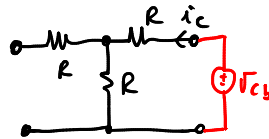


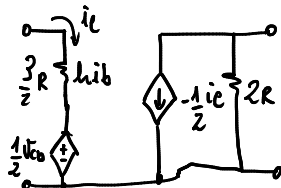
$i_c = ? = -\frac{i_e R}{R+R} = -\frac{i_e}{2}$
 $h_{fb} = -\frac{1}{2}$

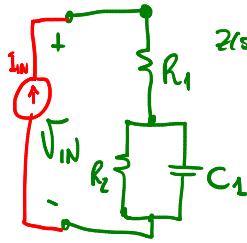
$h_{ob} = \frac{i_c}{V_{cb}} \Big|_{i_e=0}$



$i_c = \frac{V_{cb}}{R+R} = \frac{i_c}{V_{cb}} = \frac{1}{2R}$

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$$Z(s) = R_1 + R_2 \parallel \frac{1}{C_1 s}$$

$$= R_1 + \frac{R_2}{1 + R_2 C_1 s}$$

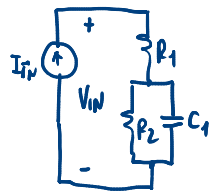
$$= \frac{R_1 + R_2 R_1 C_1 s + R_2}{1 + R_2 C_1 s}$$

$$= (R_1 + R_2) \frac{1 + \frac{R_2 R_1}{R_1 + R_2} C_1 s}{1 + R_2 C_1 s}$$

$$R_2 C_1 = \frac{1}{\omega_p}$$

$$\frac{R_2 R_1}{R_1 + R_2} C_1 = \frac{1}{\omega_0}$$

$$Z(s) = (R_1 + R_2) \frac{1 + \frac{s}{\omega_0}}{1 + \frac{s}{\omega_p}} = \frac{V_w(s)}{I_w(s)}$$



$$\frac{V_w}{I_w} = \frac{R_0 \left(1 + \frac{s}{\omega_0}\right)}{1 + \frac{s}{\omega_p}} \quad R_0 = R_1 + R_2$$

$$\omega_p = \frac{1}{C_1 R_2}$$

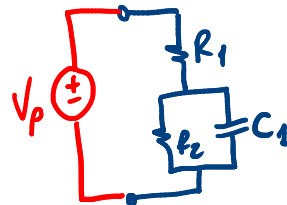
$$z_{\infty} = \frac{R_0}{\omega_0} \cdot \omega_p$$

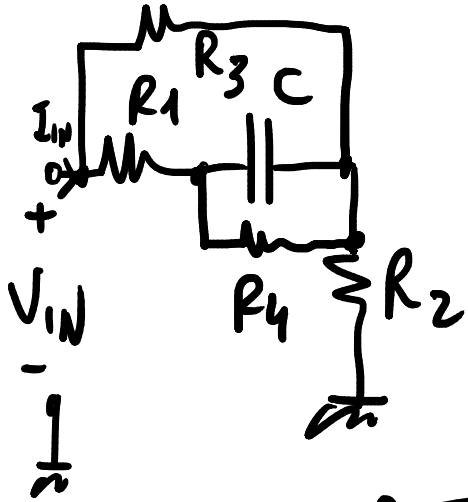
$$\omega_0 = \frac{R_0 \omega_p}{z_{\infty}}$$

$$z_{\infty} = R_1 \quad \omega_0 = \frac{R_1 + R_2}{C_1 R_2 R_1} = \frac{1}{C_1 R_1 \parallel R_2}$$

$$Z(s) = \frac{V}{I} = \frac{Z(s)}{Y(s)} \quad Z(s) = \frac{1}{Y(s)} \quad Y(s) = \frac{I(s)}{V(s)}$$

$$\omega_p^Y = \frac{1}{C_1 R_1 \parallel R_2} = \omega_0^I = \omega_0$$



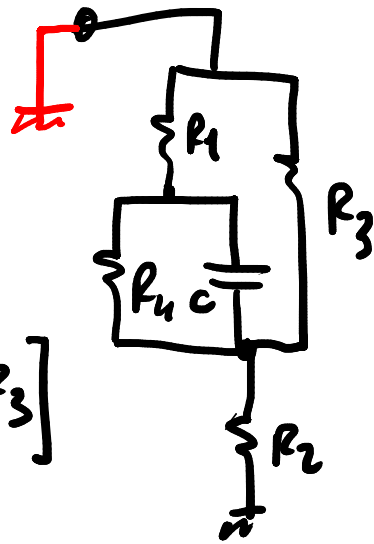


$$Z = \frac{V_{IN}}{I_{IN}}$$

$$Z = R_0 \frac{(1 + \frac{s}{\omega_0})}{(1 + \frac{s}{\omega_p})}$$

$$\omega_p = \frac{1}{CR_v}$$

$$R_v = R_4 \parallel [R_1 + R_3]$$



$$\omega_0 = \frac{1}{CR_v'}$$

$$R_0 = (R_1 + R_4) \parallel R_3 + R_2$$

$$R_4 \parallel [R_1 + R_3 \parallel R_2]$$