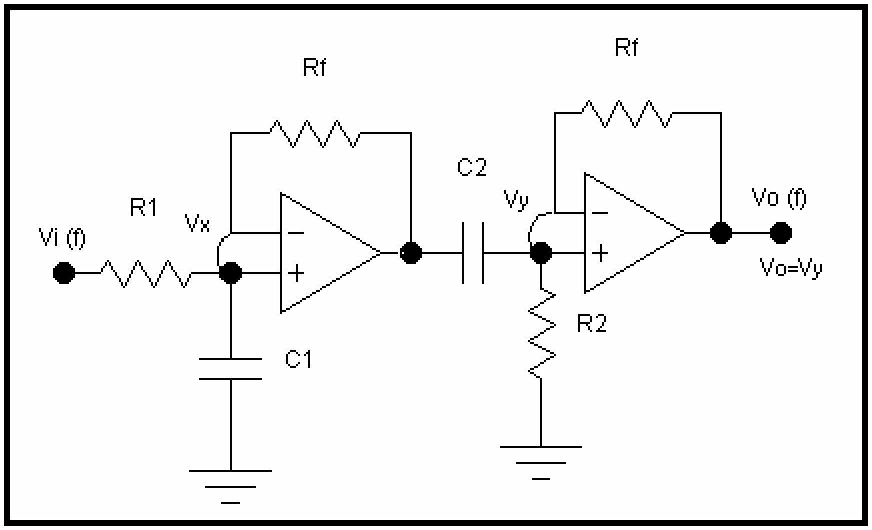
FILTRO PASABANDA: BANDA ANCHA



a. Hallar $A_V(w) = f(R, C, w)$

$$V_x = \frac{Z_{c1}}{R_1 + Z_{c1}} V_i \quad \rightarrow \quad V_x = \frac{\frac{1}{jwC}}{R_1 + \frac{1}{jwC}} V_i \quad \rightarrow \quad \boxed{V_x = \frac{1}{jwR_1C_1 + 1} V_i \quad (1)}$$

$$V_y = \frac{R_2}{R_2 + Z_{c2}} V_x \rightarrow \quad V_o = \frac{R_2}{R_2 + \frac{1}{jwC_2}} V_x \quad \rightarrow \quad \boxed{V_o = \frac{jwR_2C_2}{jwR_2C_2 + 1} V_x \quad (2)}$$

Reemplazo 1 en 2

$$V_o = \frac{jwR_2C_2}{jwR_2C_2 + 1}\left[\frac{1}{jwR_1C_1 + 1} V_i\right] \quad \rightarrow \quad V_o = \frac{jwR_2C_2}{(jwR_2C_2 + 1)(jwR_1C_1 + 1)} V_i$$

$$\frac{V_o}{V_i} = \frac{jwR_2C_2}{-w^2R_1R_2C_1C_2 + jwR_2C_2 + jwR_1C_1 + 1}$$

$$\boxed{|Av(w)| = \frac{wR_2C_2}{\sqrt{\left(1 - w^2R_1R_2C_1C_2\right)^2 + \left(wR_2C_2 + wR_1C_1\right)^2}}}$$

b. Hallar $w_c \;\; y \;\; f_c$

$$\frac{1}{\sqrt{2}}=\frac{wR_2C_2}{\sqrt{\left(1-w^2R_1R_2C_1C_2\right)^2+\left(wR_2C_2+wR_1C_1\right)^2}}$$

$$\left(\sqrt{\left(1-w^2R_1R_2C_1C_2\right)^2+\left(wR_2C_2+wR_1C_1\right)^2}\right)^2=\left(wR_2C_2\sqrt{2}\right)^2$$

$$\left(1-w^2R_1R_2C_1C_2\right)^2+\left(wR_2C_2+wR_1C_1\right)^2=2w^2R_2{}^2C_2{}^2$$

