

17. Usi non lineari dell'opAmp

Titolo nota

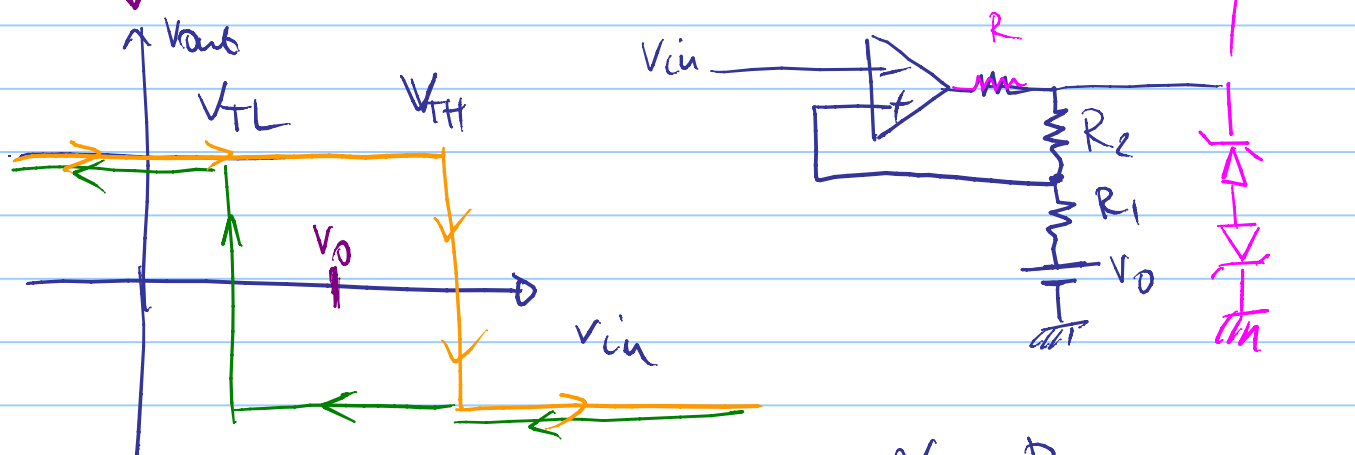
4/23/2008

3. Applicazioni non lineari

a) Comparatore



b) Trigger di Schmidt (isteresi)

