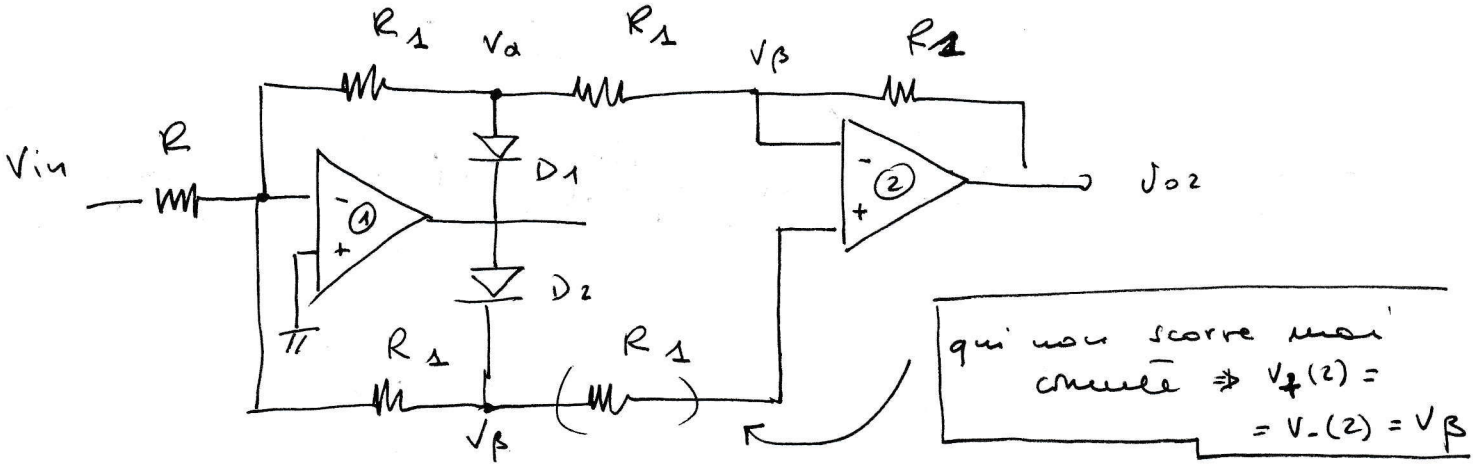
24/9/2020

ES-1



$V_{in} > 0 \rightarrow V_{o2} = -\frac{R_1}{R_1} V_\alpha = +\frac{R_1}{R} V_{in}$ (D_1 ON)

↓ sul ramo inferiore non scorre corrente.

$V_{in} < 0 \rightarrow D_2$ ON

$$\frac{V_{in}}{R} = -\frac{V_\beta}{2R_1} - \frac{V_\beta}{R_1}$$

$$\Rightarrow 3V_\beta = -\frac{2R_1}{R} V_{in} \Rightarrow V_\beta = -\frac{2}{3}\frac{R_1}{R} V_{in}$$

$$V_{o2} = V_\beta \cdot \left(1 + \frac{R_1}{2R_1}\right) = \frac{3}{2} V_\beta = -\frac{R_1}{R} V_{in}$$

