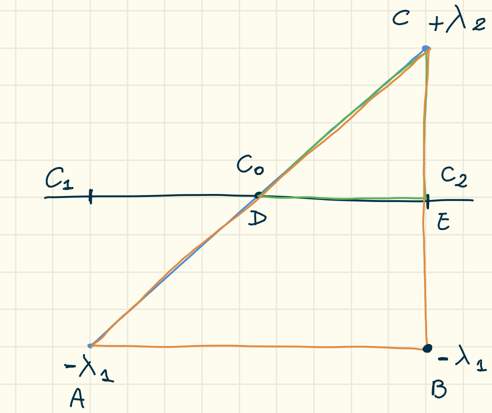
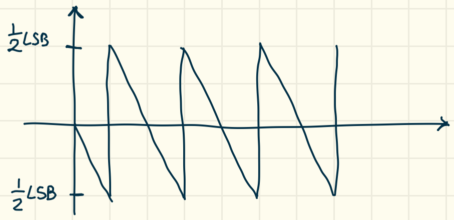


C_0 = Valore necessario di R_C per bilanciare la tensione ($V_{AB}=0$)

$AB:DE = CB:CE$

$$\frac{C_2-C_1}{C_2-C_0} = \frac{\lambda_2-\lambda_1}{\lambda_1} \rightarrow C_2-C_0 = \frac{\lambda_1(C_2-C_1)}{\lambda_2-\lambda_1}$$

$$\rightarrow C_0 = -\frac{\lambda_1(C_2-C_1)}{\lambda_2-\lambda_1} + C_2$$



$$V_e = \sqrt{\frac{1}{T}\int_0^T f^2(x)\,dx}$$

Errore di Quant. $\Rightarrow$ $$N^2 = \frac{1}{Q}\int_{-Q/2}^{Q/2} f^2(t)\,dt = \frac{q^2}{12}$$ Potenza RUMORE

IN = sin(x)

$$S_{RMS}^2 = \frac{A^2}{2}$$ Potenza della sinus.

$$SNR = 20\log_{10}\frac{S_{RMS}}{N_{RMS}} = 10\log_{10}\left(\frac{S_{RMS}}{N_{RMS}}\right)^2 = 10\log_{10}\frac{S_{RMS}^2}{N_{RMS}^2}$$ Potenze

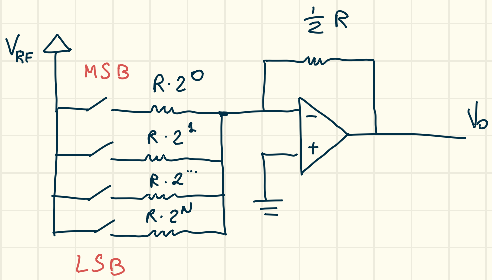
Nella Sinusoide

$$N^2 = \frac{Q^2}{12} \quad \text{ma} \quad Q = \frac{FS}{2^n} \quad e \quad FS = 2A \rightarrow Q = \frac{2A}{2^n} \rightarrow Q = \frac{\cancel{2}A}{\cancel{2}\cdot 2^{n-1}} \rightarrow Q^2 = \frac{A^2}{2^{2(n-1)}}$$

$$= \frac{A^2}{12\cdot 2^{2(n-1)}} = \frac{A^2}{\cancel{12}_{3}\cdot \cancel{2}^{-2}\cdot 2^{2n}} = \frac{A^2}{3\cdot 2^n}$$

$$SNR = 10\log_{10}\frac{S_{RMS}^2}{N_{RMS}^2} = 10\log\frac{\frac{\cancel{A^2}}{2}}{\frac{\cancel{A^2}}{3\cdot 2^n}} = 10\log\frac{3\cdot 2^n}{2} = 10\log\left(\frac{3}{2}\right) + 10\log\left(2^n\right)$$

$$= 1.76\,dB + n\cdot 10\log(2) = 1.76\,dB + N\cdot 6.02\,dB$$



$$V_o = \sum_{i=0}^{N}\left(-\frac{R_F}{R_i}\right)V_i = -\frac{R_F}{R\cdot 2^0} - \frac{R_F}{R\cdot 2^1} - \dots - \frac{R_F}{R\cdot 2^{n-2}} - \frac{R_F}{R\cdot 2^{n-1}}$$

