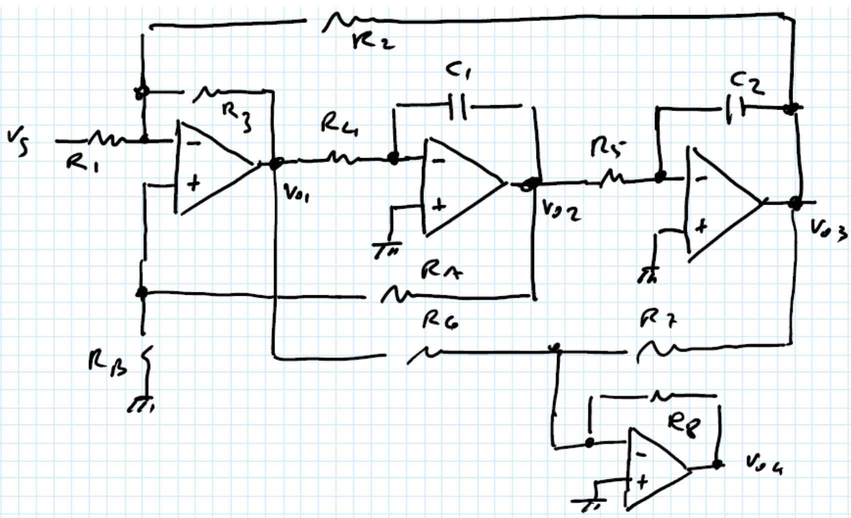


$R_1 = 1\Omega$ $R_A = 1\Omega$
$R_2 = 1\Omega$ $R_B = 1\Omega$
$R_3 = 1\Omega$ $C_1 = 1F$
$R_4 = 1\Omega$ $C_2 = 1F$
$R_5 = 1\Omega$
$R_6 = 1\Omega$
$R_7 = 1\Omega$
$R_8 = 1\Omega$

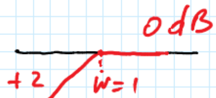
$$\begin{cases} V_{01} = -\dfrac{R_3}{R_1} V_S + \dfrac{R_B}{R_A+R_B}\,\dfrac{R_1 /\!/ R_2 + R_3}{R_1 /\!/ R_2} V_{02} - \dfrac{R_3}{R_2} V_{03} \\ V_{02} = -\dfrac{1}{sR_4C_1} V_{01} \\ V_{03} = -\dfrac{1}{sR_5C_2} V_{02} = \dfrac{1}{s^2 R_4 R_5 C_1 C_2} V_{01} \\ V_{04} = -\dfrac{R_8}{R_6} V_{01} - \dfrac{R_8}{R_7} V_{03} \end{cases}$$

con $R_i = 1\Omega$ $C_i = 1F$
$R_A = 1\Omega$ e $R_B = 1\Omega$

$$\begin{cases} V_{01} = -V_S + 1{,}5 V_{02} - V_{03} \\ V_{02} = -\dfrac{V_{01}}{s} \\ V_{03} = -\dfrac{V_{02}}{s} = \dfrac{1}{s^2} V_{01} \\ V_{04} = -V_{01} - V_{03} = \left(-1 - \dfrac{1}{s^2}\right) V_{01} = -\dfrac{s^2+1}{s^2} \cdot \dfrac{-s^2}{s^2+1{,}5s+1} V_S \end{cases}$$

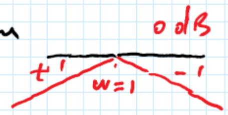
$$V_{01} = -V_S - \frac{1{,}5 V_{01}}{s} - \frac{V_{01}}{s^2} \rightarrow \left(1 + \frac{1{,}5}{s} + \frac{1}{s^2}\right) V_{01} = -V_S \rightarrow \qquad = \frac{s^2+1}{s^2+1{,}5s+1} V_S$$

$$F_1 = \frac{V_{01}}{V_S} = -\frac{s^2}{s^2+1{,}5s+1}$$ $\begin{cases} \text{2 zeri nell'origine} \\ \text{2 poli in } w=1 \end{cases}$



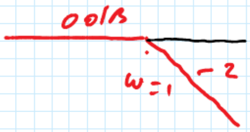
FILTRO PASSA ALTO 2° ORDINE

$$F_2 = \frac{V_{02}}{V_S} = \frac{V_{01}}{V_S} \cdot \frac{V_{02}}{V_{01}} = -\frac{s^2}{s^2+1{,}5s+1} \cdot \frac{-1}{s} = \frac{s}{s^2+1{,}5s+1}$$ $\begin{cases} \text{1 zero nell'origine} \\ \text{2 poli in } w=1 \end{cases}$



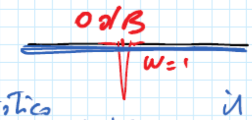
FILTRO PASSA BANDA

$$F_3 = \frac{V_{03}}{V_S} = \frac{V_{02}}{V_S} \cdot \frac{V_{03}}{V_{02}} = \frac{s}{s^2+1{,}5s+1} \cdot -\frac{1}{s} = -\frac{1}{s^2+1{,}5s+1}$$ 2 poli in $w=1$



FILTRO PASSA BASSO 2° ORDINE

$$F_4 = \frac{V_{04}}{V_S} = \frac{s^2+1}{s^2+1{,}5s+1}$$ $\begin{cases} \text{2 zeri in } w=1 \\ \text{2 poli in } w=1 \end{cases}$



(il diagramma asintotico del modulo è costante (0 dB) $\forall w$

il diagramma reale presenta un'attenuazione marcata in $w=1$

FILTRO ARRESTA BANDA

con $R_i = 10K\Omega$ e $C_i = 16mF$ $w = 2\pi f$ $f = 1KHz$

con $\dfrac{R_A}{R_B} = 1{,}12 \rightarrow$ filtro di BUTTERWORTH $Q = 1/\sqrt{2}$ $A_0 = Q = \dfrac{R_A + R_B}{3R_B}$

aumentando il rapporto $\dfrac{R_A}{R_B}$, aumenta il fattore di qualità