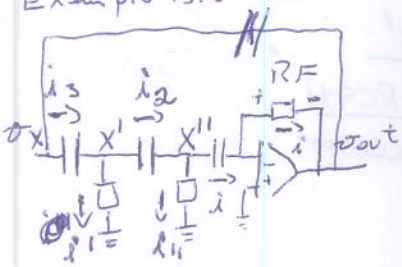
Exemplo 13.5 - Sedra



* Sem realimentação

$\rightarrow v_{out} = -R_F \cdot i''$

$\rightarrow i'' = \frac{v_x''}{1/sC} = v_x'' \cdot sC$

$\Rightarrow \boxed{v_{out} = -R_F v_x'' \cdot sC}$

$\rightarrow i_{11} = \frac{v_x''}{R}$

$\rightarrow i_2 = i + i'' = v_x'' sC + \frac{v_x''}{R} = v_x'' \left(sC + \frac{1}{R}\right)$

$1 + \frac{1}{RCs}$

$\rightarrow v_x' = v_x'' + i_2 \cdot \frac{1}{sC} = v_x'' + v_x'' \left(sC + \frac{1}{R}\right) \cdot \frac{1}{sC} = v_x'' \cdot \left(2 + \frac{1}{RCs}\right)$

$\rightarrow i' = \frac{v_x'}{R} = \frac{v_x''}{R}\left(2 + \frac{1}{RCs}\right)$

• $i_3 = i' + i_2 = \frac{v_x''}{R}\left(2 + \frac{1}{RCs}\right) + v_x''\left(sC + \frac{1}{R}\right)$

$i_3 = v_x'' \cdot \left[\left(\frac{2}{R} + \frac{1}{R^2Cs}\right) + \left(sC + \frac{1}{R}\right)\right]$

$i_3 = v_x'' \cdot \left[\frac{3}{R} + \frac{1}{R^2Cs} + sC\right]$

• $v_x = v_x' + i_3 \cdot \frac{1}{sC} = v_x''\left(2 + \frac{1}{RCs}\right) + v_x''\left[\frac{2}{RCs} + \frac{1}{R^2(sC)^2} + \left(1 + \frac{1}{RCs}\right)\right]$

$v_x = v_x'' \cdot \left[2 + \frac{1}{RCs} + \frac{2}{RCs} + \frac{1}{R^2C^2s^2} + 1 + \frac{1}{RCs}\right]$

$v_x'' = \frac{v_x}{\left[2 + \frac{3}{R} + \frac{1}{R^2Cs} + sC\left(1 + \frac{1}{R}\right)\right]} = \frac{v_x}{\frac{1}{R^2C^2s^2} + \frac{4}{RCs} + 3}$

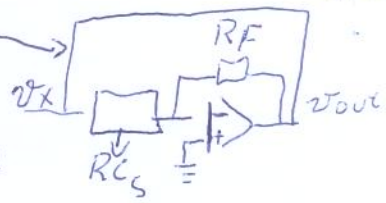
$v_{out} = -R_F \frac{v_x \, sC}{2 + \frac{3}{R} + \frac{1}{R^2Cs} + sC\left(1 + \frac{1}{R}\right)} - R_F \cdot \frac{v_x}{\frac{1}{R^2C^2s^2} + \frac{4}{RCs} + 3} \cdot sC \cdot \frac{}{}$

$v_{out} = \frac{-R_F v_x s^2C^2}{\frac{1}{R^2Cs} + \frac{4}{R} + 3sC} \cdot R = \frac{-R_F s^2C^2 R v_x}{\frac{1}{RCs} + 4 + 3RCs} \overset{s=j\omega}{=} \frac{R_F R C^2 \omega^2 v}{4 + \frac{1}{} + 3RCj\omega}$

$A_0 = \pm \frac{R_F R C^2 \omega^2}{}$ $j\omega RC$

13.6 $A(s)$ → função em malha aberta ⇒ $A(s) = A_V = \dfrac{R_F R C^2 \omega^2}{4 + j\left(3RC\omega - \frac{1}{\omega RC}\right)}$

$B(s)$ → Realimentação ⇒ $B(s) = 1$



$\therefore L(s) = A(s) \cdot B(s) = \dfrac{R_F R C^2 \omega^2}{4 + j\left(3RC\omega - \frac{1}{\omega RC}\right)}$

$\underline{L(j\omega_0)} = \emptyset \Rightarrow 3RC\omega_0 = \dfrac{1}{\omega_0 RC} \Rightarrow \omega_0 = \sqrt{\dfrac{1}{3R^2C^2}}$

$\downarrow 10^4 \quad \downarrow 16 \cdot 10^{-9}$

$\div 2\pi \hookrightarrow$ $\omega_0 = 3.608{,}4$ rad/s

$f_0 = 574{,}3$ Hz

$|L(j\omega_0)| = 1 \Rightarrow \dfrac{R_F \cdot RC^2 \cdot \omega_0^2}{4} = 1$

$R_F = \dfrac{4}{R \cdot C^2 \cdot \omega_0^2} \Rightarrow R_F = 120\,k\Omega$