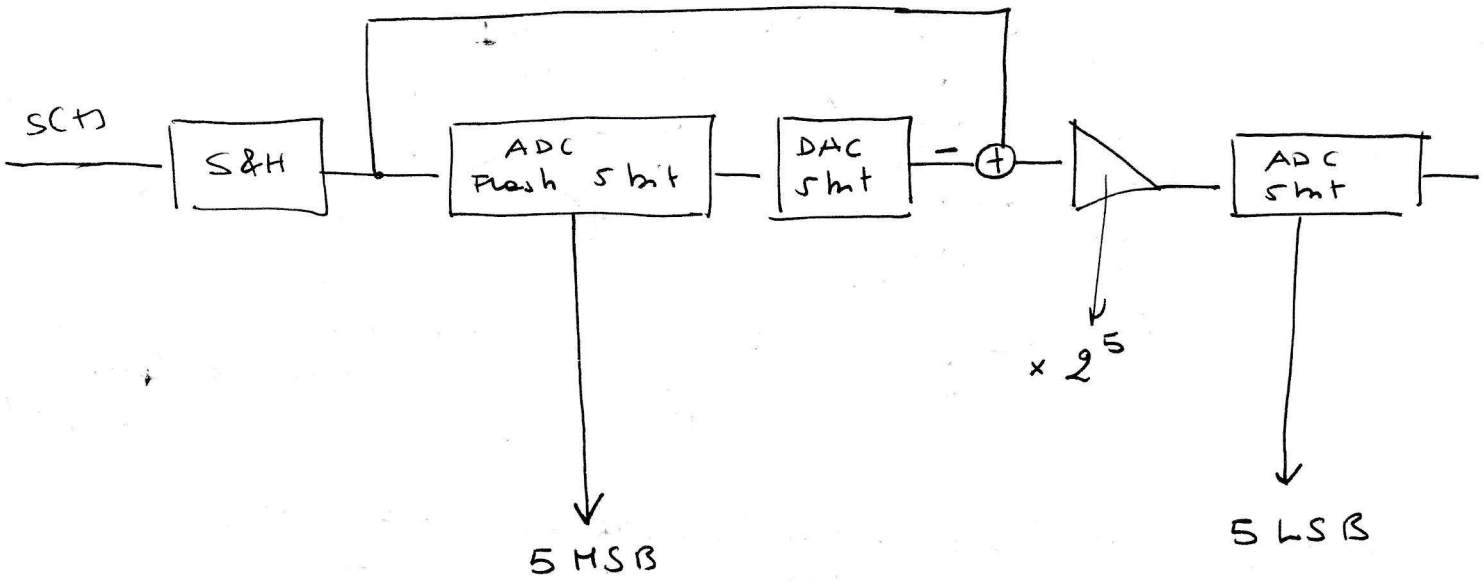
Per le specifiche $\frac{R_1}{R} = 2$

una soluzione possibile è $R_1 = 20\,k\Omega$

$R = 10\,k\Omega$

(ie cui vista dagli AO è dell'ordine di R_1)

ES. 2

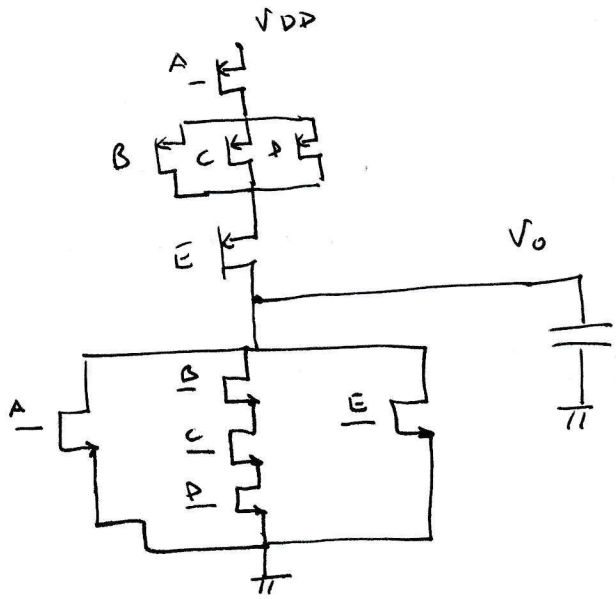


Considerando ADC flash operanti per overload.

$$SNR_{MAX_{dB}} = 6.02\,n\,(dB) + 1.76\,dB :$$

$$= \Big|_{n=10} 60.2\,dB + 1.76\,dB = 61.96\,dB$$

ES. 3 $\quad Y = \overline{A + BCD + E} \quad \rightarrow WC\ t_{P_{LH}} =$



$$= \frac{C_L \frac{V_{DD}}{2}}{\frac{1}{2}\mu_p C_{ox} \cdot \frac{1}{3}(V_{DD} + V_{TP})^2}$$

$\rightarrow WC\ t_{PHL} =$

$$= \frac{C_L \frac{V_{DD}/2}{}}{\frac{1}{2}\mu_n C_{ox} \frac{1}{3}(V_{DD} - V_{Tn})^2} =$$

$$= \frac{C \frac{V_{DD}}{2}}{\frac{1}{2} \cdot 2 \mu_p C_{ox} \cdot \frac{1}{3} (V_{DD} - V_{Th})^2}$$

essendo $V_{Th} = -V_{TP}$, ed essendo $\mu_n = 2\mu_p$

$$t_{PLH_{WC}} = 2\, t_{PHL\ WC}$$

$$t_{PHL_{WC}} = \frac{10^{-11} \cdot 2.5}{25 \cdot 10^{-6} \cdot \frac{1}{3} \cdot 16}\ s =$$

$$= \frac{3}{16} \cdot 10^{-6}\ s = \frac{3}{16}\ \mu s$$

$$t_{P_{WC}} = \frac{t_{PLH\,WC} + t_{PHL\,WC}}{2} = \frac{1}{2}\left[\frac{3}{16} + \frac{6}{16}\right] \mu s =$$

$$= \frac{1}{2} \frac{9}{16}\ \mu s = \frac{9}{32}\ \mu s = 0.28125\ \mu s$$