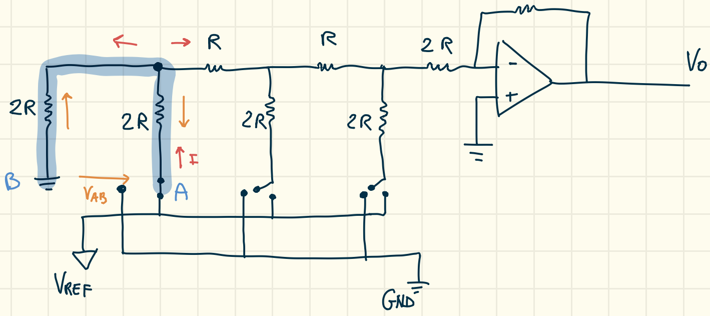
$$\text{ma } R_F = \frac{1}{2}R \rightarrow V_o = -\frac{\cancel{R}\,V_i}{2\cancel{R}\,2^0} - \frac{\cancel{R}\,V_i}{2\cancel{R}\cdot 2^1} - \dots - \frac{\cancel{R}\,V_i}{2\cancel{R}\cdot 2^{n-2}} - \frac{\cancel{R}\,V_i}{2\cancel{R}\cdot 2^{n-1}}$$

$$= -\frac{1}{2}V_i - \frac{1}{2^2}V_i - \dots - \frac{1}{2^{n-1}}V_i - \frac{1}{2^n}V_i$$

4

Il primo bit Vale LA METÀ di V_i!

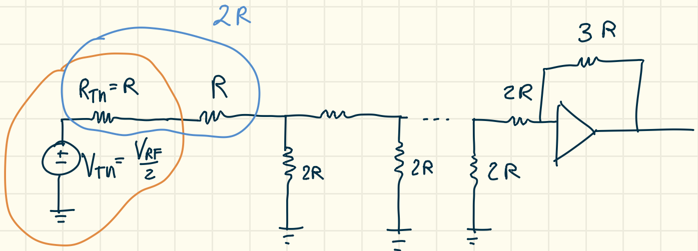
R - 2R

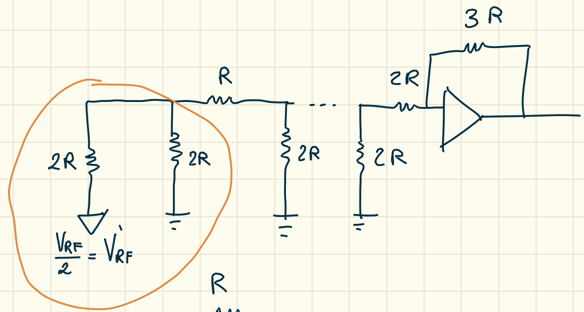


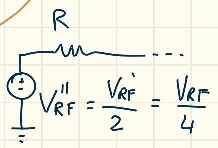
$$R_{TH} = \frac{2R \cdot 2R}{2R + 2R} = \frac{4R^{\cancel{2}}}{\cancel{4R}} = R \quad R_{Th}$$

$$V_{RF} = R_{AB} \cdot I \Rightarrow I = \frac{V_{RF}}{R_{AB}} = \frac{V_{RF}}{2R+2R} = \frac{V_{RF}}{4R}$$

$$\Rightarrow V_{Th} = 2R \cdot I = 2R \cdot \frac{V_{RF}}{4R} = \frac{V_{RF}}{2} \quad V_{Th}$$

