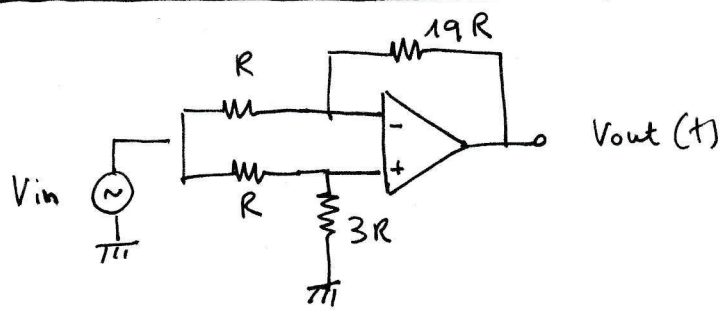
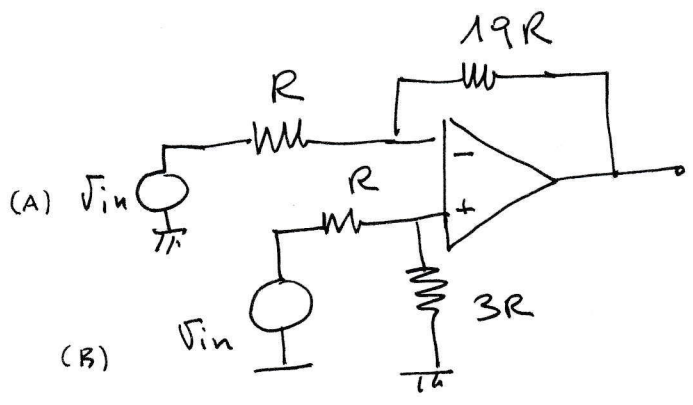


ES. 1 11/9/2018

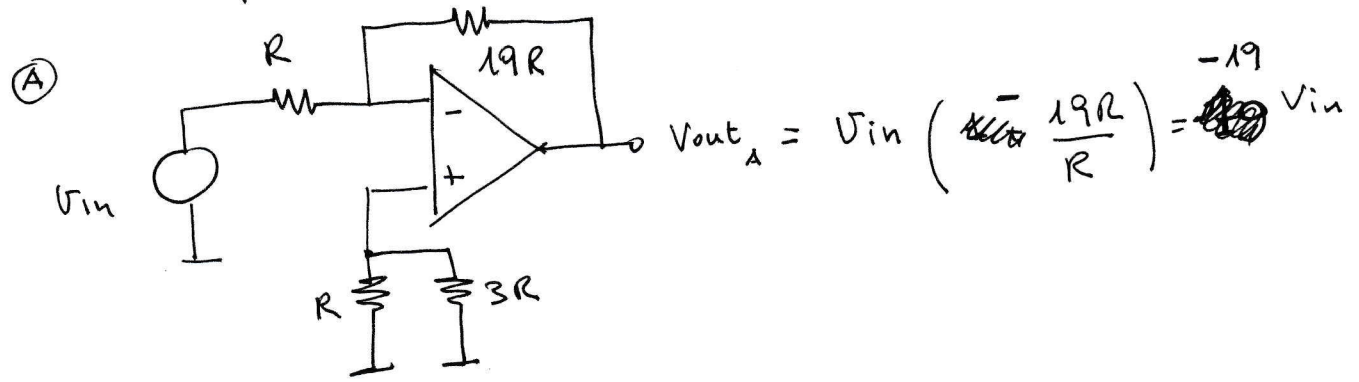
(2)



