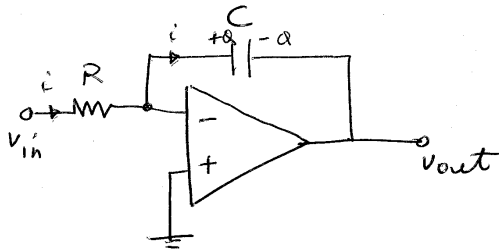


ELECTRÓNICA 1

AULA 3 - OP AMPS (CONT)

Amplificador Integrador (Integrador de Miller)



$$i = \frac{v_{in}}{R}$$

$$v_{out} = - \frac{q}{C}$$

$$\frac{dv_{out}}{dt} = - \frac{1}{C} \frac{dq}{dt}$$

mas $i = \frac{dq}{dt}$

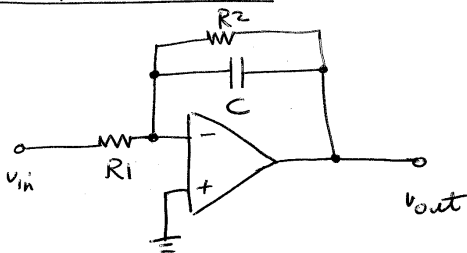
logo $\frac{dv_{out}}{dt} = - \frac{1}{C} i$

$$\frac{dv_{out}}{dt} = - \frac{1}{RC} v_{in}$$

integrando entre 0 e t (assumindo que C está des carregado no momento inicial)

$$v_{out}(t) = - \frac{1}{RC} \int_0^t v_{in}(t) dt$$

Filtro passa baixo



$$\frac{v_{out}}{v_{in}} = - \frac{R2 \parallel Z_c}{R1}$$

$$Z_c = \frac{1}{j\omega C}$$

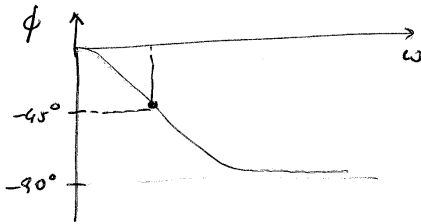
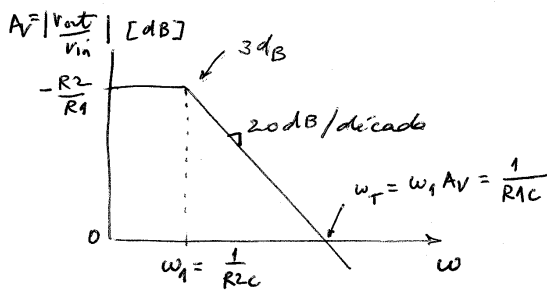
$$R_2 \parallel Z_c = \frac{R_2 \times \frac{1}{j\omega C}}{R_2 + \frac{1}{j\omega C}} = \frac{R_2}{1 + j\omega R_2 C}$$

$$\frac{v_{out}}{v_{in}} = -\frac{R_2}{R_1} \frac{1}{1 + j\omega R_2 C}$$

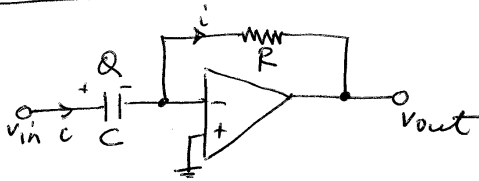
$$A_V = \left| \frac{v_{out}}{v_{in}} \right| = \frac{R_2}{R_1} \frac{1}{\sqrt{1 + \omega^2 (R_2 C)^2}}$$

