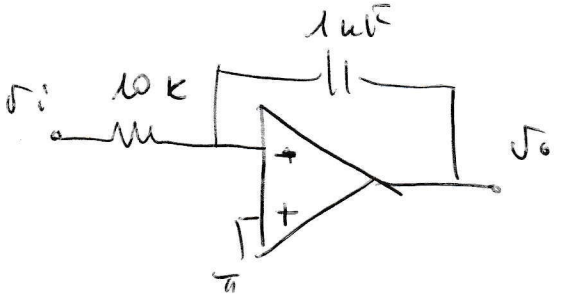
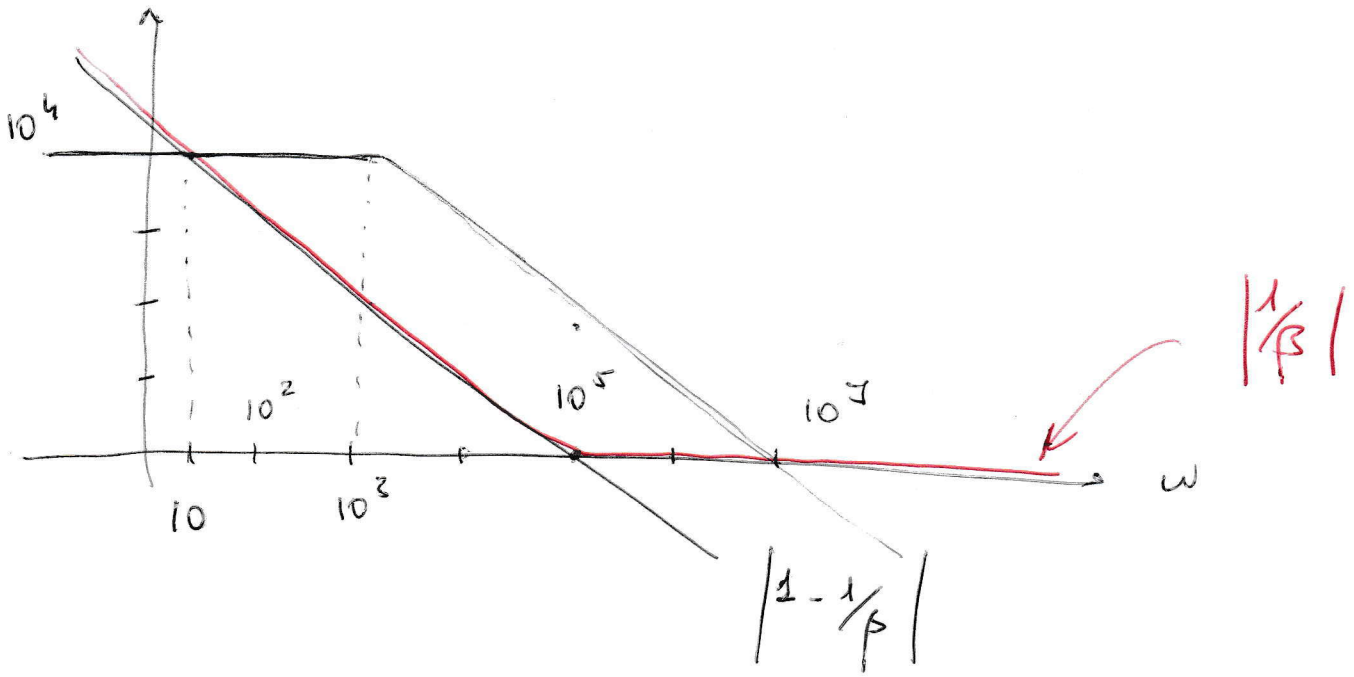
14/7/2020 (1)



GBW per avere funzionamento da integratore per $\omega > 10$ rad/s e $|\beta A|_{dB} = 40$ dB per $\omega = 10^5$ rad/s



$$\beta = \frac{R}{R + \frac{1}{j\omega C}} = \frac{j\omega CR}{1 + j\omega CR}$$

$$GBW = 10^4 \cdot 10^3 = 10^7 \text{ rad/s}$$

$$= 1.59 \text{ MHz}$$

(2)

Doppia rampa a 12 bit

$$T_{conv\ max} = 2 \cdot 2^n T_{ck} = 2^{13} \cdot T_{ck} = \Big|_{T_{ck} = 10^{-6}\,s}$$

$$= 1024 \cdot 8 \cdot 10^{-6} = 8.192 \cdot 10^{-3}\ s$$

$$SNR_{MAX} = \frac{\frac{V_{LSB}^2\, 2^{2n}}{8}}{\frac{V_{LSB}^2}{3}} = 2^{2n} \cdot 3/8$$

(Non conveniente)

$$\rightarrow \left(SNR_{MAX}\right)_{dB} = 6.02\,n\ dB - 4.25\ dB$$

$$\simeq \Big| \begin{array}{l} 68\ dB \\ n = 12 \end{array}$$

(3)

$$2(V_i - \hat{V}_T)^2 = (5 - V_i - \hat{V}_T)^2 \qquad V_T = 1V$$

$$2(V_i^2 - 2V_i + 1) = 16 + V_i^2 - 8V_i$$

$$2V_i^2 - 4V_i + 2 = 16 + V_i^2 - 8V_i$$

$$V_i^2 + 28V_i - 6 = 0$$

$$V_i^2 + 4V_i - 14 = 0$$

$$V_i = \frac{-4 \pm \sqrt{16 + 4 \cdot 14}}{2} = \frac{-4 \pm 8.48}{2}$$

$$= \frac{4.48}{2} \quad \leftarrow \text{unica sol.}$$

$$= 2.24\ V \quad \underline{\text{tensione di soglia logica}}$$

~~invertitore~~

$$t_p = \frac{t_{PLH} + t_{PHL}}{2}$$

$$t_{PLH} = \frac{\frac{V_{DD}}{2} \cdot C}{k_p (V_{DD} - V_T)^2}$$

$$t_{PHL} = \frac{\frac{V_{DD}}{2} C}{k_n (V_{DD} - V_T)^2} =$$

$$= \frac{2.5 \cdot 10^{-4}}{50 \cdot 10^{-6} \cdot 16} = 10^{-5} \cdot 0.003125 =$$

$$= 31.25 \cdot 10^{-9}\ s$$

$$t_{PLH} = 2 t_{PHL} = 31.25 \cdot 10^{-9} \cdot 2\ 5$$

$$t_p = \frac{3}{2} \cdot 31.25 \cdot 10^{-9}\ s = 46.875 \cdot 10^{-9}\ s$$