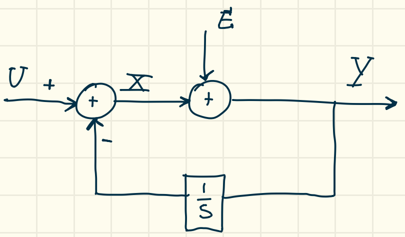






E così via

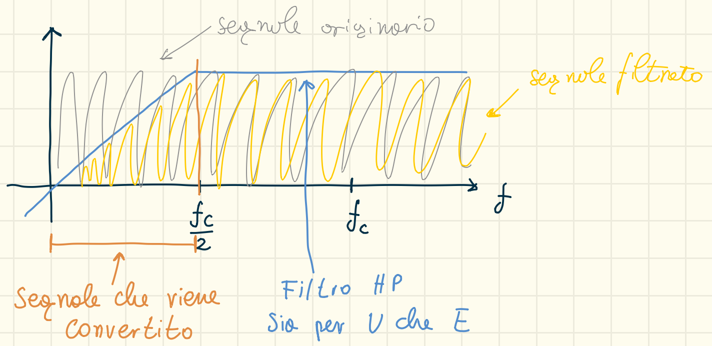
Noise Shapi

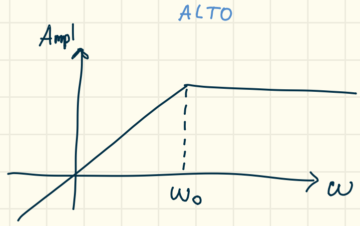


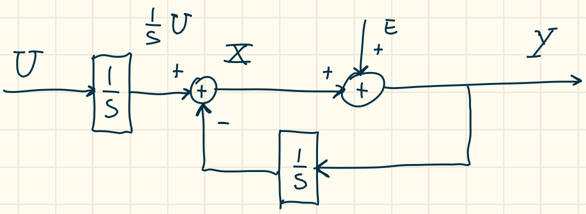
$$Y = X + E \quad \text{ma} \quad X = -\frac{1}{s}Y + U$$

$$= -\frac{1}{s}Y + U + E \rightarrow Y\underbrace{\left(1+\frac{1}{s}\right)}_{\frac{s+1}{s}} = U + E \Rightarrow Y = \frac{s}{s+1}U + \frac{s}{s+1}E$$

FILTRI PASSA ALTO







$$Y = E + X \quad \text{ma} \quad X = \frac{1}{s}U - \frac{1}{s}Y$$

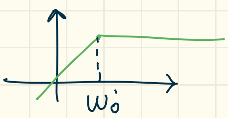
$$\rightarrow Y = E + \frac{1}{s}U - \frac{1}{s}Y$$

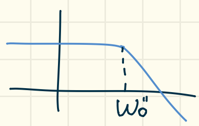
$$\rightarrow Y\underbrace{\left(1+\frac{1}{s}\right)}_{\frac{s+1}{s}} = E + \frac{1}{s}U$$

$$\rightarrow Y = \frac{s}{s+1}E + \frac{\cancel{s}}{s+1} \cdot \frac{1}{\cancel{s}}U$$

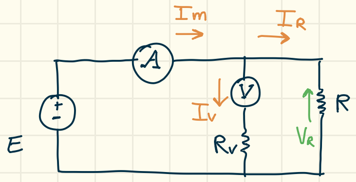
$$Y = \frac{s}{s+1}E + \frac{1}{s+1}U$$

HPF LPF





Metodo Volt Amp



Misuro la corrente: $i_m = i_V + i_R$

Maggior Parte

Imperfezione Voltmetro

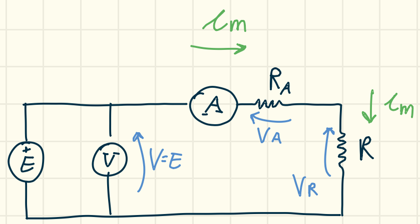
$$V = R \cdot i \Rightarrow R_m = \frac{E}{i_m} = \frac{E}{i_V + i_R}$$

$$i_V = \frac{E}{R_V}, \quad i_R = \frac{E}{R} \Rightarrow R_m = \frac{E}{\frac{E}{R_V} + \frac{E}{R}} = \frac{E}{\frac{RE + R_V E}{R_V R}} = \frac{R_V R}{R + R_V}$$

$\rightarrow$ Mi serve R $\rightarrow$ $R = \frac{R_m (R + R_V)}{R_V} = \frac{R_m R}{R_V} + \frac{R_m \cancel{R_V}}{\cancel{R_V}}$

$$\rightarrow R = R_m + \frac{R_m R}{R_V}$$

Per $R_V \to \infty$: $\lim_{V \to \infty} R_m + \cancelto{0}{\frac{R_m R}{R_V}} \rightarrow R_m$



$$E = V_A + V_R \qquad \begin{cases} V_A = i_m \cdot R_A \\ V_R = i_m R \end{cases}$$