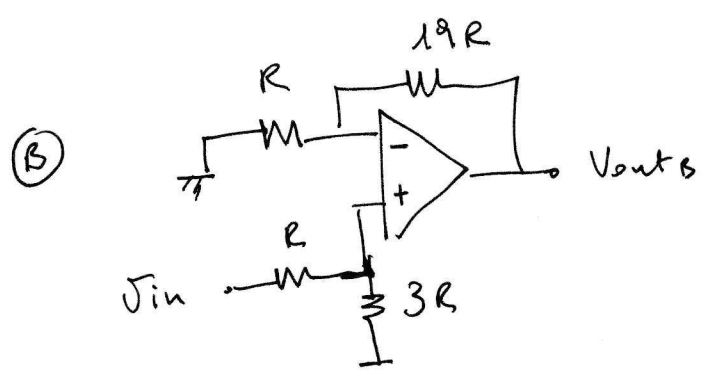
↓ E' equivalente a



↓ sovrapposizione degli effetti



$$V_{out_A} = V_{in} \left(\frac{19R}{R} \right) = -19 V_{in}$$



$$\begin{aligned} V_{out_B} &= V_{in} \left(1 + \frac{19R}{R} \right) = \\ &= V_{in} \cdot \frac{3R}{R+3R} \left(1 + \frac{19R}{R} \right) = \\ &= V_{in} \cdot \frac{3}{4} \cdot 20 = 15 V_{in} \end{aligned}$$

$$V_{out_{TOT}} = -19 V_{in} + 15 V_{in} = -4 V_{in}$$

$$V_{out_A} = \left(1 - \frac{1}{\beta}\right) \frac{\beta A_0}{1 + \beta A_0} \cdot \frac{1}{1 + j \frac{f}{f_H (1 + \beta A_0)}} \cdot V_{in}$$

2
(B)

$$V_{out_B} = \frac{1}{\beta} \frac{\beta A_0}{1 + \beta A_0} \frac{A}{1 + j \frac{f}{f_H (1 + \beta A_0)}} \cdot \frac{3}{4} V_{in}$$

$$V_{out_{A+B}} = \underbrace{\left[1 - \frac{1}{\beta} + \frac{3}{\beta 4}\right]}_1 \frac{\beta A_0}{1 + \beta A_0} \frac{1}{1 + j \frac{f}{f_H (1 + \beta A_0)}} V_{in}$$

$$= \underbrace{\left[1 - \frac{1}{\beta} \left(1 - \frac{3}{4}\right)\right]}_1 \frac{\beta A_0}{1 + \beta A_0} \frac{1}{1 + j \frac{f}{f_H (1 + \beta A_0)}} V_{in}$$