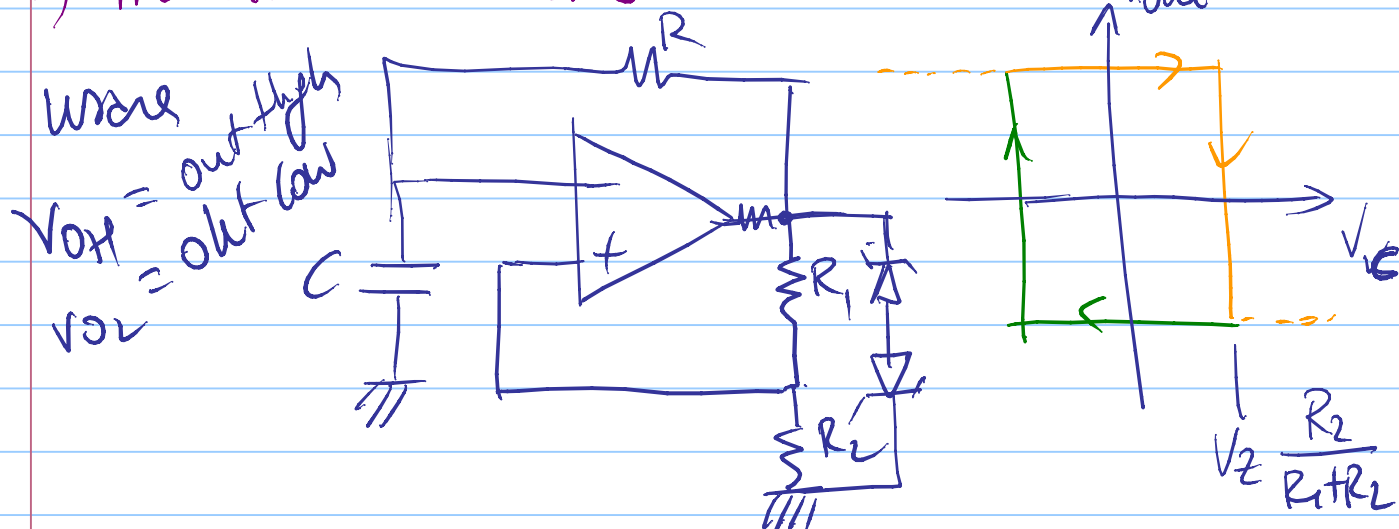


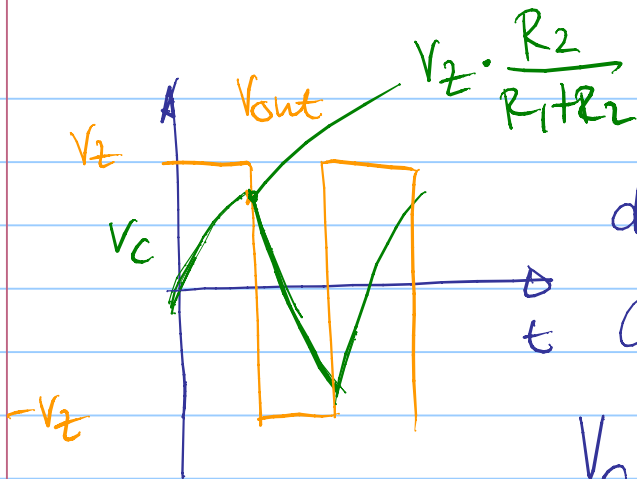
$$V_{TH} = V_0 + \frac{V_{cc} R_1}{R_1 + R_2}$$

$$V_{TL} = V_0 - \frac{V_{EE} R_1}{R_1 + R_2}$$

Immunità al rumore

c) Multivibratore stabile





Il C si carica partendo
da $V_C = V_Z \frac{R_2}{R_1 + R_2}$ verso $-V_Z$

Con costante $\tau = RC$

$$V_C = -V_Z + A e^{-t/\tau}$$

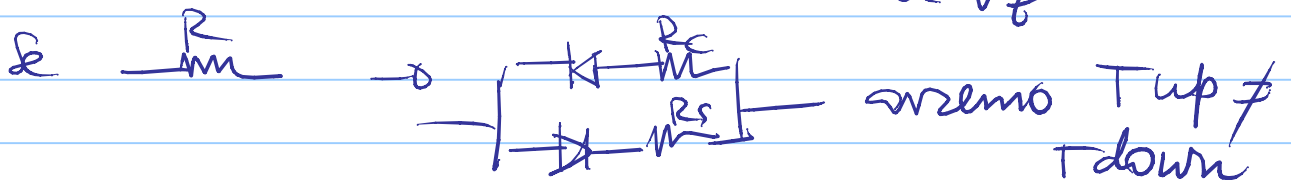
$$A = V_Z \left(1 + \frac{R_2}{R_1 + R_2} \right) = V_Z \frac{R_1 + 2R_2}{R_1 + R_2}$$

Scatto quando $V_C = -V_Z \frac{R_2}{R_1 + R_2}$

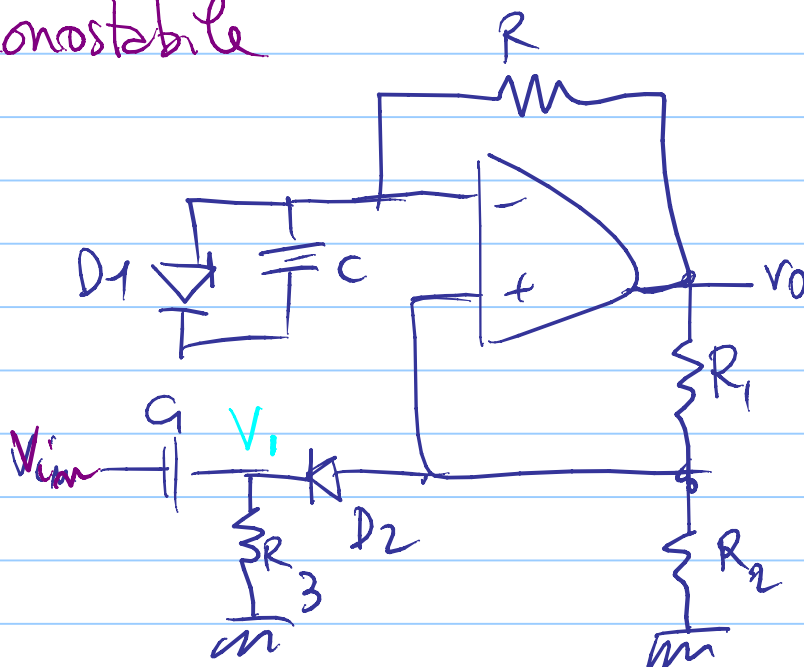
$$-V_Z + V_Z \frac{R_1 + 2R_2}{R_1 + R_2} e^{-T/2\tau} = -V_Z \frac{R_2}{R_1 + R_2}$$

