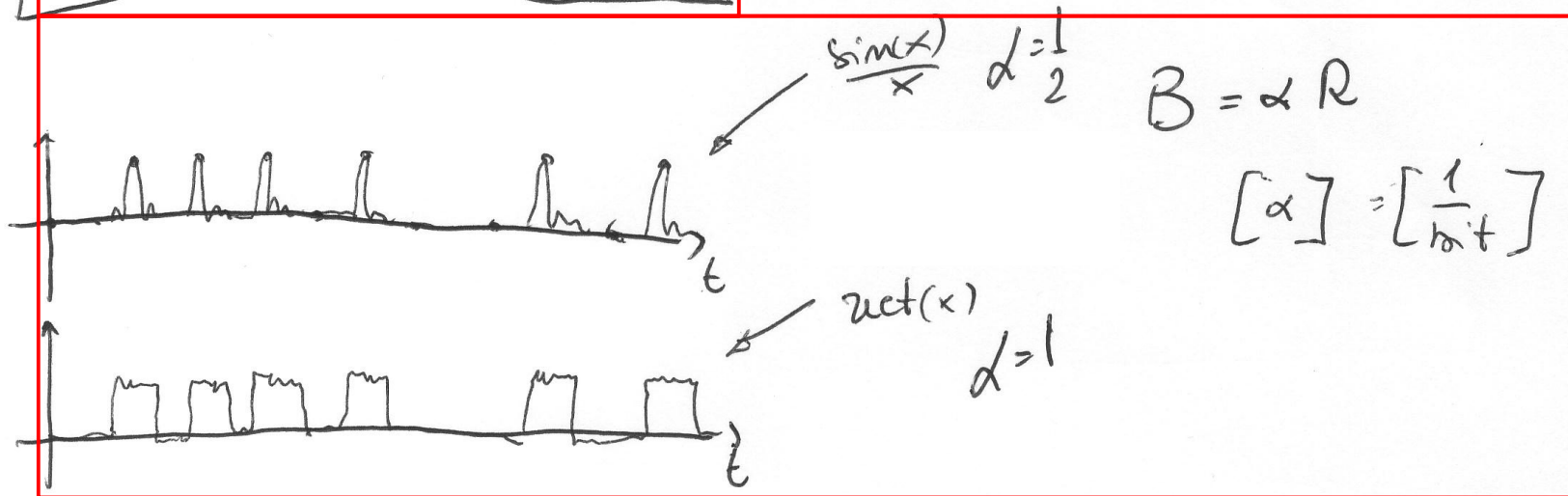
2) IPOTIZZIAMO LA DISPOSIZIONE DI UN QUANTIZZATORE A 3 BIT (8 LIVELLI)

3) CALCOLO DI R:

$$R = m \cdot f_s$$

$$[R] = \left[\frac{\text{bit}}{\cancel{\text{samples}}} \cdot \frac{\cancel{\text{samples}}}{s} \right] = \left[\frac{\text{bit}}{s} \right] = [\text{bps}]$$

$$R = 8000 \cdot 3 = 24 \text{ ~~kB~~ kbps}$$



$$B_{\frac{\sin x}{x}} = \frac{R}{2} = 12 \text{ kHz}$$

$$B_{\text{RECT}(x)} = R = 24 \text{ kHz}$$

IN FASE DI MCS210N5 IL SEGNALE PCM SARÀ AFFECTO DA **ERRORS**:

$$\left(\frac{S}{N}\right)_{\text{pr-out}} = \frac{3\pi^2}{1 + 4(\pi^2 - 1)P_e}$$

↑ errore di quantizzazione ↓ errore di rigenerazione

← potenza di picco del segnale
← potenza media statistica di disturbo

$$\left(\frac{S}{N}\right)_{\text{out}} = \frac{\pi^2}{1 + 4(\pi^2 - 1)P_e}$$

← potenza media del segnale
← potenza media ^{statistica} del rumore

QUANDO P_e È TRASCURABILE (CANALI QUASI IDEALI):

$$\left(\frac{S}{N}\right)_{\text{dB}} = 6.02m + \alpha \quad \text{con} \quad \alpha = 4.77 \quad \times \quad \left(\frac{S}{N}\right)_{\text{pr}} \\ \alpha = 0 \quad \left(\frac{S}{N}\right)_{\text{media}}$$

REGOLA DEI 6 dB