$$\left(\beta = \frac{1}{20}\right) \quad 1 - 20 \cdot \frac{1}{4} = -4$$

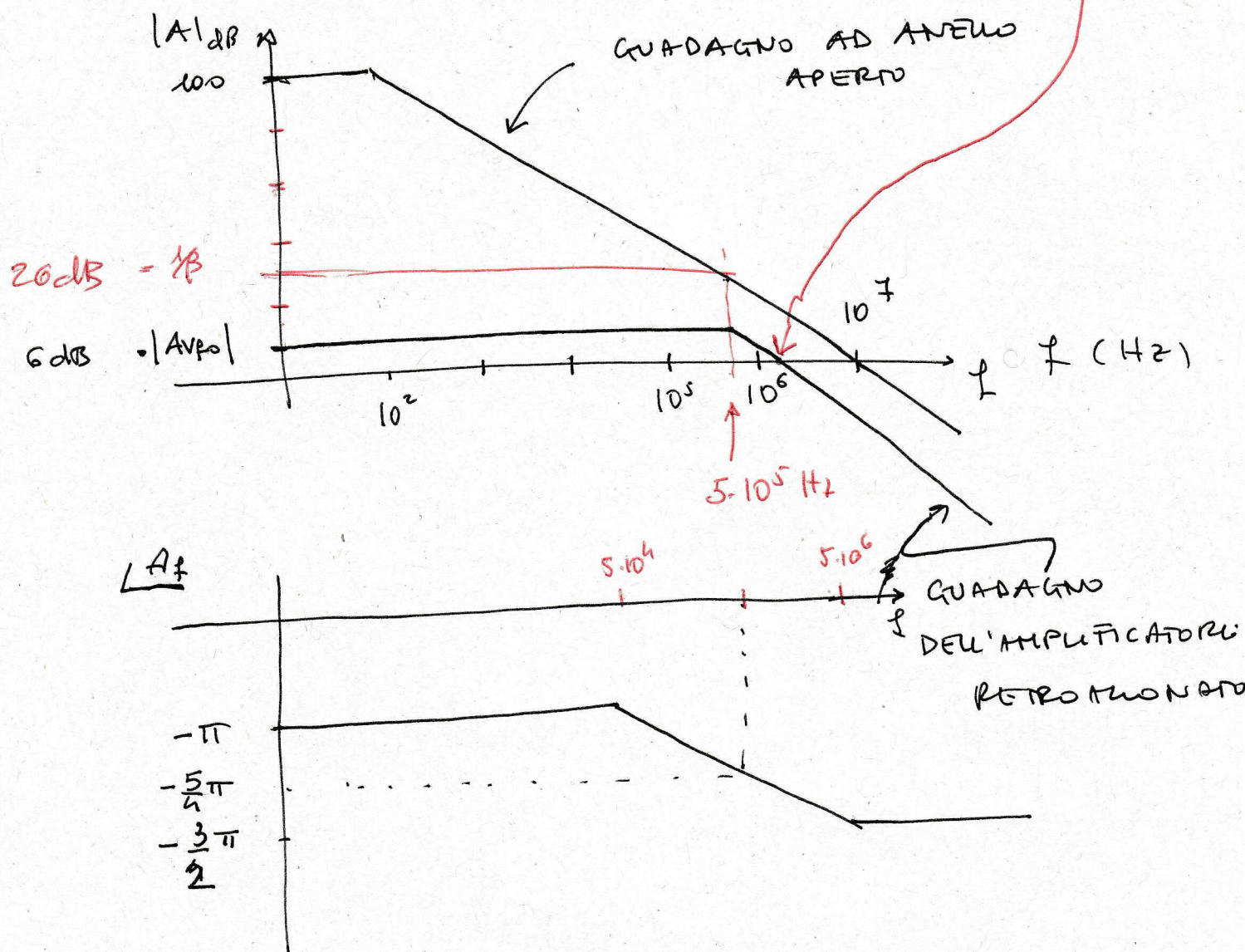
$$\frac{V_{out}}{V_{in}} = V_{in} \underbrace{-4 \cdot \frac{\beta A_0}{1 + \beta A_0}}_{A_{V_{f0}}} \frac{1}{1 + j \frac{f}{f_H (1 + \beta A_0)}}$$

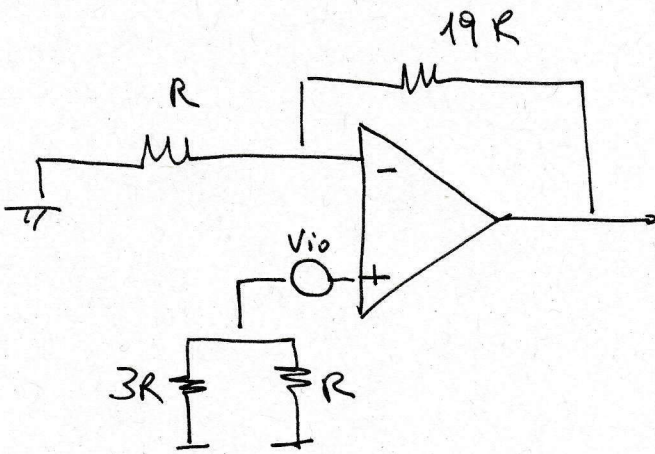
Per $f > f_H (1 + \beta A_0) \approx 100 \cdot 5000 = 5 \cdot 10^5 \text{ Hz}$

$$\left| \frac{V_{out}}{V_{in}} \right| \approx 4 \cdot \frac{\beta A_0}{1 + \beta A_0} \cdot \frac{f_H (1 + \beta A_0)}{f}$$

$$\approx \frac{4 \cdot 5 \cdot 10^3 \cdot 10^2}{f} = \frac{20 \cdot 10^5}{f} \approx$$

$\rightarrow$ per $\left| \frac{V_{out}}{V_{in}} \right| = 1 \Rightarrow \text{GBW}_f = 20 \cdot 10^5 \text{ Hz}$
 $= 2 \cdot 10^6 \text{ Hz}$





AO ideale $\Rightarrow$

$$V_{out} = V_{io} \cdot \left(1 + \frac{19R}{R} \right) =$$

$$= 20 V_{io} = \left| \begin{array}{l} 20 \text{ mV} \\ V_{io} = 1 \text{ mV} \end{array} \right.$$