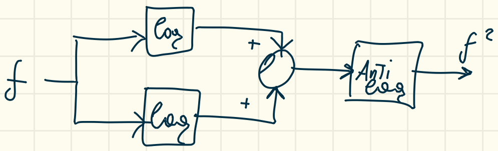
$$\rightarrow E = i_m R_A + i_m R \rightarrow R = \frac{E - i_m R_A}{i_m} \Rightarrow R = \frac{E}{i_m} - R_A$$

Se $R_A \to 0 \Rightarrow R = \frac{E}{i_m} = R_m$

TRMS:

Obbiettivo: $RMS = \sqrt{\frac{1}{T}\int_0^T f^2(t)\,dt}$ 1 2 3

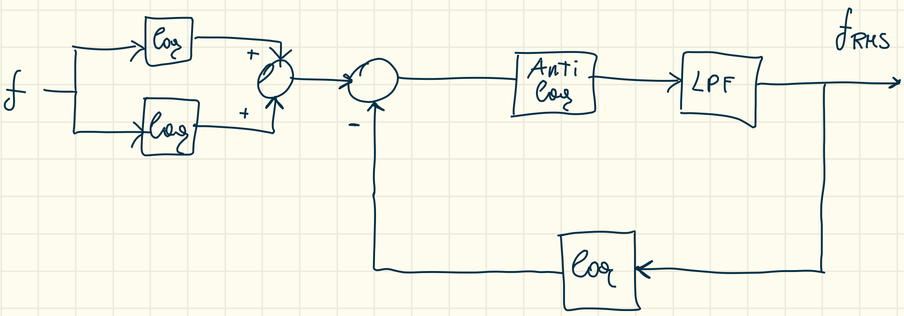
Uso i log: $\log(f^2) = 2\log(f) = \log(f) + \log(f)$



Integrazione: $\frac{1}{s} \to LPF \rightsquigarrow f^2 \to \boxed{LPF} \to f_{RMS}^2$

$\frac{1}{T}\int_0^T f^2(t)dt = f_{RMS}^2$ (RADICE)

Ma ci serve f_{RMS} e non f_{RMS}^2



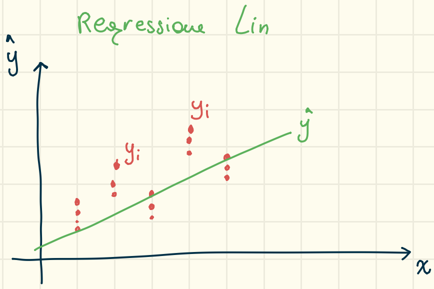
Media: $\bar{y} = \frac{1}{N}\sum_{i=1}^{N} x_i$

Varianza: $\sigma^2 = \frac{1}{N-1}\sum_{i=1}^{N}(y_i - \bar{y})^2 \Rightarrow$ Dev Std: $\sigma = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(y_i-\bar{y})^2}$

Incertezza: $u = \frac{S(x_i)}{\sqrt{N}}$

$0{,}0000001.825 \times 10^{-6} = 0'000'002 = 2\times 10^{-6}$

Regressione Lin



$\hat{y} = B_0 + B_1 x$

$\sum_{i=1}^{N}(y_i - \hat{y}_i)^2 = \sum_{i=1}^{N}(y_i - B_0 - B_1 x)^2$

$R^2 = 1 - \frac{\sum^N (y_i - \hat{y}_i)^2}{\sum^N (y_i - \bar{y}_i)}$

$S_{xy} = \sqrt{\frac{\sum^N (\hat{y}_i - y_i)^2}{N-2}}$

Classe = ______

$$\sum_{i=0}^{N} (y_i - \hat{y})^2 \quad \text{ma} \quad \hat{y} = B_0 + B_1 x \Rightarrow M.Q = \sum_{i=1}^{N} (y_i - B_0 - B_1 x_i)^2$$

$$R^2 = 1 - \frac{\sum^{N} (y_i - \hat{y}_i)^2}{\sum^{N} (y_i - \bar{y}_i)^2} \qquad S_{xy} = \sqrt{\frac{\sum^{N} (\hat{y}_i - y)^2}{N-2}}$$