$$e^{-T/2\tau} (R_1 + 2R_2) = R_1$$

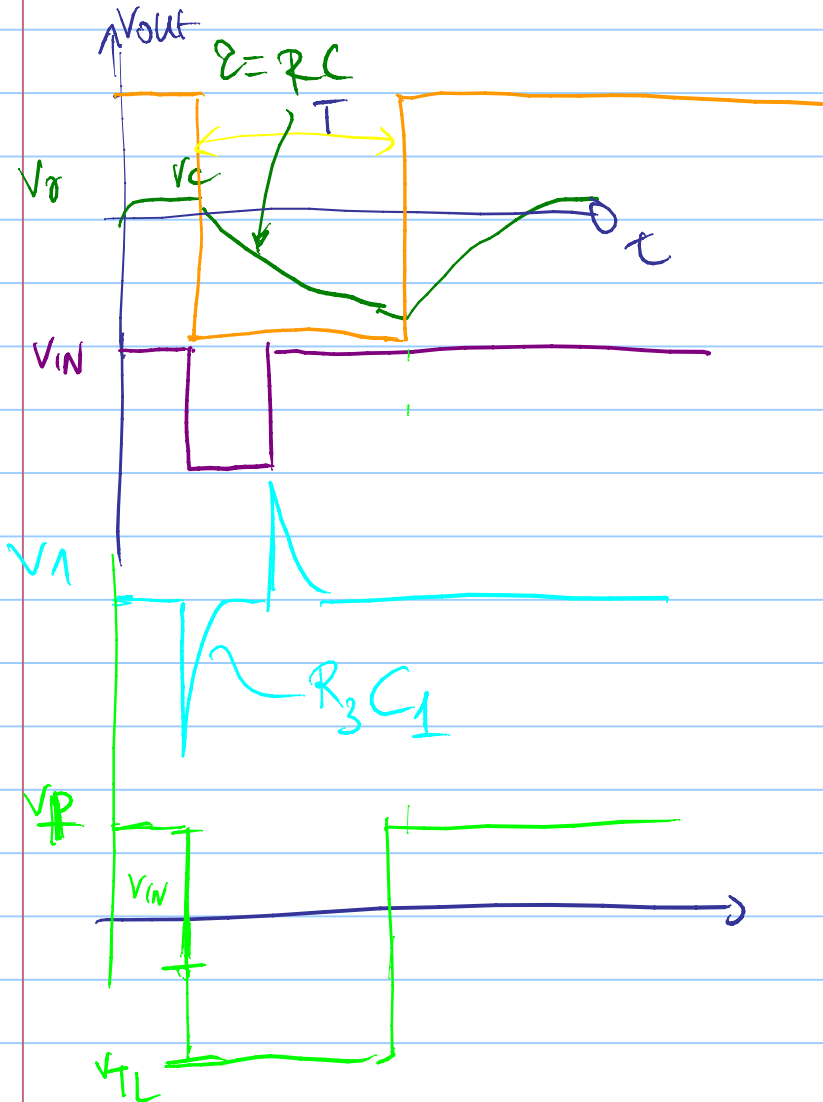
$$T = 2\tau \ln \left(1 + 2 \frac{R_2}{R_1} \right) \quad \text{indipendente da } V_Z$$



d) Monostabile



Se $V_0 = V_{cc}$, la soglia $V_+ = V_{cc} \left(1 + \frac{R_2}{R_1}\right)$ (PTH)
 V_c è bloccato a $V_x \rightarrow$ non scatta.

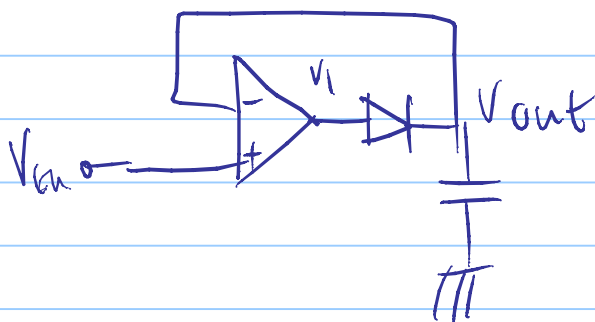


Scrive da V_x a V_{OL}
 $V = V_{OL} + (V_x - V_{OL})e^{-t/\tau}$
 $= V_{OL} - \left(1 + \frac{R_2}{R_1}\right) \text{ soglia } (V_{TL})$