$$\phi = \arctg(-\omega R_2 C)$$

$$x \text{ [dB]} = 20 \log_{10} x$$



amplificador diferenciador



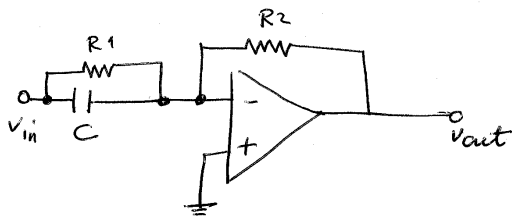
$$v_{out} = -R i$$

$$i = \frac{dq}{dt} = C \frac{dv_{in}}{dt}$$

logo

$$v_{out} = -RC \frac{dv_{in}}{dt} //$$

filtro passa-alto



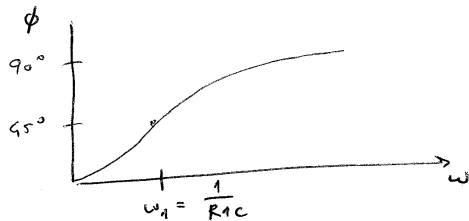
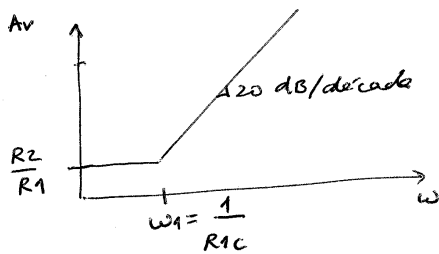
$$R1 \parallel Z_c = \frac{R1}{1 + j\omega R1 C}$$

$$\frac{V_{out}}{V_{in}} = - \frac{R2}{R1 \parallel Z_c}$$

$$\frac{V_{out}}{V_{in}} = - \frac{R2}{R1} (1 + j\omega R1 C)$$

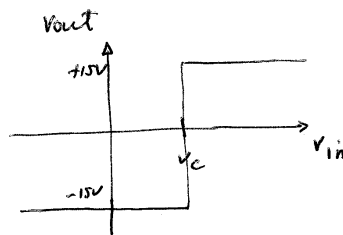
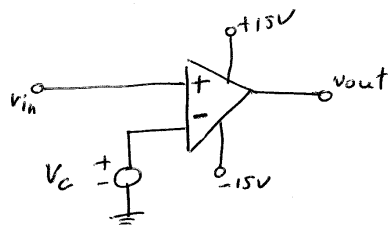
$$\left| \frac{V_{out}}{V_{in}} \right| = + \frac{R2}{R1} \sqrt{1 + \omega^2 (R1 C)^2}$$

$$\phi = \text{arctg}(\omega R1 C)$$



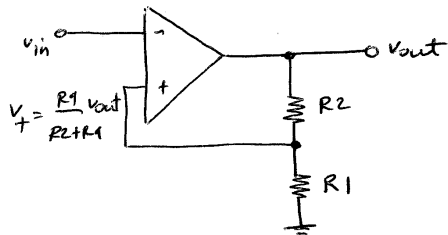
APLICAÇÕES NÃO LINEARES (REALIMENTAÇÃO POSITIVA)

COMPARADOR

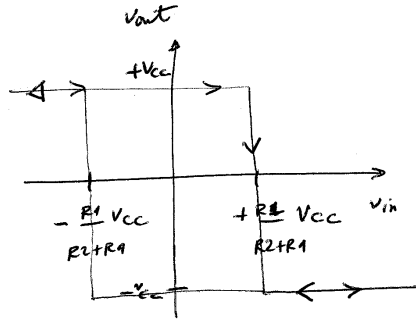
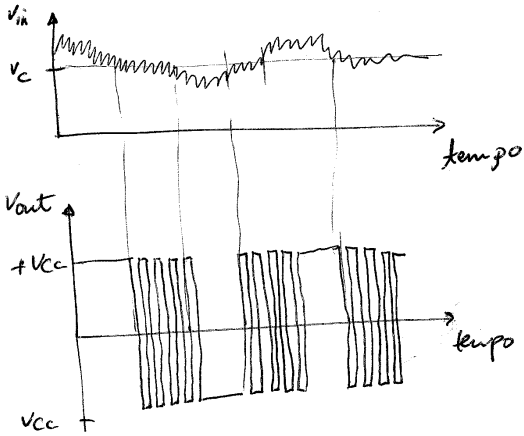


EL1 aula 3

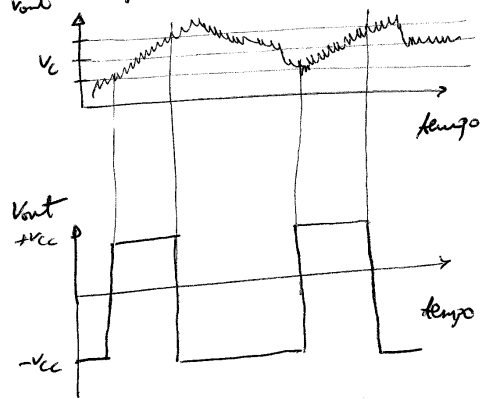
COMPARADOR COM HISTERESE



comparador sem histerese



comparador com histerese



GERADOR DE ONDA QUADRADA