$$1-2w^2R_1R_2C_1C_2+w^4R_1{}^2R_2{}^2C_1{}^2C_2{}^2+w^2R_2{}^2C_2{}^2+2w^2R_1R_2C_1C_2+w^2R_1{}^2C_1{}^2=2w^2R_2{}^2C_2{}^2$$

$$1+w^4R_1{}^2R_2{}^2C_1{}^2C_2{}^2-w^2R_2{}^2C_2{}^2+w^2R_1{}^2C_1{}^2=0$$

Como: $f_H=10f_L$, entonces:

$$f_L=\frac{1}{2\pi R_2C_2} \qquad f_H=\frac{10}{2\pi R_2C_2}=\frac{1}{2\pi R_1C_1} \qquad R_2C_2=10R_1C_1$$

Lo reemplazo en la ecuación anterior:

$$1+w^4R_1{}^2C_1{}^2(10R_2C_2)^2-w^2(10R_1C_1)^2+w^2R_1{}^2C_1{}^2=0$$

$$1+100w^4R_1{}^4C_1{}^4-100w^2R_1{}^2C_1{}^2+w^2R_1{}^2C_1{}^2=0$$

$$100w^4R_1{}^4C_1{}^4-99w^2R_1{}^2C_1{}^2+1=0$$

$$w^2\left(100w^2R_1{}^4C_1{}^4-99R_1{}^2C_1{}^2\right)+1=0$$

$$w^2+1=0$$

$$100w^2R_1{}^4C_1{}^4-99R_1{}^2C_1{}^2=0$$

$$w=\sqrt{-1}$$

$$w^2=\frac{99R_1{}^2C_1{}^2}{100R_1{}^4C_1{}^4} \rightarrow w=\sqrt{\frac{99}{100R_1{}^2C_1{}^2}} \rightarrow \boxed{w=\frac{\sqrt{99}}{10R_1C_1}}$$

$$2\pi f_H=\frac{\sqrt{99}}{10R_1C_1} \rightarrow f_H=\frac{\sqrt{99}}{20\pi R_1C_1} \rightarrow \boxed{f_H=\frac{0.1583}{R_1C_1}} \rightarrow$$

$$f_L=\frac{\frac{0.1583}{R_1C_1}}{10}$$

$$\boxed{f_L=\frac{0.01583}{R_1C_1}}$$

c. Hallar $\left|A_v(f)\right|=f(f,f_c)$

$$f_r = \sqrt{\left(\frac{0.1583}{R_1C_1}\right)\left(\frac{0.01583}{R_1C_1}\right)} = \frac{0.05}{R_1C_1} \quad \rightarrow \quad \boxed{R_1C_1 = \frac{0.05}{f_r}}$$

$$|A_v(w)| = \frac{10w\left(\frac{0.05}{f_r}\right)}{\sqrt{\left(1-10w^2\left(\frac{0.05}{f_r}\right)^2\right)^2 + \left(11w\left(\frac{0.05}{f_r}\right)\right)^2}}$$

$$\boxed{|A_v(w)| = \frac{3.1415\left(\frac{f}{f_r}\right)}{\sqrt{\left(1-0.986\left(\frac{f}{f_r}\right)^2\right)^2 + \left(3.4557\left(\frac{f}{f_r}\right)\right)^2}}}$$

d. Dibujar $|A_v(f)|$ Vs f

$$\boxed{|A_v(w)| = \frac{3.1415\left(\frac{f}{f_r}\right)}{\sqrt{\left(1-0.986\left(\frac{f}{f_r}\right)^2\right)^2 + \left(3.4557\left(\frac{f}{f_r}\right)\right)^2}}} \qquad \boxed{A_v = 20\log\left(\frac{V_0}{V_i}\right)}$$

f	$\lvert A_v(f)\rvert$	$\lvert A_v(f)\rvert\ db$
0	0	0
0.1fc	0.3	-10
0.5fc	0.8	-2
0.8 fc	0.9	-1
fc	0.9	-1
2 fc	0.8	-2
4 fc	0.6	-4
6 fc	0.5	-7
8 fc	0.4	-9
10 fc	0.3	-10