$$T = \tau \ln \frac{V_x - V_{OL}}{V_{TL} - V_{OL}}$$

$$\approx \tau \ln \left(1 + \frac{R_2}{R_1}\right)$$

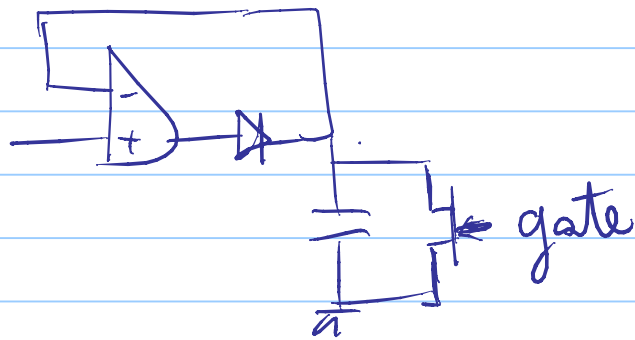
d) Rivelatore di peccato



(Si elimina la caduta del diodo)

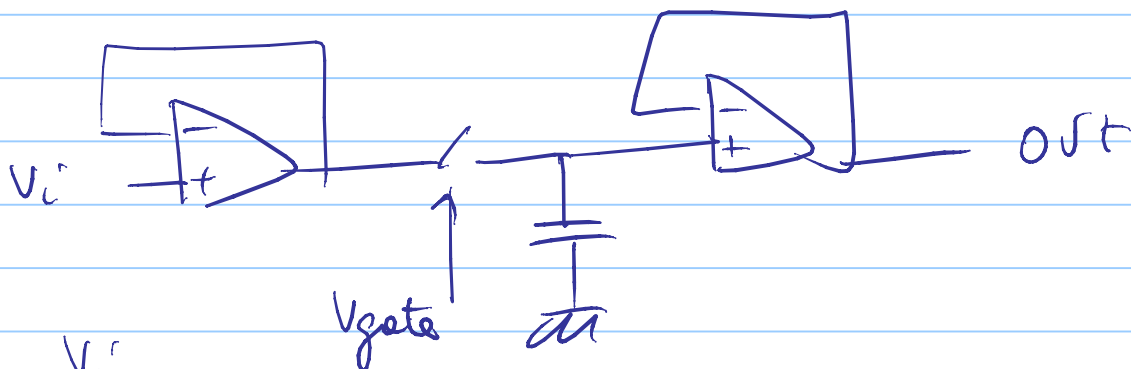
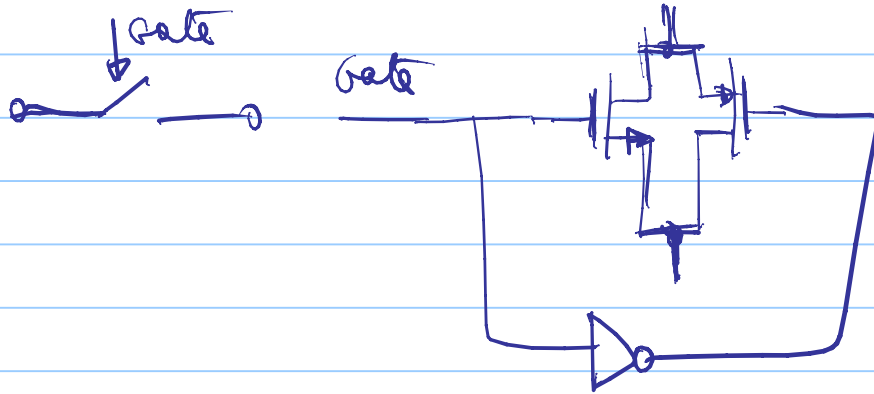
$$V_x = V_{out} + V_x$$

Resettable



Sample & Hold

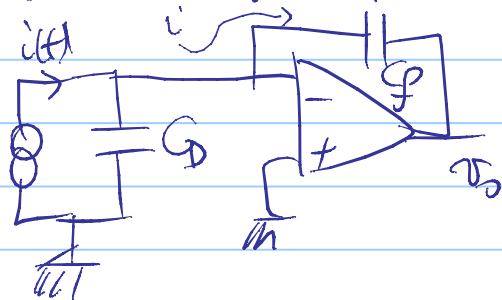
Interruttore controllato in tensione



Effetto della
resistenza
dell'interruttore

Amplificatore di carica

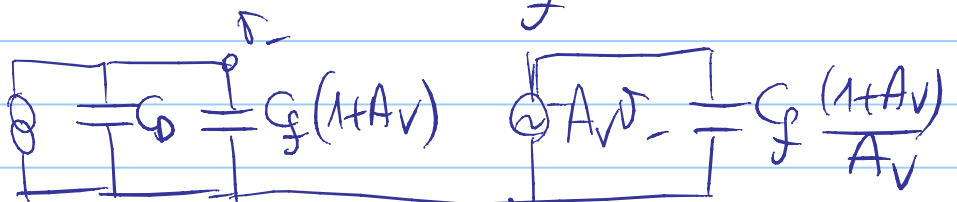
Converte la carica (ad esempio raccolta da un rivelatore) in tensione. Il rivelatore genera un impulso di corrente $i(t)$ con $Q = \int i dt$. Inoltre il rivelatore ha una sua capacità C_D .



(Masse virtuale)

$$V_o = - \frac{Q}{C_F}$$

Con Miller:

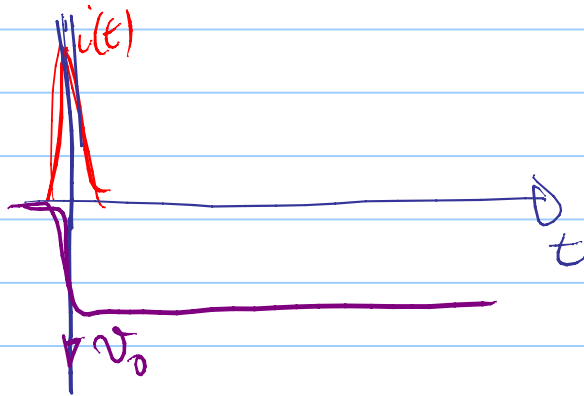


$$Z_{in} = \frac{Z_F}{1-R} = \frac{Z_F}{1+A_v}$$

$$Z_{2M} = \frac{-R Z_F}{1-R} = \frac{A_v Z_F}{1+A_v}$$

$$C' = C_0 + \overset{C_{IN}}{\underbrace{C_f(1+A_v)}} \quad v_- = \frac{Q}{C'}$$

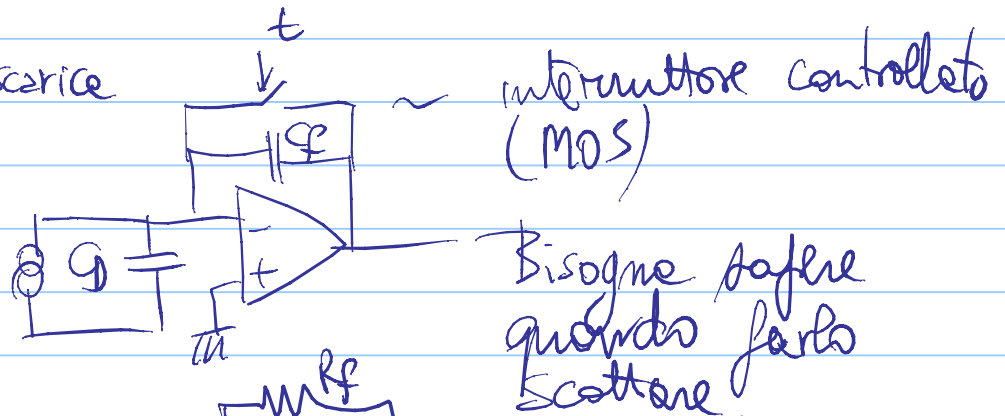
$$v_o = - \frac{A_v Q}{C_0 + C_f(1+A_v)}$$



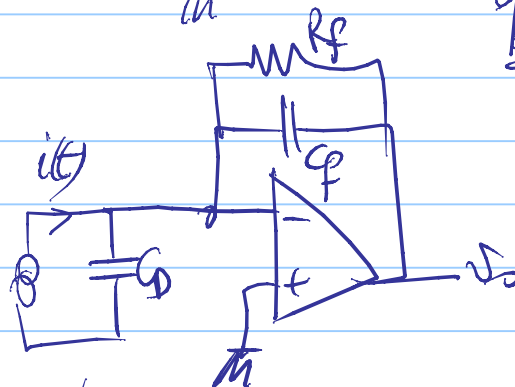
Non si scarica mai!

Due metodi di scarica

1) Switch



2) Resistenza



Le costante τ è breve rispetto a $R_f C_f = C_f \rightarrow$

$$v_o = - \frac{Q}{C_f} e^{-t/\tau}$$

Segnale "formato"
indipendente dalla durata
dell'impulso iniziale

